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October 1977

COMPARATIVE STUDIES OF ORGANIZATIONAL FACTORS IN MILITARY MAINTENANCE

KENNETH L. DRAKE
MARK S. SANDERS
WILLIAM H. CROOKS
GERSHON WELTMAN

Prepared For

CYBERNETICS TECHNOLOGY OFFICE
Defense Advanced Research Projects Agency
1400 Wilson Boulevard
Arlington, Virginia 22209

PERCEPTRONICS
6271 VARIEL AVENUE • WOODLAND HILLS • CALIFORNIA 91367 • PHONE (213) 884-7470

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This report describes a comparative analysis of organizational factors in maintenance. The research program objectives centered on the identification of organizational policies, practices and procedures that act as incentives and/or disincentives for providing cost-effectiveness maintenance in the military. The approach was to: (1) survey organizational factors in other

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maintenance; (2) compare U.S. military and U.S. civilian groups maintaining an equivalent high technology system; (3) organize and analyze field data to identify organizational factors that contribute to good and bad system performance; and (4) make specific recommendations and formulate guidelines based on the experimental and analytical results to improve maintenance system performance.

The portrait of the U.S. military maintenance system that emerges from this study is one of a frustrated mechanic working in an organization where "being a mechanic" comes after "being a soldier". In brief, military mechanics like the field of helicopter maintenance. They are, in comparison with civilian mechanics, generally satisfied with their pay, with their social environment, and even with their supervisors. However, they do not think much of their job as it is defined by the military. Compared to civilians, they have less pride in their units, they think that their job has little significance or task identity, and that it exercises few of their skills. They feel their autonomy is low, and that they receive minimal feedback from the job itself. Accordingly, they have little motivation to perform. They feel a need for growth, and in all probability, will seek this growth outside the military.

Looking at the organizations themselves, military organizations place more emphasis than do civilian organizations on non-maintenance tasks and have a philosophical attitude of "soldier first". As might be expected, the working conditions of military units are less comfortable. The military organizational structure has more levels, with maintenance tasks broken into more layers. Few differences exist between civilian and military supervisors in terms of the personal incentives used. Both rely primarily upon verbal praise and reprimands. However, civilian supervisors also use opportunities for advanced training as an incentive, whereas military supervisors do not. Within military organizations alone, cost appears to be a secondary concern to the primary goal of readiness. But there are significant differences among the several levels of maintenance supervisors regarding the importance attached to various measures of work unit effectiveness.

The results of our analysis indicate that the biggest payoff in improving military maintenance effectiveness and efficiency is not in introducing additional incentives, but rather in reducing or eliminating the existing disincentives. Two recommendations of this study stand out as being central to the improvement of maintenance. These are: (1) institute job enrichment activities to modify mechanics' jobs, and (2) reduce the impact of necessary disruptions on maintenance activities. Implementing these recommendations can yield high payoffs in maintenance efficiency and effectiveness, with a minimal expenditure on plant or personnel.

TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED)

TABLE OF CONTENTS (CONTINUED)

LIST OF FIGURES

LIST OF TABLES

EXECUTIVE SUMMARY

Problem

Dramatic changes have occurred in military maintenance since pre-World War II days, when only a small military force existed in the United States. Not only has the equipment inventory become drastically larger and more complex, but also the military forces must be maintained in a higher state of readiness in order to respond in the vastly decreased time available for mobilization. The large and diverse inventory, coupled with the necessity of continued readiness, makes equipment maintenance a fundamental element in the defense of the Nation. Indeed, maintenance now accounts for 20% to 30% of the DoD budget. It is well recognized that improvements in the maintenance system are needed to limit these costs and to derive full benefits from them. A promising approach to improving maintenance efficiency and effectiveness is to examine the organizational policies and procedures of military maintenance units, with an eye to identifying the incentives which encourage good maintenance and the disincentives which discourage it.

Technical Approach

The approach of the present study was to compare U.S. military maintenance organizations with U.S. civilian maintenance organizations, and also with Israeli military units. The purpose was to identify incentive practices which could be used effectively in the U.S. military units to improve cost efficiencies. This report discusses the results of the U.S. military and U.S. civilian comparison. The U.S. and Israeli military comparison is discussed in a separate report.

To provide a common level of technology among all maintenance groups, we studied groups working with the Bell model 206 JetRanger helicopter, a prototypical high-technology system. As a first step in the study, a model of organizational structures and functions was developed which

served to identify the crucial factors which would have to be examined in the maintenance organizations. Based on this model, and upon initial interviews with members of the organizations, survey questionnaires and interviews were developed to measure the organizational goals, structures and functions, incentives, and personnel attitudes. Questionnaires were given to 124 mechanics of four different military maintenance units and to 29 mechanics of three civilian maintenance units. In-depth interviews were conducted with 22 military and 10 civilian maintenance supervisors. In addition, rating forms were given to three levels of military maintenance supervisors to identify criteria of maintenance effectiveness. Weekly performance summaries were also obtained from all military units surveyed to measure actual available manpower and maintenance efficiencies.

