26-25125 098209
703
GENERAL ACCOUNTING OFFICE
AUG 19 1976
LAW LIBRARY

REPORT TO THE CONGRESS

BY THE COMPTROLLER GENERAL OF THE UNITED STATES

Major Cost Savings Can Be Achieved By Increasing Productivity In Real Property Management

Department of Defense

Some private industry and non-Federal organizations use systems to measure and evaluate the productivity of the people maintaining their real property. They have increased productivity 10 to 45 percent.

If certain serious problems can be overcome, the military services can similarly increase productivity and save money.

The Secretary of Defense should require that work standards be improved, the number of jobs covered by standards be increased, and summary information based on standards be more widely used.

703506 098209

LCD-76-320

AUG. 19, 1976

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

B-163762

To the President of the Senate and the
Speaker of the House of Representatives

This report describes how major cost savings can be achieved by increasing productivity in Department of Defense real property maintenance operations. It demonstrates the benefits available through effective implementation and use of work measurement systems in real property maintenance operations and identifies areas within the military services' systems needing improvement.

Because of congressional interest in rising maintenance costs and the benefits available through use of work measurement systems, we wanted to know if the Department of Defense had effectively implemented such systems in real property maintenance.

We made our review pursuant to the Budget and Accounting Act, 1921 (31 U.S.C. 53), and the Accounting and Auditing Act of 1950 (31 U.S.C. 67).

We are sending copies of this report to the Director, Office of Management and Budget; the Secretary of Defense; and the Secretaries of the Army, Navy, and Air Force.

Comptroller General
of the United States

Contents

		Page
DIGEST		i
CHAPTER		
1	INTRODUCTION	1
	Congressional interest in effective maintenance and repair of real property	1
	History of work measurement systems for real property maintenance	2
	Scope of review	3
2	WORK MEASUREMENT SYSTEMS INCREASE PRODUCTIVITY	5
	A case study--implementation of a work measurement system	6
	Key elements to achieving effective systems	7
3	DOD WORK MEASUREMENT SYSTEMS HAVE BECOME INEFFECTIVE	8
	Validity of performance standards reduced by obsolescence	8
	Inadequate use of performance standards	10
	Little use made of work measurement data	12
	Work measurement data not reported beyond the installation levels	14
4	WHY HAVE DOD WORK MEASUREMENT SYSTEMS BECOME INEFFECTIVE?	15
	Inadequate controls over implementation	15
	Lack of management support	19
5	AGENCY COMMENTS AND OUR EVALUATIONS, CONCLUSIONS, AND RECOMMENDATIONS	21
	Agency comments and our evaluations	21
	Conclusions	23
	Recommendations	24
	Matters for Consideration by the Congress	24
	Suggestion to the National Center for Productivity and Quality of Working Life	25

APPENDIX		Page
I	DOD commands and installations included in GAO's review	26
II	Examples of benefits obtained through implementing work measurement systems in real property maintenance	27
III	Requirements of an effective work measurement system	30
IV	Letter dated February 17, 1976, from Acting Assistant Secretary of Defense (Installations and Logistics)	32
V	Principal officials responsible for administration of activities discussed in this report	40

ABBREVIATIONS

DOD	Department of Defense
NAVFAC	Naval Facilities Engineering Command
GAO	General Accounting Office

GLOSSARY

Engineered performance standard	The time (staff-hours) it should take a worker or a group of trained workers, working at a normal pace, to produce a described unit of work of an acceptable quality according to a specified method under specific working conditions. It is derived from a complete, objective analysis and measurement of the task.
Efficiency	The ratio of standard time to actual time, usually expressed as a percentage.
Productivity	The ratio of output to input.
Work measurement	A technique employed independently or in conjunction with cost accounting for the collection of data on staff-hours and production by work units, so that the relationship between output and staff-hours can be calculated and used as the basis for personnel planning, scheduling, production, budget justification, performance evaluation, and cost control.

COMPTROLLER GENERAL'S
REPORT TO THE CONGRESS

MAJOR COST SAVINGS CAN BE ACHIEVED BY INCREASING PRODUCTIVITY IN REAL PROPERTY MANAGEMENT
Department of Defense

D I G E S T

The military services have some serious problems in the systems they use to measure and evaluate how productive their labor forces are in real property maintenance. These problems have caused the services to fall far short of the achievements possible with adequate work measurement systems. Non-Federal organizations have reported productivity increases of 10 to 45 percent after implementing adequate systems.

The Department of Defense spends more than $2 billion annually for maintenance, repair, and minor construction to restore or preserve real property. Therefore, a relatively small increase in productivity has the potential for major cost savings. Establishment and effective administration of a work performance standards program would be a major contribution to realizing this improvement.

GAO recommends that the Secretary of Defense:

--Establish controls and procedures for monitoring the progress of the services in complying with Defense instructions for implementing work measurement systems.

--Insure that resources are provided to update and maintain the work performance standards and to effectively use work measurement systems.

--Insure that sufficient training is provided to operating personnel and managers on the uses and benefits of work measurement systems.

--Require that productivity data be summarized for managers to use in evaluating, budgeting, and allocating resources. (See p. 24.)

The work performance standards for maintenance in Defense are largely outdated. Valid performance standards are needed for reliable estimating, scheduling, and cost controlling of this work. (See pp. 2 and 8.)

In the early 1960s, the Navy spent about $17 million to develop engineered performance standards, which specify the labor time appropriate for real property maintenance tasks. At that time industry generally considered the Navy standards as a major breakthrough. In 1969 Defense asked the other services to adopt the Navy standards in their maintenance management systems. (See pp. 2 and 9.)

When originally developed, the Navy standards applied to about 80 percent of its maintenance work, such as carpentry, electrical, masonry, plumbing, and painting work. Army, Navy, and Air Force instructions exclude some maintenance work from the use of standards and allow supervisors' discretion in applying standards to some other work. At the installations visited, the military departments did not use the standards for all the jobs for which they were intended. (See pp. 2, 10 and 16.)

By 1974 the Navy standards applied to only about 60 percent of its work, due to changes in materials, equipment, and maintenance techniques. The Navy then began a 5-year program to update its standards. The program was not provided sufficient resources for much progress. (See pp. 8 and 9.)

The services were not using standards to estimate and control maintenance work to the extent possible. An internal Navy study at three public works centers concluded that only about 20 percent of the maintenance work covered by standards was being measured and controlled. The study reported that about $1.1 million a year could be saved by proper use of standards. GAO's review at several Army and Air Force installations indicates even less use of standards. (See pp. 10 to 12.)

The services generally are not compiling and evaluating data on the actual work done, compared to the standards for work done, even where standards are used to estimate work requirements. Defense headquarters did not request periodic reports on work measurement in the services and cannot measure the services' progress in using work management systems.

GAO believes that the services need to not only update standards but also install, support, and use, at all levels, a system of work measurement and evaluation. (See pp. 12 to 14.)

Defense generally agreed with GAO's conclusions and recommendations. Defense said that, although its present policy was adequate, appropriate action would be taken within available resources to update standards and to emphasize work measurement systems. (See p. 21.)

Although Defense said that appropriate action would be taken within available resources to update standards, the services argued that inadequate funds were available to do the work necessary to achieve the payoffs GAO identified. In view of this, the Congress, through its appropriation process, should consider earmarking funds for standards development since such an investment, properly applied, will yield net cost reductions in Government operations. (See p. 24.)

Since maintenance operations are common to many Government agencies and to State and local governments, GAO suggests that the Executive Director, National Center for Productivity and Quality of Working Life, with the assistance of such other agencies as he deems appropriate, provide guidance for the use of work measurement data in real property maintenance as part of their overall plans to help improve productivity within the Federal, State, and local governments. (See p. 25.)

CHAPTER 1

INTRODUCTION

The Department of Defense (DOD) spends more than $3 billion annually and employs almost 200,000 persons to operate and maintain real property with a replacement value in 1974 of more than $100 billion. About $2 billion of this annual expenditure is for maintenance, repair, and minor construction to restore or preserve real property. Nevertheless, DOD's backlog of maintenance work was estimated at more than $1 billion in fiscal year 1974, significantly exceeding the desired backlog of $200 million.

Budget limitations make it essential that Government agencies obtain the greatest output possible from resources. One means used by management to attain maximum productivity from available resources is a work measurement system. Elements and uses of a work measurement system are shown schematically on page 4 and the requirements are described in appendix III, page 30.

CONGRESSIONAL INTEREST IN EFFECTIVE MAINTENANCE AND REPAIR OF REAL PROPERTY

The Congress has, over the years, expressed interest in the effective maintenance and repair of real property. In 1962 the House Committee on Appropriations established a minimum amount to be spent annually to maintain real property, to reduce the probability that large expenditures would be required if property deteriorated from a lack of maintenance and repair.

DOD, in its fiscal year 1975 budget, requested an increase of about $274 million over its prior year funding to operate and maintain real property. The House Committee on Appropriations reduced this amount by $75 million, citing DOD's lack of management controls over real property maintenance and insufficient knowledge of realistic funding needs. The Committee also expressed concern that DOD could not provide reasonable estimates of the maintenance and repair backlog.