Findings

The portrait of the U.S. military maintenance system that emerges from this study is one of a frustrated mechanic working in an organization where "being a mechanic" comes after "being a soldier". In brief, military mechanics like the field of helicopter maintenance. They are, in comparison with civilian mechanics, generally satisfied with their pay, with their social environment, and even with their supervisors. However, they do not think much of their job as it is defined by the military. Compared to civilians, they have less pride in their units, they think that their job has little significance or task identity, and that it exercises few of their skills. They feel their autonomy is low, and that they receive minimal feedback from the job itself. Accordingly, they have little motivation to perform. They feel a need for growth, and in all probability, will seek this growth outside the military.

Looking at the organizations themselves, military organizations place more emphasis than do civilian organizations on non-maintenance tasks and have a philosophical attitude of "soldier first". As might be expected, the working conditions of military units are less comfortable. The military organizational structure has more levels, with maintenance tasks

broken into more layers. Few differences exist between civilian and military supervisors in terms of the personal incentives used. Both rely primarily upon verbal praise and reprimands. However, civilian supervisors also use opportunities for advanced training as an incentive, whereas military supervisors do not. Within military organizations alone, cost appears to be a secondary concern to the primary goal of readiness. But there are significant differences among the several levels of maintenance supervisors regarding the importance attached to various measures of work unit effectiveness.

Recommendations

The results of our analysis indicate that the biggest payoff in improving military maintenance effectiveness and efficiency is not in introducing additional incentives, but rather in reducing or eliminating the existing disincentives. Military mechanics like being mechanics and want to spend more time at it. However, they find that other things come first or that the job is arranged to frustrate good performance. With proper attention to job design and job scheduling, improved efficiencies could be achieved not only in terms of reduced maintenance-hours per equipment use-hours, but also in terms of improved on-the-job training and higher re-enlistment rates among mechanics. Two recommendations of this study stand out as being central to the improvement of maintenance. These are:

(1) Institute job enrichment activities to modify mechanics' jobs.

(2) Reduce the impact of necessary disruptions on maintenance activities.

Implementing these recommendations can yield high payoffs in maintenance efficiency and effectiveness, with a minimal expenditure on plant or personnel. Subsequent field testing at a military installation will examine means by which the recommendations could be implemented. The field test will examine the performance effects of job rescheduling as a means of reducing job disruptions.

1. INTRODUCTION

1.1 Overview

This report presents the results of the first year's effort in a research program directed towards improving the maintenance capability in military systems. The intent of the program was to explore those organizational factors, emphasizing incentive structures, which might be responsible for the high costs of the military maintenance operations. The technical approach combined descriptive and analytical methods. It centered on a comparative examination of U.S. military and civilian groups performing maintenance on equivalent and representative light helicopter systems. The research goal of the program was to utilize the obtained data to generate recommendations for improving the effectiveness and efficiency of aviation maintenance, and other high technology military maintenance activities. In addition, the program included an analysis of Israeli military maintenance practices as a potential source of innovative organizational policies. This report discusses the results of the U.S. military and U.S. civilian comparison. The U.S. and Israeli military comparison is discussed in a separate report.

1.2 Background

1.2.1 Problem Statement. The role of the Department of Defense is to provide for the national security of the United States. The activities and costs required to maintain the national security have changed dramatically since the days when only a relatively small military force existed and very little equipment was available in the military inventory. For example, in the 1930's, the top speed of the nearly 1000 aircraft in the Army Air Corps' inventory was about 200 miles per hour. A relaxed attitude prevailed among defense planners, and it was generally assumed that a year or two would be available to the United States to mobilize both people and industry to meet any hostile challenge.

Drastic changes, however, have occurred within the world situation over the intervening decades. A great many more people are now involved in the defense of the Nation and in the maintenance of an all-services inventory of thousands of aircraft, missiles, and other systems. At the same time, the quantity and sophistication of military weapons of other nations has also increased, and the United States is no longer isolated from direct or surprise attack. In the environment of today's world, the time available for mobilization of military forces has been reduced from years and months to perhaps as little as a few hours. As we cannot delay mobilization until after hostilities have begun, it is necessary for military forces to maintain a constant state of readiness and to be capable of responding rapidly to any situation. The multitude of situations into which the military can be called, coupled with the mix of weapons and hardware required to counter those situations, makes the success of any modern day military mission dependent on the continued readiness of military people and equipment. Military equipment readiness is thus a fundamental element in the defense of the Nation. The role of maintenance forces within the Department of Defense, accordingly is to sustain equipment in a state of operational readiness, consistent with the demands of the operating forces, and to do this at the lowest possible costs.