The Committee also reduced the fiscal year 1976 budget request 1/ by $25 million because it believed DOD had inadequate management control over real property maintenance operations. It said that DOD should establish better means of obtaining centralized management control over this expensive operation.

1/DOD requested about $150 million over its fiscal year 1975 funding.

HISTORY OF WORK MEASUREMENT SYSTEMS FOR REAL PROPERTY MAINTENANCE

To improve productivity, the Bureau of the Budget (now the Office of Management and Budget), in 1950, prescribed the use of industrial engineering techniques in the Government. Its Circular A-44, issued in 1950, provided for a management improvement program requiring Federal agencies to establish performance goals, measure performance against the goals, and analyze the results to determine corrective actions needed to improve performance. Circular A-11, also issued in 1950, stated that work measurement, unit costs, and productivity indexes should be used to support budget justifications for staffing requirements.

In June 1955 DOD issued instructions for managing real property maintenance, with a prime objective of insuring optimum use of resources. This instruction required

--establishment and use of standard costs by work measurement unit, such as square feet and gallons;

--use of cost data to compare estimated performance with actual performance; and

--analysis of cost variations.

By the early 1960s, the Navy, with the assistance of a consulting firm, made a great contribution to work measurement in real property maintenance by developing engineered performance standards to cover about 80 percent of its maintenance work. These standards, established at a cost exceeding $17 million, were based on industrial engineering techniques which accurately established the time it should take to perform a given task or work element. The standards were considered a major breakthrough and were highly acclaimed by industry. They have been made available to and used by private enterprise and non-Federal governments.

In August 1967 DOD established a task force to provide standards for real property maintenance and repair work throughout DOD. The task force recommended that all services use the engineered performance standards the Navy developed. In April 1969 DOD requested the military services to integrate the Navy standards into their real property maintenance management systems.

DOD, in March 1972, issued a directive which consolidated into one document the objectives and policies of the real property maintenance program. The directive required that work control systems be established, that engineered work performance

standards be used for estimating labor requirements and for scheduling work, and that timely and meaningful reports be prepared to measure and evaluate performance.

DOD's Productivity Program established in August 1975 consolidated DOD's work measurement systems with its other efforts to enhance, measure, and evaluate productivity. The program covers a broad range of DOD activities, including real property maintenance, and emphasizes using labor performance standards (work measurement) in workload planning and control, balancing of resources, and determining labor efficiency.

SCOPE OF REVIEW

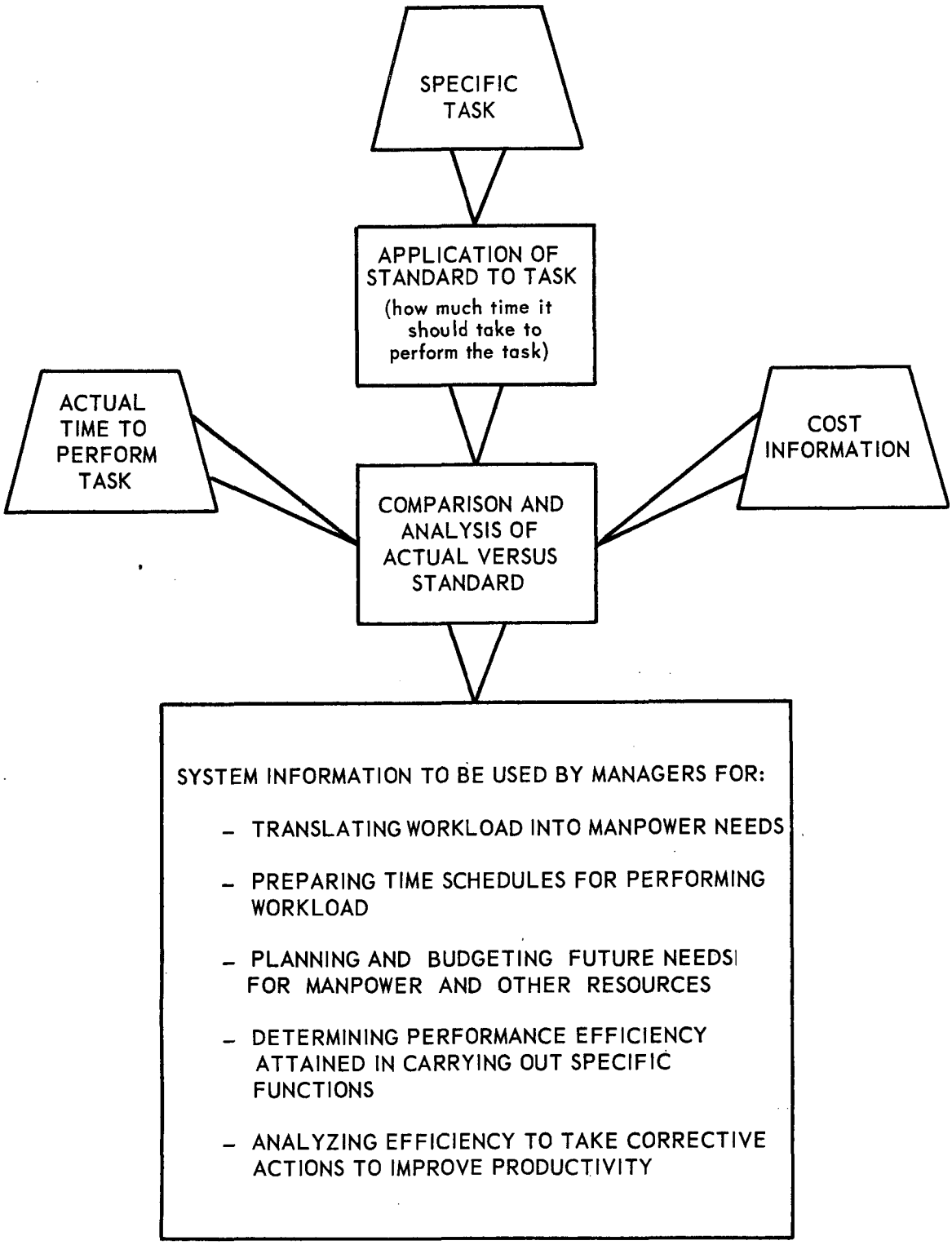
Our review, in which the fieldwork was completed in October 1975, was directed toward evaluating the military services' use of work measurement techniques to improve productivity in real property maintenance. We made our review at DOD and military service headquarters, various intermediate commands, and seven military installations. (See app. I.) We examined records and interviewed personnel regarding the use of work measurement techniques.

To compare the use of work measurement techniques between Federal and non-Federal organizations, we asked 16 private companies and local governments for the results of their use of work measurement systems in real property maintenance. From the 11 which responded, we selected 3 local governments and 1 private industrial organization to visit and obtain details on their use of work measurement systems.

4 20

5 35

ELEMENTS AND USES OF A WORK MEASUREMENT SYSTEM



CHAPTER 2

WORK MEASUREMENT SYSTEMS INCREASE PRODUCTIVITY

Studies by both professional consulting firms and the Navy show that, without work measurement systems, performance efficiency 1/ ranges from about 30 to 50 percent. Following implementation of work measurement systems based on engineered standards, performance efficiency increased to 80 percent or more.

The experience of the 11 companies and local governments which provided information on their systems was consistent with the studies' results. All these organizations had efficiency increases after using work measurement systems. The increases ranged from 10 to 45 percent--with those systems longest in operation having the highest increases.

Following are examples of productivity gains reported by several of these organizations after using work measurement systems. (See app. II for additional information on the work measurement systems of the non-Federal organizations.)

A major west coast city reported that efficiency increased 45 percent in the work force employed in its Recreation and Parks Department. The city estimated that this increase produced a saving of about $45 million over an 11-year period, principally in reduced payroll cost. The city's cost to implement and maintain the system for this period was about $4 million, a net saving of $41 million. Over 1,250 craftsmen were covered by the system in June 1974.

A city which implemented a work measurement system in two divisions of its Public Utilities Department in 1969 had efficiency increases of 13 and 23 percent, based on data for 1971 through 1974. This same data showed net annual savings averaging $200,000 for the work force of about 100 craftsmen.

A major corporation had an average performance efficiency increase of 17 percent in maintenance operations after using work measurement systems for about 2 years at five of its plants and for less than 1 year at seven plants. The company reported gross annual savings of $920,000--reduced payroll costs of $173,000 and increased maintenance production valued at $747,000. Principally because of the latter, the corporation's maintenance backlog was greatly

---

1/Performance efficiency is a ratio of standard hours to actual hours, usually expressed as a percentage.

reduced. It also reported better maintenance service, upgraded plant facilities, and improved supervision. It projected annual savings of $1,350,000 upon full implementation at all plants.

A CASE STUDY--IMPLEMENTATION OF A WORK MEASUREMENT SYSTEM

A major west coast county government employed a professional consulting firm in 1972 to assist in implementing a work measurement system for a portion of its facilities maintenance operations. That firm used the Navy's engineered performance standards as a starting point. But, where these standards were obsolete or otherwise not applicable, the firm developed the necessary standards or obtained them from other sources. Thus the county acquired engineered standards for about 85 percent of its maintenance functions.

The consulting firm organized and conducted training and orientation programs.

--Estimators and others were trained in the use and application of the standards.

--Supervisors and managers received training on the data the system would produce and the techniques for analyzing and using such data.

--Orientation sessions were held for supervisory personnel and workmen, to inform them of the benefits and to help reduce normal resistance to productivity measurement systems.

County officials indicated the cost incurred to educate and inform personnel was essential to gain support for and successfully implement the system.

In July 1973 county managers considered the system operational and obtained the services of a different professional consulting firm to evaluate the effectiveness of the system and to assess the value of productivity increases achieved. This firm's study, completed in July 1974, assessed the effects of the system for 58 craftsmen representing the painting, masonry, carpentry, cabinet, electrical, and plumbing crafts. It stated that the system had (1) improved service to "customers," (2) improved cost control, and (3) provided better manpower accountability. The firm also reported that performance efficiency increased from 50 percent at implementation to 60 percent. It reported that measurable annual savings totaled $186,800 for the six crafts studied. The savings were

achieved by reducing the work force by two persons and by additional output through improved performance, which reduced the maintenance backlog and lessened the need for future expenditures. The annual savings were reduced by recurring costs of $105,500 to operate the system, amounting to a net annual saving of $81,300.

The consulting firm projected that, upon full implementation of the work measurement systems to all maintenance operations, net annual savings should ultimately total $432,500. This projection was based on an expected 20-percent increase in the productivity of 183 craftsmen. But the firm emphasized that there were opportunities to greatly exceed this projection.

KEY ELEMENTS TO ACHIEVING EFFECTIVE SYSTEMS

On our visits to four non-Federal organizations, we identified the principal reasons their systems were effective. These organizations generally stressed the following key elements they considered essential to obtaining accurate, meaningful measurement data and to using it to improve performance.

--Engineered performance standards must cover about 75 to 80 percent of the maintenance workload to develop accurate and reliable measurement data.

--Estimators assigned to apply the standards must receive thorough training in their use.

--Records on actual production time must be kept and analyzed to identify the reasons for major differences between actual and standard production time.

--Work measurement data must be periodically summarized in reports to management to provide a basis for planning work and allocating resources.

Aside from management's recognition of the importance of these key elements, one additional factor was present--perhaps the most important in achieving effective systems. Management at all levels was interested in and fully supported implementing and maintaining the systems.

CHAPTER 3

DOD WORK MEASUREMENT SYSTEMS HAVE BECOME INEFFECTIVE

Twenty years after work measurement systems were first required (June 1955) in DOD and 5 years after use of engineered performance standards was required, systems in operation at seven installations had serious deficiencies. Because of these deficiencies, much of the work measurement data was of little value and, where reasonably valid, the data often was not used. Improvements were needed for each of the key elements of the work measurement systems.

The major problem areas we identified follow.

--The engineered performance standards were allowed to deteriorate and become obsolete.

--Performance standards received limited or no use for estimating costs and scheduling work.

--Work measurement data was not adequately compiled and analyzed to identify and correct the causes of differences between actual performance and standard work performance.

--Implementing instructions do not require management to use productivity data in preparing budgets and in allocating resources.

VALIDITY OF PERFORMANCE STANDARDS REDUCED BY OBSOLESCENCE

After developing standards for property maintenance, the Navy did not establish an effective program to subsequently update them. Without the necessary adjustments for changes in technology and introduction of new tools and materials, the standards had deteriorated due to obsolescence. In fiscal year 1974 the Navy established a 5-year program to update the standards. But the resources made available for this purpose have been inadequate. Unless the program is given higher priority, it is unlikely that the standards can be upgraded to provide adequate coverage within 5 years.

Valid performance standards provide the means to accurately and consistently estimate how much time it should take to complete a particular project. Comparisons of actual performance with the standards provide data on relative efficiency. Analyses of variances between actual

performance and standard performance can identify particular patterns and problems that limit productivity. It is through correction of such problems that management can achieve major productivity gains.

It is generally accepted that performance standards must cover about 75 to 80 percent of the work to provide consistent and meaningful work measurement data. This was stressed by both the managers of the non-Federal systems we reviewed and various consultants we contacted, including the firm that participated with the Navy in developing engineered performance standards for real property maintenance.

Once this percentage goal is achieved, the standards must be periodically reviewed and updated to avoid obsolescence as new work techniques, tools, and materials are developed.

The Navy's engineered standards, developed at a cost of more than $17 million, initially covered 80 percent of property maintenance functions. But the Navy did not establish an effective program to maintain the standards to avoid obsolescence. Only limited resources were provided for this purpose during the 1960s, and no resources were provided for fiscal years 1970 through 1974 to update the standards. As a result, the standards had greatly deteriorated by 1974.

At the time of our review, the Navy had no information showing the extent to which the standards had deteriorated. Officials estimated that overall coverage had declined to between 55 and 65 percent. This estimate was consistent with a non-Federal organization's estimate that Navy standards covered about 60 percent of its maintenance work. The organization had turned elsewhere to obtain the remaining standards needed. Several of the Air Force and Army installations visited had also identified Navy-developed standards that had become obsolete. However, none of these had been reported to the Navy because no requirement existed for such reports.

Following are illustrations of the deterioration of the maintenance performance standards.

--The standards provide details for estimating the labor hours for the crafts and the materials required to construct shower stalls. This was appropriate in the 1960s when most showers were constructed in place. Shower stalls are now often bought preassembled, and site work is largely limited to installing the assembled units. Since the standards dealt with

construction and installation of showers, they provide no basis for estimating work required to install preassembled units.

--The standards cover the work elements required to install electric cables above ground--hung from utility poles. They were not updated to cover installing cables underground--a common practice which uses entirely different processes and often requires trench-digging equipment.

In 1975 specific standards handbooks were assigned to each of the Naval Facilities Engineering Command's (NAVFAC's) six engineering field divisions for updating. However, as mentioned previously, it appears unlikely that the Navy will complete updating the standards in the 5-year period. We visited an engineering field division to evaluate its progress. We were told that the division could apply only about 1.5 staff-years to update the standards in fiscal year 1974. According to an official, this level of effort would not accomplish the work in the time allotted and the division was unable to apply more effort to the project because of a lack of resources and higher priority work.

INADEQUATE USE OF PERFORMANCE STANDARDS

Proper use of engineered performance standards in estimating how much time a project should take is a critical step in an effective work measurement system. Otherwise, there is no valid basis for producing consistent, accurate estimates and subsequently analyzing the actual efficiency of the work force. At six of the installations we visited, engineered performance standards were not used to estimate the number of labor hours required for large segments of the maintenance workload. They were not used at all at the seventh installation. Accordingly, none had an adequate basis for analyzing and using the data collected on actual work performance.

Each of the services issued instructions and procedures requiring the use of the Navy's engineered performance standards. Each excluded some maintenance work from the requirement and, in effect, excluded other work by leaving use of the standards to the discretion of the individual estimators. A leading consultant firm contends that, unless standards are applied to about 75 to 80 percent of maintenance workload, little faith can be placed in the accuracy of the performance data.

We used the services' instructions and procedures to estimate the percent of work they would cover. We estimated that, if the instructions were fully implemented, the Army,

Navy, and Air Force would cover 85, 80, and 55 percent, respectively, of their maintenance work. However, the instructions were not fully implemented, and the installations were making only limited use of the standards for estimating and planning maintenance projects. Most of the installations' records did not readily show the extent to which the standards were used. To obtain a measure of the use, we reviewed available management studies and analyzed maintenance work orders on a test basis.

As shown by the following examples, much of the maintenance work requiring the use of standards was not submitted to the estimators, and, even when submitted, standards were used infrequently.

--A 1973 naval audit report disclosed that only 36 percent of the maintenance and repair work at the Oceana Naval Air Station, Virginia Beach, Virginia, was planned and was therefore subjected to the use of standards. Our review of planned work for 3,000 estimated hours showed standards were used to estimate only 22 percent.

--At Fort Bragg, North Carolina, about 20 percent of the total maintenance work was processed through the estimators for applying standards. Our review of about 5,600 estimated hours of planned work disclosed that standards were used to estimate 54 percent.

--At Fort Lee, Virginia, standards were not used to estimate the time required to perform the maintenance work.

--Our review of about 4,700 hours of planned work at Seymour Johnson Air Force Base, North Carolina, disclosed that standards were used for only 17 percent.

Our tests to determine the extent to which standards were applied involved only that portion of the maintenance work submitted to estimators. No standards were applied to any of the work bypassing the estimators. Therefore, if our tests had included the total maintenance work, the percentage of standards use would have been considerably lower.

An independent, internal Navy study at three public works centers produced findings comparable to ours. The study report issued in May 1974 stated the standards were used for about 20 percent of the maintenance work to which

they should have been applied. It stated also that standards were often improperly applied. The result was excessive estimates averaging about 14 percent over what they should have been. The report estimated that $1.1 million a year could be saved by properly using the standards.

The work orders we reviewed were not statistically selected, and the results may not be representative. However, our analyses and the Navy's study showed that the standards were not used for large portions of the work to which they should have been applied. It was also apparent that standards were used substantially less than the 80 percent considered essential if accurate, meaningful work measurement data was to be produced.