1.2.2 Costs of Maintenance. Maintenance costs have soared in recent years. Recent studies (Smith et al., 1970; Turke, 1977) estimate the costs of maintenance to be from 20 to 30 percent of the DoD budget. Unfortunately these cost figures only portray the overall costs of maintenance. Currently, there is no system in the military services which accurately computes separate costs of support systems and subsystems. General Accounting Office audit report (1971) revealed the cost accounting practices varied so widely among the services and within services that no meaningful comparisons of activities performing similar work could be made. The apparent reason for this is that there is no single appropriations agency that totally finances maintenance functions. Funds for maintenance

come from such agencies as military personnel, operations and maintenance, procurement, and military construction. Many "within house" funds such as manpower, supply, transportations and so forth ultimately end up being used for maintenance. Nevertheless, a low estimate places the cost of depot and unit level weapon system and equipment maintenance at $18 to $20 billion with approximately $6.5 billion of that going to depot. The problem with specifying the cost of maintenance below the depot level is that manpower and other resources utilized for maintenance at the unit level are also utilized for other tasks associated with other military duties. On the one hand, high levels of funding appears necessary in order to sustain a high quality of maintenance and in turn, a high level of equipment readiness. On the other hand, maintenance costs must be controlled to free funds for the modernization of defense capabilities. New, complex, technological weapon systems generate added costs associated with personnel selection, placement, and training. Other cost factors associated with complexity are the high cost of parts and the increased maintenance man-hours required to maintain equipment readiness. It is usual to expect that the maintenance costs of a weapon system in many cases exceed those of acquiring the system initially. The acquisition cost, although given more publicity, is often not the major cost of a system. The cost of the long term commitment cannot be accurately known at the outset. It thus becomes essential to devise procedures for controlling costs over the equipment's entire life cycle. As the costs of maintenance have grown in both magnitude and importance, the need for control has been specifically recognized. This has resulted in the placement of the Office of Maintenance Policy under the directorship of the Deputy Assistant Secretary of Defense (Turke, 1977).

1.2.3 Improving Maintenance Effectiveness. There are active ongoing programs to improve maintenance management. These programs are fashioned to increase readiness and decrease costs by using logistics support planning designed to control downstream maintenance workloads and costs.

When a new weapon system enters initial production 80% or more of its future maintenance requirements have been set as a consequence of design. Potential maintenance can be reduced if the equipment is designed to ensure high reliability and maintainability. Logistics support planning is a promising long term solution to reducing maintenance costs. However, logistic support planning does not solve the immediate problems of military maintenance operations. The DoD currently has a large inventory of equipment varying in age, type, technology and degree of complexity. What is needed is a method for improving effectiveness and efficiency in the current operational environment.

In addition to being a large proportion of the military's day-to-day activities, it is well recognized that current systems of military maintenance fall far short of optimum performance. Even where maintenance is effective, in the sense of keeping equipment operationally ready, it is inefficient in terms of personnel, material, and time. To many, it seems that the rapid growth in equipment complexity has outstripped the ability of the system to prepare and orient maintenance personnel adequately. As a result, virtually all recent attempts at improving maintenance have focused on two areas: (1) improving technician skills, primarily through training, and (2) providing on-the-job aids, primarily manuals and other technical devices (King and Duva, 1975). Research and development in these areas has emphasized new types of equipment, and there has been only a limited effect on maintenance system performance (Bond, 1970).

A major reason for the previous lack of payoff in maintenance research and development is a relative neglect of important organizational factors. For instance, Foley (1975) has pointed out that "methods used to select, train, and promote maintenance personnel in themselves contribute to inefficient maintenance." Attention to organizational effectiveness, which includes such factors as management policies, incentive structures, and inter-personnel relations, in addition to training programs and task

design, has caused significant improvement in other organizational contexts (Zawacki, 1974). Attention to organizational policies and procedures may be a highly promising means of improving the cost-effectiveness of military maintenance. This is the approach which was followed in the current study.

Improvements in system effectiveness due to organizational modifications have been previously demonstrated in a large number of cases. For example, Vroom (1964) and Lawler (1971) provide extensive reviews of the literature showing that when organizational policies, incentive systems, and work situations are structured to make reward (both intrinsic and extrinsic) contingent upon performance, increases in productivity, job attendance and motivation result. Similarly, Porter and Lawler (1965) reviewed much of the then current literature regarding the effects of organizational structure on worker attitudes and performance. Variables such as span of control, work shop size, and tall or flat organizational structure, were shown to be related to productivity, job satisfaction, absenteeism, and turnover.

In the area of organizational development, Hitchcock and Sanders (1974) found strong relationships between various dimensions of organizational climate/management practices and the criterion of accidents among munition workers. Goal setting, as an organizational practice, has also been shown to improve job performance (Latham and Kinne, 1974). Lawler (1969) found evidence of increased productivity in 6 out of 10 studies which redesigned jobs to increase intrinsic motivation. Ford (1969) reported a 27% reduction in turnover through such efforts; and Bowers (1973), studying 23 civilian organizations, demonstrated the effectiveness of organizational development in improving decision making performance. The research evidence, then, overwhelmingly supports the contention that organizational policies and practices have direct and significant effects on personnel performance and organizational effectiveness.

1.3 Objectives

The principal objective of this study is to identify organizational policies, practices and procedures that act as incentives and/or disincentives for providing cost-effective maintenance in the military. We have taken a broad view of incentives and disincentives and included system characteristics, policies, and procedures which appeared to impact directly on the work motivation of the maintenance personnel. Focus is upon those organizational factors which affect the work unit personnel and immediate supervisors who control maintenance on a day-to-day basis. In this context, we have emphasized that performance can be improved both by introducing and increasing incentives and by removing and decreasing disincentives.