One reason for the low use rate was insufficient resources. Experts in the field generally consider that effective standards application can be maintained when there is one estimator to every 30 to 35 craftsmen. At the installations we visited, the ratio of assigned estimators to craftsmen ranged from 1:28 to 1:212, with an average ratio of 1:42. But these ratios had little meaning because many of the estimators had other duties. Available data on manpower utilization did not permit our estimating an accurate ratio. In many cases, the ratios exceeded that of 1 estimator to every 30 to 35 craftsmen recommended by experts in the field.

Another important factor was a lack of training. Particularly at the Air Force installations, many of those responsible for using the standards were not experienced and had received no training in their application. The Navy had a formal training program but had decreased its emphasis. In contrast, by late 1973 the Army had provided training to most of its estimators.

Local managers told us that manpower ceilings and budget limitations restricted the resources they could devote to application of the standards. This was undoubtedly a major contributing factor. But we believe an equally important factor was the low priority given to the program. In fact, many managers were candid in stating their lack of confidence that standards could be beneficially used for property maintenance.

LITTLE USE MADE OF WORK MEASUREMENT DATA

Evaluating actual work performance in relation to standard performance is the very essence of a work measurement system. Analysis of such data can lead to identification and correction of the causes of inefficiencies and thus increase

productivity. Since the services' work standards had deteriorated and the installations were making only limited use of the remaining valid standards, none of the installations we visited had a valid basis for evaluating actual performance against standard performance to identify inefficiencies. We therefore limited our review to assessing the extent to which actual work performance data was recorded and the uses made of it. Such data was being recorded at all the installations, apparently because instructions required it, but essentially no beneficial use was made of the data. In fact, this situation raised serious questions as to whether these installations were realizing any benefits from the cost invested in work measurement systems.

An effective work measurement system should provide timely, accurate data for each management level. Estimated time based on valid standards and actual time for each job should be accumulated and summarized on the performance of each shop and each successively higher management level.

Both the Navy and the Army have specific guidance for using work measurement data to evaluate the efficiency of their maintenance operations. The Navy requires that estimated hours and actual hours be accumlated for each completed job showing time expended by each work center. The data is to be summarized for each craft and for the entire maintenance organization. For the Army, estimated hours and actual hours are to be accumulated and analyzed for each job and summarized for each shop.

The Air Force's base engineer automated-management system does compile estimated hours and actual hours for each completed work order, by craft, and total for the work order. The estimated hours are based mostly on the experience of the job estimators and to a lesser extent on valid performance standards. (See pp. 10 and 11.) Although the estimated hours are not always based on valid standards, when summarized by each shop or maintenance activity, they would provide at least a rough basis for scheduling materials, equipment, and people, if not a reliable measure of productivity. Currently, the system does not summarize the data in this manner. In fact, the Air Force rejected a request by one of its organizations that the property management system be expanded to provide for summary reports to permit analysis of work performance. An Air Force command-level official confirmed that the request was denied and that Air Force installations had no authority to apply resources to this purpose without approval. Therefore, Air Force policy and the Air Force-wide system severely restricted the potential benefits of work measurement systems.

Although Navy and Army instructions required analysis of work production data, this was being done to only a limited extent at some installations and not at all at others. For example, Fort Bragg was not accumulating and compiling production data, a necessary step before any meaningful analysis can be made. This was noted by an inspection team in 1974, after which Fort Bragg began to compile the production data. But, at the time of our visit, we did not identify any uses being made of it. Fort Bragg officials told us that they saw no value in having production data and that the data was being recorded and accumulated only because it was required.

At the Navy's Public Works Center, Norfolk, Viginia, the data was accumulated and some analyses were being made; but these were insufficient for meaningful work measurement. The analyses were infrequent and the use of performance standards was insufficient for evaluation. At the other Navy installation we visited, no analyses were being made.

Officials at all seven installations said that a lack of resources precluded operating the work measurement systems as intended. At most installations, managers responsible for the program felt work measurement systems were not an effective management tool for maintenance work. Many voiced opinions that the systems cost more than any value available from them. We believe these attitudes contributed to the low priorities assigned to the systems in relation to other programs competing for available resources.

WORK MEASUREMENT DATA NOT REPORTED BEYOND THE INSTALLATION LEVELS

DOD's 1955 and 1972 instructions stressed the use of work measurement techniques at the operating levels. They did not address the usefulness of such data for top managers' purposes. In fact, DOD's 1972 instruction tended to discourage such use by stating that recurring reports to higher levels be held to a minimum. The instruction provided that maximum use would be made of special one-time requests and onsite evaluations.

Whether influenced by DOD's instructions or not, each service's implementing instruction had the effect of limiting potential benefits to those achievable at the installtion levels. None of the services required compilation and reporting of work measurement data in a form that could be used by top-level managers for forecasting trends, preparing budgets, and allocating resources.

CHAPTER 4

WHY HAVE DOD WORK MEASUREMENT SYSTEMS BECOME INEFFECTIVE?

The ineffectiveness of the systems was undoubtedly affected by budget constraints and higher priorities, particularly when resources were diverted during the height of the Southeast Asia conflict. But we believe lack of progress was limited principally because:

--Neither DOD nor the military departments established adequate controls or monitored progress sufficiently to insure effective implementation of the work measurement system.

--There was an apparent lack of management support for the systems--in the form of the low priorities assigned the program and in the beliefs and attitudes of responsible managers.

INADEQUATE CONTROLS OVER IMPLEMENTATION

DOD's initial directive in 1955 required the services to develop work measurement systems for property maintenance. After the Navy successfully developed its comprehensive engineered performance standards for property maintenance, DOD, in 1969, instructed all services to use these standards to achieve DOD-wide uniformity. A more formal DOD instruction issued in 1972 made it clear the services were to develop complete work measurement systems--compiling actual work performance data, analyzing such data in terms of the work standards, and following through to identify and correct causes of major differences.

In both its 1969 and its 1972 instructions, DOD required each of the services to report actions taken to implement the instructions. But it did not establish controls or require further feedback on the services' progress in complying with the instructions or the effectiveness of the systems in terms of benefits achieved. In effect, DOD delegated the program to the services without providing performance criteria, such as milestones or completion dates, and without provisions to adequately monitor or otherwise insure effective implementation of the program.

DOD officials were not receiving any periodic progress reports. They had, essentially, no information on (1) the extent to which engineered performance standards were applied or (2) the extent to which work measurement data was compiled,

analyzed, and used at the installation levels. DOD told us it had no plans to establish procedures or controls to obtain compliance. It also said DOD's role was limited to establishing policies, and the services were responsible for their implementation. The Directorate of Facilities Management, with a staff of only three persons, did not have the capability to review or monitor the services' progress.

The responses to DOD's 1969 directive varied among the services, but none of the services took effective steps to implement the standards. The services provided written guidance and procedures on the extent to which operating levels should apply the standards to plan and estimate maintenance work. However, none established adequate controls to insure effective actions by the many military installations which were to separately implement use of engineered performance standards. Therefore the extent of actual use of the standards was, in effect, left to the discretion of literally hundreds of installation-level managers--all with varying degrees of interest, expertise, and resources.

Apparently because of the lack of emphasis, the installations we reviewed either were not using engineered performance standards or were applying them to only limited portions of the work they were intended to cover. This contrasted markedly with the non-Federal organizations we visited which stressed that standards must cover about 75 to 80 percent of the maintenance work to produce meaningful work measurement data. The following paragraphs describe more fully the principal shortcomings of the services in responding to DOD's 1969 and 1972 instructions.

Department of the Navy

The Navy began using the engineered performance standards before DOD's 1969 instruction. In a 1965 study, the Navy estimated its installations had, in 1 year, achieved measurable savings of $1.5 million from use of the standards for planning and estimating maintenance jobs. The study stressed the need for more effective use of the standards to achieve further economies.

From the early 1960s to mid-1960s, the Navy monitored the development and use of the standards. Its early procedures included annual inspections of each installation. At that time NAVFAC was responsible for all Navy property maintenance, including monitoring the use made of maintenance work standards. In 1968, however, responsibility for property maintenance, including monitoring and evaluating work measurement systems, was largely decentralized by transfer from NAVFAC to the Navy's operating

commands. NAVFAC retained responsibility for monitoring the use made of the standards at the Navy public works centers and construction battalion centers.

The emphasis and the priority placed on the effectiveness of installations' using the standards appeared to diminish with decentralization. Our review at NAVFAC's Atlantic Division office disclosed that before 1963 a special management team visited each Navy installation in the Atlantic Division annually to evaluate the effectiveness of the use of the work performance standards. In 1963 the office reduced the frequency of its inspections to once every 2 years. It discontinued scheduled inspections in 1966 and made inspections only when requested by an installation. In 1970 the team was discontinued, and available personnel were used to make inspections. We found that such requests were infrequent; for example, during an 18-month period, the office received no request to review use of standards. Thus, about a year after DOD reemphasized the use of engineered performance standards, the Navy's principal program for monitoring progress and assessing effectiveness essentially ceased.

The Navy's diminished emphasis on developing and maintaining effective work measurement systems was apparent in other ways. At the height of its program, about 1963, NAVFAC employed 48 trained industrial engineers to develop and maintain the standards and to monitor their use. At the time of our review, NAVFAC's technical force assigned for these purposes had been reduced to four persons. As a result of the reduction, the standards DOD had directed all three services to use were deteriorating.

Reasons for the overall decline in the Navy's technical capability are difficult to assess. NAVFAC cited principally a lack of resources and overriding priorities. Doubtlessly, tight budget constraints were limiting factors. We believe, however, the decline in the Navy's technical capability can also be related to (1) a lack of management controls over and attention given to the program by top management and (2) decentralizing of maintenance responsibility without assuring that operating commands, acting separately, would satisfactorily carry out responsibilities formerly managed by NAVFAC.

Department of the Army

At the time of our review, the Army had made little progress in using engineered performance standards to achieve effective maintenance work measurement systems at the operating levels. Lack of progress was due principally to (1) delays in responding to DOD's instructions and (2) insufficient emphasis and control to insure timely and effective progress. But in 1974 top Army

managers appeared keenly interested in developing and using maintenance work measurement data.

We could find little evidence that the Army took any immediate major action in response to DOD's 1969 directive. It was not until after DOD reemphasized its requirements in 1972 that the Army advised its components they would be required to develop work measurement systems based on engineered performance standards. Thereafter the importance placed on implementing the maintenance work measurement systems by top managers increased appreciably. Recognizing that trained personnel would be needed to make effective use of the standards, the Army developed a training program which was attended by installation estimators. The training was essentially completed by late 1973, at which time the Army installations were to start using the engineered performance standards.

The increased emphasis placed on the program by top Army managers was indicated in other ways. The Army recognized that the standards were deteriorating due to obsolescence. In 1974 it provided the Navy with $51,000 to partially fund the cost of updating the standards. The Army had plans to establish a program, under the direction of Army headquarters, for identifying and updating obsolete maintenance work performance standards.

Although by 1974 top Army managers appeared to be making a strong effort, success in developing and using maintenance work measurement data at the operating levels was still limited. Like the other services, the Army had no system for routinely monitoring progress and had established no implementing requirements. Success of the program's implementation rested principally on the interest and initiative of responsible officials at the individual installations.

The standards were receiving only limited use at one Army installation and none at all at the other Army installation we visited. We discussed this lack of use with officials at command and Department of the Army levels. These officials recognized that one of their principal problems was the need to inform their managers and convince them of the benefits from effective use of work measurement techniques. However, the Army had not formulated a program designed to do this. It also had no plans to establish controls to insure satisfactory progress in developing and using work measurement systems at the installations.

Department of the Air Force

The Air Force had done little to implement an effective work measurement system. The procedures issued in 1970 provided for using engineered performance standards for only about 55 percent of maintenance work. More important, although the Air Force required its installations to record and accumulate production data, the procedures do not provide for summary reports to facilitate analysis of the data.

LACK OF MANAGEMENT SUPPORT

We believe that management's commitment, interest, and emphasis are necessary to achieve maximum benefits from work measurement systems. In non-Federal organizations, funds were provided; expert help was obtained; personnel were trained; and, more important, managers and supervisors were involved. In our opinion, it was a total commitment by management in these non-Federal organizations that achieved the benefits. (See ch. 2.)

In contrast, officials responsible for implementing and controlling the work measurement systems of the Army and Air Force services told us they had no confidence in the systems. They felt that the many variables in maintenance tasks did not lend themselves to satisfactory use of work measurement techniques. Many expressed opinions that the cost of establishing maintenance work measurement systems exceeded any potential value. Others felt the standards were too complicated and their application required too much time to be cost beneficial.

For example:

--Air Force headquarters officials felt that the standards did not adequately measure maintenance work performance, work measurement techniques were of value only for industrial-type functions having repetitive processes, and the benefits would not be worth the cost to update and maintain the maintenance work standards.

--Officials at two major Air Force commands voiced comments similar to those by headquarters officials. Additionally, one official said that the command had not particularly emphasized using the standards or assessing the extent of their use because it did not recognize the existence of a maintenance work measurement system.

--At a major Army command, officials were generally aware--principally through command inspections--that little use was made of the standards. They told us they had no effective means to enforce such use. Furthermore, they believed most real property maintenance managers made only token efforts to comply with the Army's requirements.

Similar comments were made by managers at most of the installations we visited.

These views provide strong evidence that lack of support, and even opposition, is widespread among those responsible for implementing and using the systems. This may be the principal reason for the low priority given, and the inadequate resources assigned, to the development and operation of the systems.

CHAPTER 5

AGENCY COMMENTS AND OUR EVALUATIONS, CONCLUSIONS, AND RECOMMENDATIONS

AGENCY COMMENTS AND OUR EVALUATIONS

We submitted our report to DOD for comments, and DOD solicited comments from the individual services. (See app. IV.) DOD generally agreed with our findings and recommendations. Certain of the individual services' comments, however, indicated that fund shortages would preclude revitalizing and using work measurement systems.

DOD agreed that labor productivity increases could be achieved by (1) improving methods, procedures, and processes, (2) making prudent use of engineered performance standards, (3) providing more efficient and cost effective tools, equipment, and facilities, (4) increasing the skills of the work force through better and more effective training, and (5) motivating all personnel to be more efficient and alert to opportunities for improvements. DOD said that, although its present policy was considered adequate, continued emphasis would be given to seeking additional improvements in the area to insure the most effective use of available resources. Specifically, it plans to identify and eliminate unnecessary and nonproductive functions, increase efficiency in required functions, improve program evaluations, and take appropriate action to update standards and emphasize work measurement systems within available resources. DOD said that the real property maintenance program had received increased attention during the last 18 months but that higher priority areas had diverted internal audit attention away from engineered standards.

We agree that DOD supports the requirement for a productivity program in its policy and guidance statements. The statements provide the basic framework for effecting productivity improvements and for determining and evaluating labor productivity in major support functions. DOD's planned actions to update standards and emphasize work measurement systems are steps in the right direction. However, DOD needs to take additional action to establish those controls necessary to insure effective implementation and use of such systems by the military services.

DOD said that establishing and achieving the degree of monitoring of engineered performance standards at the Office of Secretary of Defense level implied by our report would require an increase in staff which would be contrary to the

present atmosphere of reducing headquarters staffing levels. We believe, howewver, that effective monitoring can be done through the military departments.

The Army said that it had taken or planned to take action relative to certain deficiencies and that these actions should help improve its work measurement systems. These actions include establishing a program which should result in improved control over implementing instructions, establishing an engineered performance standards training program, and formulating plans for establishing a training program for managers on using management data generated by the work measurement systems.

The Army disagreed with us on certain findings. While the Army argued on the one hand that standards had not become obsolete, as we reported, elsewhere it reported allocating $65,000 over 2 years to update certain standards and plans to give increasing priority to this area. Also, the Army did not consider the two installations in our review to be representative of all Army installations and said its installations use standards in varying degrees. The two installations we visited may not be representative, but our review of reports made by the two Army major commands responsible for these installations showed that the Army found similar deficiencies during visits to other installations.

The Navy agreed with our findings that work measurement systems had slowly fallen into disuse. It explained that increasing administrative costs and difficulties in updating standards, training personnel, and maintaining the management information system necessary to exploit engineered standards caused the use of such systems to decline. It further stated that civilian personnel ceilings had encouraged eliminating administrative positions to retain shop personnel. The Navy recognized the benefits available through the use of effective systems, and, although it contended that DOD generally remained ahead of industry in the use of standards, it said that improved standards usage was a desired objective that would be pursued insofar as resources permitted. However, it stated that an improvement in standards implementation in the foreseeable future was not likely because of current funding limitations.

The Navy also recognized that private firms that had orginally obtained standards from the services had been able to maintain them. But it said that, although it was still looking for standards from private sources, it had been unable to find standards suitable for use without costly updating and modification. We believe, as evidenced by the May 1974 Navy internal study and by the actions of non-Federal entities, the productivity increases and resultant savings possible

through implementation and use of work measurement systems adequately justify the need for standards to be properly maintained and used. We therefore believe the Navy should give this area sufficient attention and support.

The Air Force did not believe it would achieve the 10 to 45 percent increases in productivity we reported as experienced by the non-Federal activities. Although we did not measure current productivity levels in DOD, we do know the work measurement systems are deficient and are in need of major improvements and that non-Federal activities that implemented work measurement systems have increased their productivity. In fact, the Air Force agreed that (1) the standards had become obsolete, (2) the standards were used very little to estimate costs and schedule work, and (3) work measurement data was not adequately analyzed to identify problems.

The Air Force proposed to use standards for 55 percent of its direct labor effort and beyond this whenever the costs for the additional coverage can be offset by identifiable payback. Although this will be an improvement over present use, it still falls short of the 75 to 80 percent generally considered necessary to provide consistent and meaningful work measurement data. We therefore believe the Air Force should determine whether coverage beyond the 55 percent would be cost effective.