The program objective can be divided into the following specific subobjectives:

(1) Survey and categorize the critical organizational and interpersonal factors which control the ability of a military maintenance system to deliver effective and efficient maintenance.

(2) Investigate a selected number of military and civilian groups maintaining an equivalent high technology system to acquire, by questionnaire and interview, comparative field data on maintenance organizational goals, structure and function, support structure, incentives, and personnel attitudes, as well as the cost effectiveness of maintenance.

(3) Organize and analyze the field data so as to permit (a) direct comparison among U.S. systems, and (b) identification of the key organizational factors contributing to good and bad system performance.

(4) On the basis of the experimental and analytical results, formulate guidelines and specific recommendations for the improvement of maintenance system performance.

1.4 Approach

The approach of the present study was to compare U.S. military maintenance organizations with U.S. civilian maintenance organizations. The purpose was to identify incentive practices which could be used effectively in U.S. military units to improve cost efficiencies. The technique used in this project for collecting comparative data is that of investigative reporting. U.S. civilian and military maintenance organizations were critically evaluated to isolate factors which could, by their presence or absence, hinder military maintenance efficiency. It was anticipated that the analysis of civilian operations data would generate hypotheses that may have been overlooked if only military installations were investigated.

The investigative reporter model involves essentially following inefficient practice up through the organization in an effort to discover how those certain practices originate and persist. This can be contrasted with organizational analysis which is usually content only to describe the presence of the factor. In essence, the approach is to "pick up a string and follow it to its end". For example, if it is discovered that maintenance personnel are called off their jobs unpredictably to perform other duties such as burial detail, this practice is traced to its source. Who assigns the men to other duties? Why are maintenance men selected rather than another less critical classification? Can assignments be made more predictable? Etc.? Such questions require moving through, and up, the organization from level to level to uncover the rationale (or lack of it) that fosters the inefficient procedure.

Surveys and interviews of military mechanics and their supervisors served as the primary data for isolating inefficient procedures, each of which was followed up by interviewing appropriate personnel in an effort to "follow the string". Surveys and interviews of civilian maintenance personnel served to identify procedures and factors which might improve efficiency in U.S. military maintenance. It was also anticipated that different levels of an organization may have different criteria, or models, of how to define organization effectiveness. It is possible, for example, that as we move up the organization, global criteria, such as availability of the maintained equipment, become more important than specific criteria, such as turnover among personnel, waste (good parts replaced), or down time. These differences in definition and criteria may account for the existence of certain procedures and factors. In essence, something may exist because it is not considered inefficient by a particular definition of organizational effectiveness. An attempt was made to "capture" the definitions of effectiveness of various people at different levels of both civilian and military organizations using questionnaire methodology.

1.5 System Selection

To focus the specific comparative examination of U.S. military and U.S. civilian maintenance organizations, initial selection was made of a system maintained by both groups. The basic requirements of candidate systems were that they be used in the same, or nearly the same, form by the U.S. military and by U.S. civilian organizations. Complete systems were favored over components. It was also desired that the systems be used in combat, be representative of modern mechanisms, both electronically and mechanically, and have some degree of criticality in use, so as to provide motivation for proper maintenance.

Several candidate systems were considered for study, including (1) light aircraft, (2) transport aircraft, (3) light helicopters, (4) heavy helicopters, (5) ground transport vehicles, and (6) support

equipment. Based on a standard of suitability for the purposes of this study, aircraft systems were superior to others, helicopters were superior to airplanes, and light helicopters had the most favorable characteristics overall. Based on a survey of currently-available light helicopters, the Bell Model 206 JetRanger appeared to best fit the criteria for this study and was selected as the focal system.

The JetRanger helicopter is a single-crew, 4 to 5-place helicopter powered by an Allison turbine engine. It weighs about 3,000 pounds, has a maximum speed of 120-140 knots, and climbs to 20,000 feet in the civilian version. For the purposes of the present study, it is found in three main configurations:

(1) Model OH-58A Kiowa. Figure 1-1 shows the Army's version of the JetRanger. The OH-58A is used as a light observation helicopter, as well as for transport and as a utility vehicle. It can also carry the XM-27E gun system with 2,000 rounds of ammunition. About 2,200 are in service throughout the Army. They are maintained by military personnel.

(2) Model 206B JetRanger. This is the civilian version, pictured in Figure 1-2. There are more than 5,000 in use over 50 countries. It is used as an air taxi, executive transport, police aircraft, ambulance, and all-around utility vehicle. Maintenance is independent or by Bell Helicopter.

(3) Model TH-57A SeaRanger. The Navy's version, shown in Figure 1-3 is used at Naval Air Station, Whiting Field, Florida, for training purposes. Every Navy flier now receiving primary helicopter training learns his skills in the TH-57A. The 40 craft based at Whiting Field are maintained by Navy personnel with depot level maintenance support directly from Bell under 10-year contracts with the Navy.

FIGURE 1-1. U.S. ARMY OH-58A KIOWA

FIGURE 1-2. BELL MODEL 206B JETRANGER

FIGURE 1-3. U.S. NAVY TH-57A SEARANGER

As a multi-purpose aircraft, the JetRanger features a variety of subsystems; these include: (1) airframe, (2) powerplant, (3) transmission and drivetrain, (4) flight control, (5) fuel and oil, (6) electrical, (7) avionics, and (8) interior and ventilation. In addition, the aircraft can be fitted with various accessories for its special-purpose applications. Each subsystem involves individual problems of check-out, diagnosis and parts supply, and can be taken as representative of similar systems in the same category.