The Air Force does not believe the current state of the art exists in the Federal sector to allow for resource measurement for budgeting purposes. We found that work measurement systems in some non-Federal activities do provide data for budgeting purposes. With improvements in standards and analysis of management data, DOD systems can also provide for such data. The Air Force proposes to take some actions in this regard. We believe these actions are important steps in attaining the goal of providing for and using resource measurement data in the budgeting process.

CONCLUSIONS

The maintenance work measurement systems of the military services have failed substantially to obtain the benefits such systems offer. In contrast to the productivity increases achieved by non-Federal organizations, the systems we observed at the services' installations were deficient in the key elements which produced these productivity increases. There was strong evidence that the systems were implemented and were operated only to the extent necessary to achieve token compliance with DOD requirements.

Our interviews at all levels disclosed a widespread lack of confidence among responsible managers in the military services concerning the question of whether work measurement techniques can be successfully applied to maintenance functions. We believe the lack of support was a major factor leading to inadequate controls over systems' implementation, assignment of inadequate resources to operate and maintain them, and deterioration of the engineered performance standards.

DOD instructions and guidance regarding implementation of maintenance work measurement systems were inadequate. They did not provide for effective controls that would insure reasonable implementation, nor did they provide for furnishing top management with productivity data that could be valuable for assessing the efficiency of maintenance operations and for forecasting needs, preparing budgets, and allocating resources on the basis of productivity trends. We believe that, before any real progress can be achieved, it is essential that (1) the work performance standards be updated and (2) every effort be taken to convince top managers of the benefits available through the effective use of work measurement data.

RECOMMENDATIONS

We recommend that the Secretary of Defense

--establish controls and procedures for monitoring the progress of the services in complying with its instructions for implementing work measurement systems;

--insure resources are provided to update and maintain the work performance standards and to effectively use work measurement systems;

--insure that sufficient training is provided to operating personnel and managers on the uses and benefits of work measurement systems; and

--require that productivity data be summarized for managers to use in evaluating, budgeting, and allocating resources.

MATTERS FOR CONSIDERATION BY THE CONGRESS

Since the services argue that inadequate funds are available to do the work necessary to achieve the payoffs we identify, the

Congress, through its appropriation process, should consider earmarking funds for standards development since such an investment, properly applied, will yield net cost reductions in Government operations.

SUGGESTION TO THE NATIONAL CENTER FOR PRODUCTIVITY AND QUALITY OF WORKING LIFE

Since maintenance operations are common to many Government agencies and to State and local governments, we suggest that the Executive Director, National Center for Productivity and Quality of Working Life, with the assistance of such other agencies as he deems appropriate, provide guidance for the use of work measurement data in real property maintenance as part of their overall plans to help improve productivity within the Federal, State, and local governments.

DOD COMMANDS AND INSTALLATIONS

INCLUDED IN GAO'S REVIEW

DOD:

Office of the Assistant Secretary of Defense (Installations and Logistics)

ARMY:

Headquarters, Department of the Army (Office of the Chief Engineer), Washington, D.C.
Headquarters, U.S. Army Forces Command, Fort McPherson, Georgia
Headquarters, U.S. Army Training and Doctrine Command, Fort Monroe, Virginia
Headquarters, XVIII Airborne Corps and Fort Bragg, North Carolina
Headquarters, U.S. Army Quartermaster Center and Fort Lee, Virginia

AIR FORCE:

Headquarters, Department of the Air Force (Directorate of Facilities Engineering), Arlington, Virginia
Headquarters, Air Force Logistics Command, Wright-Patterson Air Force Base, Ohio
Headquarters, Air Training Command, San Antonio, Texas
Headquarters, Tactical Air Command, Langley Air Force Base, Virginia
San Antonio Air Logistics Center, Kelly Air Force Base, Texas
Randolph Air Force Base, San Antonio, Texas
Seymour Johnson Air Force Base, North Carolina

NAVY:

Headquarters, Naval Facilities Engineering Command, Alexandria, Virginia
Atlantic Division, Naval Facilities Engineering Command, Norfolk, Virginia
Commander in Chief, U.S. Atlantic Fleet, Norfolk, Virginia
Commander, Naval Air force, U.S. Atlantic Fleet, Norfolk, Virginia
Navy Public Works Center, Norfolk, Virginia
U.S. Naval Air Station Oceana, Virginia Beach, Virginia

EXAMPLES OF BENEFITS OBTAINED THROUGH IMPLEMENTING WORK MEASUREMENT SYSTEMS IN REAL PROPERTY MAINTENANCE

COMPANY A

Company A began implementing a work measurement system in 1967 for repairs and maintenance of its facilities. After only 29 months, the company reported annual cost savings of $920,000 at 12 plants. These savings represent payroll reductions of $173,000 and increased maintenance output of $747,000. One-time costs of $209,000 and recurring annual costs of $279,000 provided net savings of $432,000 for the first year and annual recurring savings of $641,000. Annual net savings of over $1 million are projected when the system is fully operational at the 12 plants.

The performance efficiency of the 425 craftsmen in the 12 plants was 52 percent before implementation and in 29 months had increased to 69 percent. Cost per standard hour decreased from $6.78 to $4.91, and a target cost was set at $4.05.

Information provided on one plant in which the system had been implemented for about 4 years showed the following results.

--The actual annual payroll was reduced from $328,000 to $322,000, even though there were three pay increases averaging 6 percent each.

--Performance efficiency of 52 percent increased to 87 percent during the first 18 months.

--Over $100,000 in increased maintenance output was being obtained.

--The maintenance backlog was reduced by two-thirds in the most recent year.

Other reported benefits included (1) better maintenance service to users, (2) upgraded plant facilities, (3) increased supervision capability, and (4) more competent craftsmen. Because of its success, this company was aggressively implementing the system in other plants, with an ultimate goal to have it cover 80 percent of the maintenance payroll.

In implementing the system, the company

--trained personnel in the use of work measurement techniques,

--developed engineered performance standards to cover over 80 percent of all maintenance work,

--attained a ratio of one planner and one estimator to 30 craftsmen,

--developed an automated data collection system, and

--established procedures requiring analysis of data at the plants and at headquarters.

To insure the proper operation of the system and to provide training, an industrial engineer is assigned at each plant. Standards are revised continuously as methods change, the application of standards is reviewed periodically, and the overall system is evaluated every 2 years.

Company officials said that the system was successful without paying wage incentives and that the key factor for success was management support from the top down.

CITY A

In 1964 city A began using a work measurement system to improve maintenance operations in its Recreation and Parks Department. During the first 3 years of operation, performance efficiency increased from a previous level of 46 percent to 87 percent.

For the 11 years ended in 1974, the city reported a $45 million saving consisting of $24 million in payroll costs and $21 million in increased production. About $4 million had been expended through June 30, 1974, to implement and operate the system, providing a net saving of over $40 million.

The work measurement system was installed by a private consulting firm and was implemented in phases, starting with three crafts. At June 30, 1974, 1,268 maintenance personnel were covered by the system. There were 16 employees performing support functions relating to the system. This city trained personnel already in the work force to assume the support functions.

This city also instituted a work measurement system in its Street Maintenance Bureau. In December 1971, the system was discontinued on a test basis to determine whether performance efficiency would be affected. Performance efficiency decreased in 9 of the Bureau's 10 work centers. In 1973 the system was reinstituted, and performance efficiency immediately began increasing in 7 of the 10 centers.

CITY B

In 1969 city B installed a work measurement system in its Public Utilities Department with the assistance of a private consulting firm. The system was applied to work performed by 109 craftsmen in the Electric and Water Divisions.

The city reported gross savings of $1,194,000 for fiscal years 1971-74 and costs of $396,000 to implement and operate the system, providing a net savings of $798,000 for the 4-year period. The saving was achieved through manpower reductions and productivity increases.

Performance efficiency increased from 74 percent in 1970 to 87 percent in 1974 for the Electric Division. It increased from 63 percent to 86 percent for the Water Division during the same period. These increases were conservatively calculated because they were measured from a base period of 24 weeks ended June 4, 1970. If measured from the 3-month starting period which ended October 1969 (when performance data first became available), the percentage increases would have been considerably greater.

The system helped both divisions to reduce the work backlog. Benefits also cited by city officials included

--an effective, efficient means of scheduling work;

--a means for identifying and highlighting problem areas for management action;

--the standardization of procedures based on the most productive methods;

--the creation of a competent staff to conduct methods improvement studies and to evaluate maintenance improvement proposals relating to manpower, materials, and equipment;

--a simplified and improved reporting system for management control; and

--a means of determining manpower requirements.

REQUIREMENTS OF AN EFFECTIVE WORK MEASUREMENT SYSTEM

Only optimum productivity levels can insure maximum use of an organizations's available resources. Work measurement systems in real property maintenance provide a means of obtaining optimum productivity levels. Such systems are prime management tools for planning, scheduling, and controlling resources. However, to be effective, such systems must be soundly conceived, properly implemented, and used effectively.

Management emphasis at all organization levels on the importance of using work measurement techniques is a prerequisite for a successful work measurement system. Experience has shown performance efficiency decreases when management does not actively support the use of such systems.

The essential ingredients of a work measurement system include adequately maintaining engineered performance standards, properly applying the standards for planning and estimating work, compiling useful work measurement data, and effectively managing the use of the data to evaluate and improve the performance and efficiency of real property maintenance operations. A weakness in any one of these ingredients could adversely affect the entire system which would then provide less than optimum benefits.

COVERAGE BY ENGINEERED STANDARDS

Consultants generally agree that about 75 to 80 percent of maintenance work should be covered by engineered standards. These standards provide the time it should take trained workers, working at a normal pace, to produce a defined unit of work of an acceptable quality. They are derived from a complete, objective measurement and analysis of work elements using such various techniques as work sampling and time studies. Because two similar maintenance and repair tasks are never exactly alike, engineered standards are developed to fall within a range of time rather than the precise times which are characteristic of repetitive industrial production. This range-of-time concept makes it possible to set accurate and reliable standards for maintenance work.

Engineered standards are the most accurate basis for planning and estimating work. They provide an established norm for estimating the amount of work to be done during a specific period and for measuring the labor force's efficiency in accomplishing that work. They should be reviewed and updated periodically to show method and technology changes.

APPLICATION OF ENGINEERED STANDARDS

The availability of standards is not enough. They must be correctly applied to planned work by trained planners and estimators to provide accurate projections of labor requirements. Proper use will produce effective phasing in of different crafts involved in a job.

According to experts, a ratio of one qualified planner and estimator for 25 to 35 craftsmen is necessary for effective application of standards. The planners and estimators should receive thorough initial training and periodic refresher training in the use of engineered standards.

USE OF WORK MEASUREMENT DATA

A good work measurement reporting system provides timely, accurate work measurement data in a format easily usable by managers at all levels. Work measurement data, appropriately summarized, is very useful at intermediate and top-management levels for evaluating performance and determining resource requirements. Its use in formulating budgets provides for accurate and realistic projections of manpower and dollar requirements.

Work measurement reports at lower management levels provide useful data for budgeting and manpower planning, distributing manpower resources, supervising operations, and evaluating performance. Effective use of work measurement data keeps managers informed of labor's performance and provides indications of ways to improve the efficiency of maintenance operations. Significant variances between standard and actual labor hours for individual jobs must be routinely analyzed. By such analysis and continuous monitoring of trends, managers can promptly identify those areas requiring corrective action to help improve productivity. Some potential benefits from this type of analysis are improved coverage of maintenance work by engineered standards, new or better maintenance techniques and methods, and improved maintenance organization and procedures.

ASSISTANT SECRETARY OF DEFENSE
WASHINGTON, D.C. 20301

IN
INSTALLATIONS AND LOGISTICS

17 FEB 1976

Mr. F. J. Shafer
Director, Logistics and
Communications Division
U. S. General Accounting Office
Washington, D. C. 20548

Dear Mr. Shafer:

This is in response to your letter of December 8, 1975 to the Secretary of Defense which forwarded copies of your draft report entitled "Opportunities for Improving Productivity in Real Property Maintenance Operations," Code 945238 (OSD Case #4241).

The draft report has been reviewed by this office and the Military Departments. Comments resulting from these reviews are attached.

We appreciate the opportunity to review and comment on this report. The findings and recommendations contained therein will be helpful in our continuing efforts DoD-wide toward a more economical and effective real property maintenance activity program.

Sincerely,

JOHN J. BENNETT
Acting Assistant Secretary of Defense
(Installations and Logistics)

Enclosure
Comments

Department of Defense Position
on
GAO Draft Report, dated December 8, 1975
(Code 945 238 - OSD Case #4241)

"Opportunities for Improving Productivity in Real Property Maintenance Operations"

I. GAO Draft Report Summary

The military services have some serious problems in the systems they use to measure and evaluate how productive their labor forces are in real property maintenance. These problems have caused the Services to fall far short of the achievements obtained by nonfederal organizations which have adequate work measurement systems. These nonfederal organizations have reported productivity increases of 10 to 45 percent after they implemented their systems.

The Department of Defense spends more than $2 billion annually for maintenance, repair and minor construction to restore or preserve real property. Therefore, a relatively small increase in productivity has the potential for major cost savings.

DoD has not realized productivity increases similar to those achieved by nonfederal organizations principally because: (1) Engineered Performance Standards (EPS), which provide for consistent planning and estimating, have been allowed to deteriorate and become obsolete; (2) the standards are used very little or not at all for estimating project costs and scheduling work; (3) work measurement data is not adequately analyzed to identify problems so that timely corrective action could be taken to improve productivity; and (4) implementing instructions lack provisions for use of productivity data by top management in budget preparation and allocation of resources.

GAO recommends that the Secretary of Defense: (1) Establish controls and procedures necessary to monitor the progress of the Services in complying with its implementing instructions; (2) assure resources are provided to update and maintain the work performance standards and to effectively operate work measurement systems; (3) assure sufficient training is provided both operating personnel and managers on the uses and benefits of work measurement systems; and (4) require that productivity data be summarized for management to use in evaluating, budgeting and allocating resources.

II. Defense Position Summary

DoD in general agrees with the basic conclusions and recommendations of the draft report. DoD Directive 5010.31 outlines broad objectives

for the DoD Productivity Program which is, "The Primary objective of the DoD Productivity Program is to achieve optimum productivity growth throughout the Department of Defense in order to attain the highest possible level of Defense preparedness with available resources."

DoD policy and guidance in the past strongly supported a requirement for a productivity improvement program. While present policy is considered adequate, continued emphasis will be given to seeking additional improvements in this area, so as to insure the most effective use of available resources. Attention will be given to identify and eliminate unnecessary and nonproductive functions, increase efficiency in required functions, and improved program evaluations. Labor productivity increases can be achieved by improving methods, procedures and processes; making prudent use of EPS; providing more efficient and cost effective tools, equipment and facilities; increasing the skills of our workforce through better and more effective training; and motivating all personnel to be more efficient and alert to opportunities for improvements.

III. Defense Comments

A. General

1. Present policies and direction by OSD for establishing EPS is considered adequate. The DoD Productivity Program, DoD Directive 5050.31, provides the basic framework for effecting productivity improvements and for determining and evaluating labor productivity in all major support functions. DoD components are required to establish productivity improvement goals by major support functions prior to the beginning of each year. Positive actions must be taken in all areas of responsibility; such as, unnecessary and nonproductive functions; increased emphasis on improvements in methods, processes and procedures; timely identification and funding of fast payback productivity enhancing projects; and more effective use of work standards. DoD Directive 4165.2 sets forth the objectives for the DoD Real Property Maintenance Activities (RPMA) Program. One specific objective is:

> "Work Planning and Control. Management effectiveness in carrying out programming and planning of the RPMA Program depend largely on information collected and actions taken prior to the breakdown of facilities. Work control systems will ensure that effective direction and control of allocated resources is maintained and that these resources are expended in accordance with established work plans. Such systems shall provide, as appropriate, for classification, planning, estimating, approval, authorization, and scheduling in accordance with priorities.

"(1) Approval of work shall be delegated to the lowest organizational level, consistent with prescribed limitations and the need for command control, to ensure that resources are expended in accordance with mission priorities.

"(2) A job system, including output measures, will be used to authorize the performance of work and to ensure that charges are properly made to designated cost areas and related to end results (outputs).

"(3) Engineered work performance standards will be used where practicable and feasible for estimating labor requirements and scheduling work."

2. Contrary to the GAO comment (page 26), the RPMA Program does maintain a relative priority within the logistic area in OASD(I&L). In fact, over the last 18 months, OSD management has provided increased attention as well as a high visibility to RPMA. Under the OSD concept of decentralized control, participatory management policies are established by OSD and the Services made responsible for their implementation. Implementation by the Services is monitored through audits and staff visits. In fact implementation of EPS has been formally identified as an audit area of interest to the OSD and Service audit agencies for the past several years. Higher priority areas of interest have evidently diverted internal audit attention from EPS. To establish and achieve the degree of EPS monitoring at the OSD level, implied by the GAO report, would require an increase of staff whith is contrary to the present atmosphere of reducing headquarters staffing levels.

3. The GAO quote that "A DoD official felt that maintenance work was too involved to permit effective use of performance standards." (page 33) is not correct. Of the OSD individuals contacted, all firmly support the concept of EPS and believe that it can and should be implemented. As indicated by the above referenced directives, it is the OSD policy that performance standards be utilized.

4. Appropriate action will be taken to update standards and emphasize work measurement systems within available resources.

B. Army

1. GAO states that EPS has been allowed to deteriorate. The Army's EPS found in Technical Bulletins 420-1 through 420-32 cover 85 percent of the RPMA requirements. Task times, frequencies and equipment may change but the EPS does not become obsolete due to these changes.

2. GAO states that the standards are used little or not at all. The Army considers the two installations surveyed not to be representative of all installations. All Major Commands (MACOMs) use EPS in varying degrees. The Army TB 420-1, para 4.4.8 discusses planner/estimator (P/E) output and notes that under ideal conditions a P/E is able to support 32.5 shop personnel. Office of the Chief of Engineers (OCE) is currently determining what the actual ratio of P/E is to the labor force CONUS-wide.