Table 1-1 presents a summary comparison of Army (AVSCOM, 1975) and civilian (Bell Helicopter Co., 1977) OH-58/206 helicopter fleet characteristics. The maintenance cost data, unfortunately, are based on different accounting methods. Thus, direct comparisons can be interpreted only qualitatively.

TABLE 1-1. OH-58A/206 FLEET CHARACTERISTICS

ARMY HELICOPTER FLEET (JUNE 1975)	
INTRODUCED FOR ARMY USE:	MAY 1969
SIZE OF FLEET:	2082
MEAN AGE/AC:	44 MONTHS
MEAN FH/AC:	760 HOURS
MEAN FH/MO/AC:	14.0 HOURS
MEAN FT/MO/AC:	37.2 FLIGHTS
MEAN FT TIME/AC:	22.6 MIN
MAINTENANCE DATA	
MMH/FH:	1.4 (APPROX)
COST/MH:	$11.60
DIRECT MAINTENANCE OPERATING COST:	$98.90/HOUR

CIVILIAN HELICOPTER FLEET (JUNE 1976)	
NUMBER OF OPERATORS:	176
NUMBER OF AIRCRAFT:	884
MAINTENANCE DATA	
MMH/FH:	.53
COST/MH:	$10.00
DIRECT MAINTENANCE OPERATING COST:	$33.23/HOUR

2. A MODEL OF ORGANIZATIONAL EFFECTIVENESS

2.1 Overview

Maintenance organizations are complex structures encompassing a multitude of factors which can potentially affect the overall effectiveness of the organization. A need exists, therefore, to structure the critical organizational and interpersonal factors in a coherent fashion to facilitate measurement and analysis. A model was developed for this purpose. An organization's effectiveness is a direct consequence of the behavior and attitudes of the individual personnel. Organizational processes, demands, constraints, incentives, philosophies, etc. impact on organizational effectiveness only as they effect the performance of the individual worker. The central focus of the model is, therefore, the primary work group composed of supervisor and maintenance personnel. The concept of "focal person" is introduced in the model to denote an individual person. Each member of the work group is, in essence, a focal person.

The model proposed was not intended to be all inclusive, but served to direct attention to important variables which required assessment to document comparisons between military and non-military maintenance systems. The model is not unique to maintenance organizations but is applicable to most any organization. The specific factors might change and work importance might vary but the basic model is generalizable. It is this generalizability that made it attractive for the current comparison of military and non-military organizations. A model specific to military organization would have made meaningful comparisons with non-military organizations difficult and tenuous.

The basic model is illustrated in Figure 2-1. The model is divided into three main parts; organizational inputs, work unit, and organizational outputs. Organizational inputs to the work group are seen

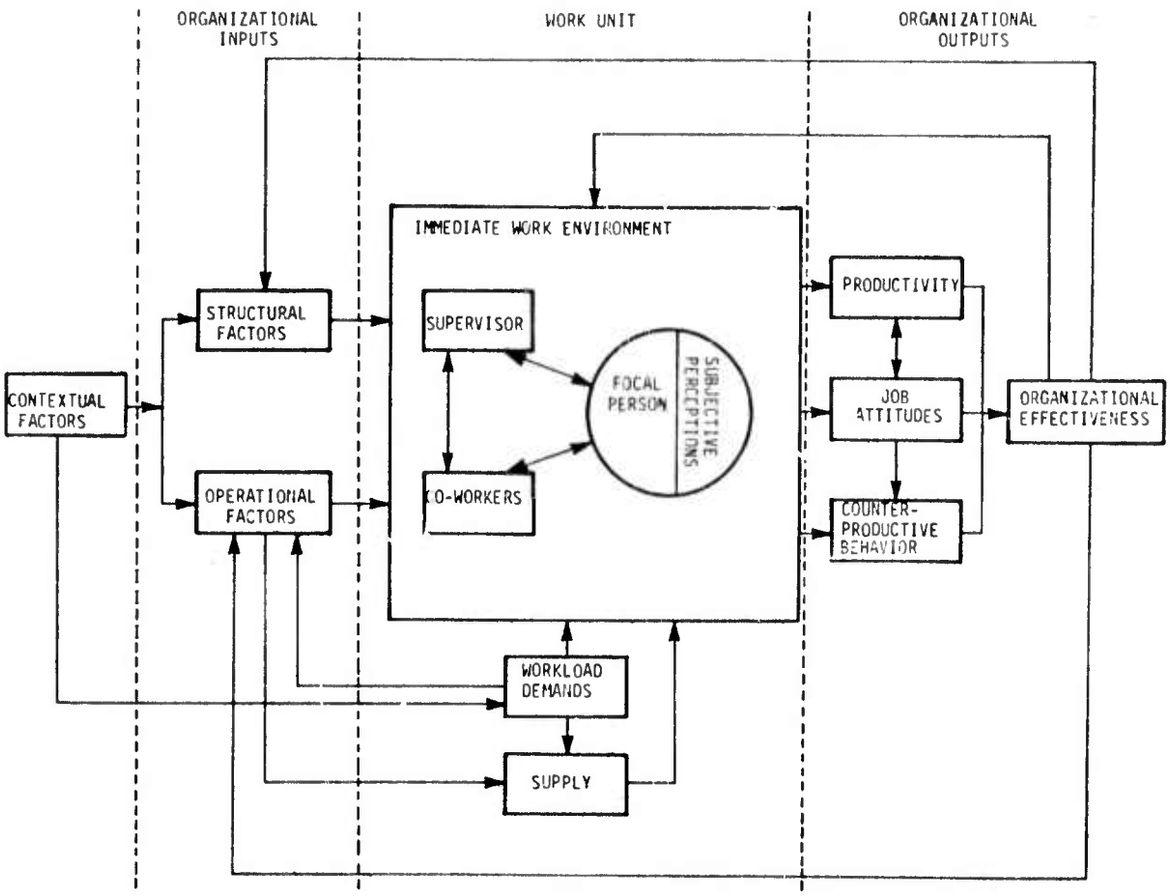

FIGURE 2-1. MODEL OF INCENTIVES AND ORGANIZATIONAL EFFECTIVENESS

as being influenced by contextual factors outside the organization. Within the work group unit the supervisor and co-workers influence the focal person. Organizational inputs are seen as influencing each member of the work group directly as well as through interactions. Central to the model is the importance placed on the work group members' subjective perceptions of the organization and themselves. These perceptions directly impact organizational outputs.

The model is closed loop in that information concerning the organizational outputs are fed back and effect changes in the organizational inputs and the work unit. The system, itself, is an open system in that it affects, and is affected by, the outside environment.

2.2 Contextual Factors

All organizations operate in an environment. That environment (context) places demands and constraints on, and supplies capabilities to the organization. To fully understand the "why" of an organization, it is important that its context be described. These factors become more critical when comparing military and non-military organizations because processes and functions found in one organization may be inappropriate in the other due to different contextual demands and constraints. Five principle contextual factors are included in this model; societal role, uncertainty, technology, human resources, and other organizations and agencies.

2.2.1 Societal Role. The organization's function in society is based upon the organization's original charter and its primary objectives (Porter, et al, 1975). Societal roles are generally conceived of in broad terms and have been used to classify organizations. Blau and Scott (1962) proposed a classification scheme based on the concept of prime beneficiary, i.e., who benefits the "membership", that is, the military. Some non-military organizations primarily benefit the owners and outside clients. However,

a non-military police helicopter maintenance organization may be more similar to a military organization than would an airport service facility with respect to societal role.

2.2.2 Uncertainty and Complexity. Burack (1975) suggests that contextual factors can be identified by degree of uncertainty and complexity. Uncertainty and complexity refer to the consistency and predictability of the components of the environment that directly impinge on the operation of the organization. These components include such things as customer demand, manpower, supplies, and technological change.

Burns and Stacker (1961) found that very different types of management systems arose depending upon the stability of the organization's environment. With stable environments, operations and working behavior were governed by instructions and decisions issued by supervisors' tight command hierarchy with information flowing up and decisions and instructions flowing down, almost a classic military structure. But where there was a rapidly changing environment, a more "loose" operation developed; formal definition in terms of methods, duties and power were reduced, interaction ran laterally as well as vertically, communication between people of different ranks tended to resemble lateral co-equal consultation, almost the antithesis of a classic military structure. Further, if an organization's structure and function does not match its environment, the organization will be less effective than when structure and function match the environment (Lawrence and Lorshe, 1967).

It is important, therefore, to assess the uncertainty and complexity of the environments of the organizations studied. Suggestions for altering the military organization must take the reality of environment into consideration. Some non-military modes of operation may not be efficient for the military because of differences in their environments.

2.2.3 Technology. Technology can be defined as the "techniques used by organizations in work-flow activities to transform inputs into outputs" (Porter, et al , 1975). Chapple and Sayles (1961) term technology as who does what with whom, when, where, and how often. There is a controversy in the literature over the dominance that technology has in determining the basic operating structure and organizational characteristics. Woodward (1958) believes technology is the major determinant of structure and function. Pugh, Hickson, Hinings, and Turner (1969) on the other hand, argue that size is the major determinant. Pennow (1967) asserts that organizations cannot be compared unless their technology is similar while Hickson, Pugh and Pheysey (1969) state that there are principles that hold across organizations irrespective of task and technology. Fortunately, in the current study, this variable is being held constant by concentrating effort on the maintenance of a single type of helicopter.

2.2.4 Human Resources. The contextual factor of human resources addresses the types of people (ability, motivation, etc.) that an organization has available to it. This impacts on the functioning of the organization and its ultimate effectiveness in various ways. Availability of human resources effects the selection, placement and training function of the organization. In addition, it impacts on the choice of control mechanisms and work structures. For example, Porter, Lawler and Hackman (1975) suggest that employees who are more educated or skilled resent tight controls, especially when activities are not well specified. Further, not providing enough structure to activities for low skill level employees can also be frustrating. Individuals with strong higher order needs (e.g., self-actualization, autonomy) prefer organizations with informal atmospheres and less structured activities; whereas individuals who do not possess these traits perform more efficiently in more structured organizations.