3. GAO states that work measurement data is not adequately analyzed. OCE instructs all facilities engineers that the work management system in AR 420-17 and DA Pamphlet 420-6 requires analysis of estimated work with actual work. OCE staff visits and MACOM inspections indicate major improvements are being made in this area.

4. The GAO Draft Report states implementing instructions lack provisions for use of productivity data by top management. OCE and MACOMs do use the Technical Data Report which is complied from fiscal and productivity data provided to MACOMs by the installations. The Army believes that there is room for improvement in this area to provide consolidated information at MACOM level.

5. GAO recommends establishing controls over its implementing instructions. OCE has established programs which should result in improved control over implementing instructions.

6. GAO recommends that resources are provided to update and maintain EPS. OCE has provided $65,000 over the past two years to update certain standards (heating and air conditioning and emergency procedures). Plans are to give increasing priority to this area.

7. GAO recommends that sufficient training be provided. OCE has established an EPS training course at the Army Management Engineering Training Agency (AMETA) and currently have 20 certified instructors at MACOM installations throughout the Continental United States (CONUS). These certified instructors have conducted three week classes to approximatley 300 P/E throughout CONUS.

8. GAO suggests that productivity data be used for management to use in evaluating, budgeting and allocating resources. OCE has over the past two years conducted a detailed review of the RPMA operations at all installations. The data contracted from technical visits and staff visits indicate the managers in the field require instruction in evaluating management data. This instruction is scheduled to start by MACOMs during FY 77 in addition to the usual technical and staff visits.

APPENDIX IV

C. Navy

1. The subject GAO Draft Report concludes that the military services have problems in the systems they use to measure and evaluate the productivity of their labor forces in real property maintenance. The report recommends that services provide resources to update, maintain, train for, and monitor use of work performance standards, and establish procedures to control the use of work performance standards and productivity data in evaluating, budgeting and allocating resources.

2. The Navy made a major effort in the late 1950's to install Engineered Performance Standards (EPS). The benefits were and are still recognized. However, the system slowly fell into disuse because of increasing administrative costs and difficulties of updating the standards, training planners and estimators, and maintaining the management information system necessary to exploit EPS. In recent years, civilian personnel ceiling reductions have encouraged elimination of administrative positions in order to keep productive shop personnel. It has not been feasible to obtain the EPS services by contract.

3. Also, contrary to the GAO study conclusions, the Navy believes that the Department of Defense generally remains ahead of industry in the use of EPS. Of the few private firms using EPS, many originally obtained them from the services and have been able to modify and maintain them. However the Navy has not been able to find in the private sector EP Standards suitable for use without costly updating and modification. We are continuing to look for private sources.

4. Improvement in the utilization of work performance standards is a desired Navy objective which will be pursued insofar as resources permit. Unfortunately, however, current funding for real property maintenance is so limited that even many programs which have a high, long-term pay off cannot be supported. Efforts must be concentrated on operational readiness. It is therefore not likely that there will be an improvement in EPS implementation in the foreseeable future.

D. Air Force

1. The GAO report asserts that the Air Force would achieve productivity increases of 10 to 45 percent through the expanded use of engineered performance standards for planning and estimating. It is believed that this assertion is not valid. The methods for increasing productivity that the GAO identified in nonfederal organizations are, to a large degree, already implemented in the Air Force. The nonfederal organizations original management systems apparently made little or no use of standards and the associated inefficiencies thus allowed for major improvements when standards were introduced. As the Air Force already uses standards, albeit at a higher level of aggregation, such major increases could not be expected. Air Force manpower standards, at work center level, determine the size of the base level civil engineering work force. These standards are developed under the aegis of the Air Force Management Engineering Program and are applied Air Force-wide. They are developed through recognized industrial engineering techniques that relate manpower requirements to workload factors. The Air Force has also incorporated several management procedures; i.e., industrial engineering analysis, quality control and the "controller concept" (individual craftsman work assignment and monitoring) over the past several years to provide Positive Work Force Control of in-service resources. In view of the above, the Air Force does not anticipate an increase in productivity to the degree identified in the GAO report.

2. GAO alleges that EPS have become obsolete. The Air Force agrees that EPS have become obsolete and do not cover the latest technological development in materials, equipment or the way in which work is performed today. The Air Force recognized this problem in 1974 and authorized the use of comparable commercial or locally developed standards for the intervening period until the EPS are updated.

3. The GAO states that standards are used very little to estimate costs and schedule work. The Air Force is currently applying EPS only to planning of work orders which constitute a relatively small portion of the direct labor effort.

4. The GAO states that work measurement data is not adequately analyzed to identify problems. The Air Force concurs in the findings and proposes to increase their effort in the analysis of work measurement data.

5. The GAO states that implementing instructions lack provisions for use of productivity data in budget preparation and resource allocation. The resources necessary to satisfy these requirements are determined using engineered manpower standards based on factors

such as square footage of facilities, acres of land and tons of refuse. Historical consumption provides the basis for determining utilities requirements while major repair and maintenance projects are identified by highly qualified engineers. Productivity measurements for RPMA can be useful in determining relative effectiveness of one installation versus another or of one function/activity in successive time periods. They do not provide, in the current state of the art in the federal sector, either a tested or reasonably precise means of resource measurement for budgeting purposes.

6. The Air Force proposes to use Engineered Performance Standards (EPS) for the work categories that are covered by the Navy's P-700 series of publications. This will cover 55 percent of our present direct labor effort and can be implemented with existing resources. The three categories of work to be included in the 55 percent coverage are:

a. Work orders used to perform multitask and multitrade projects where detailed planning is required to assure efficient utilization of resources.

b. Recurring maintenance which includes preidentifiable and repetitive maintenance tasks associated primarily with equipment.

c. Operations and services which includes preidentifiable and repetitive service activities and attendant functions.

The remainder of the direct labor effort includes job orders and service calls. The scope of this work is not predictable and normally involves small, one-man, single trade jobs, each of which requires few labor hours. As a result, detailed planning through the use of EPS is not an effective application of labor standards for this type of work. The Air Force is prepared to use EPS beyond 55 percent coverage of the direct labor effort whenever the costs for the additional coverage can be offset by identifiable payback.

PRINCIPAL OFFICIALS RESPONSIBLE FOR ADMINISTRATION OF ACTIVITIES DISCUSSED IN THIS REPORT

	Tenure of office	
	From	To
DEPARTMENT OF DEFENSE		
SECRETARY OF DEFENSE:		
Donald H. Rumsfeld	Nov. 1975	Present
James R. Schlesinger	July 1973	Nov. 1975
William P. Clements, Jr. (acting)	May 1973	July 1973
Elliot L. Richardson	Jan. 1973	Apr. 1973
Melvin R. Laird	Jan. 1969	Jan. 1973
ASSISTANT SECRETARY OF DEFENSE (INSTALLATIONS AND LOGISTICS):		
Frank A. Shrontz	Feb. 1976	Present
Dr. John J. Bennett (acting)	Apr. 1975	Feb. 1976
Arthur I. Mendolia	June 1973	Mar. 1975
Hugh McCullough (acting)	Jan. 1973	June 1973
Barry J. Shillito	Feb. 1969	Jan. 1973
DEPARTMENT OF THE AIR FORCE		
SECRETARY OF THE AIR FORCE:		
Thomas C. Reed	Jan. 1976	Present
James W. Plummer (acting)	Nov. 1975	Jan. 1976
John L. McLucas	July 1973	Nov. 1975
John L. McLucas (acting)	June 1973	July 1973
Dr. Robert C. Seamans, Jr.	Jan. 1969	May 1973
ASSISTANT SECRETARY OF THE AIR FORCE (INSTALLATIONS AND LOGISTICS):		
J. Gordon Knapp	Mar. 1976	Present
Frank A. Shrontz	Oct. 1973	Feb. 1976
Richard J. Keegan (acting)	Aug. 1973	Oct. 1973
Lewis E. Turner (acting)	Jan. 1973	Aug. 1973
Philip N. Whittaker	May 1969	Jan. 1973

APPENDIX V

	Tenure of office	
	From	To
DEPARTMENT OF THE ARMY		
SECRETARY OF THE ARMY:		
Martin R. Hoffmann	Aug. 1975	Present
Norman R. Augustine (acting)	July 1975	Aug. 1975
Howard H. Callaway	June 1973	July 1975
Robert F. Froehlke	July 1971	June 1973
ASSISTANT SECRETARY OF THE ARMY (INSTALLATIONS AND LOGISTICS):		
Harold L. Brownman	Oct. 1974	Present
Edwin Greiner	Aug. 1974	Oct. 1974
Eugene E. Berg	Nov. 1973	July 1974
Vincent P. Huggard (acting)	Apr. 1973	Nov. 1973
Dudley C. Mecum	Oct. 1971	Apr. 1973
DEPARTMENT OF THE NAVY		
SECRETARY OF THE NAVY:		
J. William Middendorf II	June 1974	Present
J. William Middendorf II (acting)	Apr. 1974	June 1974
John W. Warner	May 1972	Apr. 1974
John H. Chafee	Jan. 1969	May 1972
ASSISTANT SECRETARY OF THE NAVY (INSTALLATIONS AND LOGISTICS):		
Jack L. Bowers	June 1973	Present
Charles L. Ill	July 1971	May 1973