Military and non-military maintenance organizations differ widely in the availability of human resources. Non-military organizations can

require FAA A&P licenses for its mechanics; the military cannot because they are not available in sufficient numbers. The motivation of military and non-military personnel may differ on important dimensions of need, expectations, etc., and this must be documented and considered.

2.2.5 Other Organizations and Agencies. For non-military maintenance organizations, government agencies, principally the FAA, set regulations which impact the organization. FAA maintenance requirements, mechanic license requirements, and reporting requirements, etc., all effect the operation and effectiveness of the organization. In addition to the government agencies, non-military maintenance organizations must deal with the helicopter manufacturer on such things as parts availability, service on major components, service directives, etc.

The military is also impacted by other organizations and agencies. Their budget, procedures, etc., are often decided by other parts of the military and government. The military must also deal with the helicopter manufacturer in many of the same ways a non-military operator must.

It is critical that these other organizations and agencies be identified and their impact assessed. It is possible that some incentives and disincentives for effective maintenance arise from these outside agents.

2.3 Organizational Inputs

Organizational inputs are viewed from the perspective of the work unit. The organization impacts the work unit through two major sets of factors, structural and operational. Structural factors involve the physical structure and arrangement of the organization. Structural factors include size, administrative ratio, shape, span of control, and dispersion. Operational factors involve function and process and include such factors as

formalization, communication, job design, policies and philosophies, work demands, pay and promotion, and selection, placement and training. Attention to both sets of factors, structural and operational, provide the greatest understanding of behavior in organizations (Porter, et al., 1975).

2.3.1 Size. The size of an organization is usually thought of in terms of the number of employees rather than other measures such as amount of assets. Researchers have been unclear with respect to what entity was being measured: total organization; major subunits, or functional work units. The research of Pugh, et al (1969) found size to be strongly correlated with the structure of activities including specialization of roles, standardization of functions and formalization of rules and procedures. This is supported by the work of Hall, Haas and Johnson (1967). Porter and Lawler (1965) reviewed twenty-three studies and found in all but three cases that as a work group size increases, job satisfaction decreased, and absenteeism, labor disputes and turn-over increased. To compare organizational effectiveness between organizations, the size, especially work unit size, must be taken into consideration.

2.3.2 Administrative Staff Ratio. The administrative staff ratio is defined as the number of administrative (managing, supervision, foremen, clerical personnel) divided by the number of maintenance workers (Melman, 1951). This variable may often provide insight into comparisons of military and non-military organizations. Generally, the larger the ratio the greater the division of labor and the more complex the control structure of the organization.

2.3.3 Shape. Shape is defined in terms of the number of levels in an organizational hierarchy in relation to the size of the organization. If an organization has many levels in relation to its size, it would be termed tall. Another organization with few levels in relation to its size would be termed flat.

There is evidence (Woodward, 1958; Hickson, et al , 1969) that indicates that the total number of levels in the organizational hierarchy is related to the degree of technical complexity that is utilized. Kaufman and Seidman (1970) found that both tall and flat structures existed in a sample of governmental agencies. The evidence supporting which is the best structural design, flat or tall, is sparse and inconsistent. There is evidence that suggests that in smaller organizations managers are more satisfied with a taller structure (Porter and Lawler, 1965). Here again, as with size and administrative ratio, the differences in shapes between military and non-military organizations may provide clues to differences in overall effectiveness.

2.3.4 Span of Control. Span of control is defined as the number of subordinates reporting directly to a supervisor. Large work groups do not necessarily require large spans of control. If another level of supervision (e.g., foreman) is inserted so that a few workers report to a foreman and a few foremen report to a supervisor a small span of control is achieved. In general, flat organizations have a larger span of control than do tall organizations of equal size. Span of control can have an impact on worker's feelings of autonomy. The degree of feedback given workers about their performance, the closeness of supervision afforded, and the upward flow of information affect personnel productivity and satisfaction. It is important, therefore, that the span of control be measured in each organization included in the present study.

2.3.5 Spatial Dispersion. The spatial dispersion of an organization refers to the number of spatially separated places in which the members of the organization work. Spatial dispersion is related to other structural factors. For example, the relative size of the administrative component increases as spatial dispersion increases (Anderson and Wauriv, 1961). Pugh, et al (1969) found that in dispersed organizations, the workers had more discretion in how they were to carry on their day-to-day activities

and they had more control over the work that was to be done. Spatial dispersion, therefore, must be assessed and analyzed to determine what impact it has on maintenance effectiveness. It is likely that military maintenance will be more dispersed than non-military and this could result in differences in worker attitudes and overall effectiveness.

2.3.6 Formalization. This factor deals with the extent to which rules, standards, procedures, etc. exist which indicate how activities are to be carried out. Inkson, Pugh and Hickson (1970) have developed an objective scoring system for measuring formalization by assessing the number, type and distribution of rules, standards, procedures and documents. Current thinking (Hall, 1972; Porter, et al , 1975) is that no single degree of formalization will be appropriate for all organizations nor even for all units within the same organization. The military is noted for its high degree of formalization. This may impact on the attitudes of maintenance personnel. They may feel a lack of responsibility, autonomy and self esteem, but it may engender a sense of security and certainty. The degree of formalization may act as either an incentive, disincentive, or both. This was explored in the present study.

2.3.7 Communication Processes. There are several dimensions to the communication process: the degree of communication, the direction of communication, existence of formal and informal channels, the quality of the communication, and the speed of the communication. Katz and Kahn (1966) identified five elements of downward communication which need to be assessed to understand the operation of that aspect of the communication channel: (1) job information, (2) rationale for the task, (3) information regarding procedures and practices, (4) feedback regarding performance, and (5) ideology to get subordinates to accept and believe in the organization's goals. Katz and Kahn categorize upward communication into four types; what the person says (1) about himself, his performance and his problems, (2) about others and their problems (3) about organizational policies and practices, and (4) about what needs to be done and how it can be done.

It is possible that military and non-military organizations differ in the degree to which each of the components is stressed with resultant differences in personnel attitudes and behavior. An analysis of the degree and quality of each type of communication may offer insights into the effectiveness of sources of incentives and disincentives in the organization.

2.3.8 Organization of Work. How the organization structures the work for the primary work unit is an important determinant of work unit performance and attitudes. The traditional approach to the design of jobs (Taylor, 1911) held that the job should be simplified, standardized and specialized. This type design had the expected advantages of minimal training requirements, low skill requirements and worker inter-changeability. Job design was thought of in terms of what a man can do rather than what he is willing to do (Swain, 1973). Traditional job design turned out not to have the expected economic savings due to high rates of turnover, absenteeism, grievances (Lawler, 1973) and in some cases, sabotage (Swain 1973). Some individuals have a need for jobs that are more complex, challenging and interesting. Davis (1961) suggests that job designs can be classified as (1) process-centered or equipment-centered, (2) worker-centered, or (3) a combination of equipment- and worker-centered. In the first case, work tasks are specified and organized from the point of view of the job to be accomplished. That is to say, a worker's tasks are organized to maximize his output and to simplify the sequence of activities which he must perform. At the other end of the continuum, the worker-centered approach organizes the work tasks to maximize worker satisfaction and participation. The assumption of the latter approach is that high productivity will be maintained with high worker involvement in and identification with his job.

Herzberg (1968) contends that by increasing self-authority, accountability, decision making, reduction of controls, etc., workers will gain greater job satisfaction. According to this view, satisfaction

is the result of responsibility, achievement, recognition, and growth. After studying Herzberg's principles of job enrichment as they apply to military aircraft maintenance crew chiefs, McIntire (1974) gave several recommendations, as follows: Each crew chief should be assigned a specific aircraft and be given a voice in making the maintenance schedule. This would alleviate shifting of responsibilities while maintaining accountability. Having crew chiefs complete the work they begin on their own aircraft would allow closure, feedback of effectiveness and increase job identity. Crew chiefs should be allowed specialized training enabling them to become experts in their field.

Using a similar approach to job design, Schwartz (1976) redesigned a Navy facilities maintenance operation aboard a ship by establishing a maintenance team, identifying tasks, development of information and work scheduling system, allocating proper equipment, and implementing a training program. Results from applying this redesign demonstrated a reduction in maintenance man-hours, improved appearance and cleanliness, and an increase in job skills and knowledge. In a related study of present military maintenance job designs, Cantrell, Hartman, and Sums (1967) found that during an average 45.4 hour work week, Air Force mechanics spent about 27.4 hours working on their primary tasks and about 11.6 hours were spent sitting around waiting for parts. The most frequently elicited comments from airmen were: (1) being kept on duty when there was nothing to do and then called in from their scheduled off-duty time, (2) the fact that they were required to do busy work, and (3) the arbitrary and unrealistic work schedules imposed. Cantrell, et al, indicated that work schedules were under the control and authority of the local commander.

2.3.9 Rewards and Punishment. Rewards and punishments given by an organization include pay, promotion, recognition, transfer, demotion and termination. In the military, other forms of rewards and punishments are also possible. Not only the type and frequency of rewards and punishments need to be

documented, but also the basis for administering them must also be considered. Lawler (1971) indicates that when rewards are made contingent on good performance, motivation to perform increases. An individual is likely to feel dissatisfaction if he perceives himself to have a higher input than other people who are receiving the same level of reward (Lawler, 1973). Since improper reward allocation leads to dissatisfaction and dissatisfaction leads to turnover, then extrinsic rewards may affect the decision to remain at an organization. Lawler (1973) indicates that dissatisfaction seems to cause turnover due to individuals searching for more attractive alternatives elsewhere, and because it influences the perception that the job will provide future rewards they desire.

The purpose of an incentive system then is to provide the worker with the greatest job satisfaction and at the same time, motivate him to work with greater efficiency to obtain organizational objectives (Hamilton, 1964). An incentive system geared only toward increased output may not be appropriate for avaiation maintenance where quality is a key factor. Therefore, an incentive system for aviation mechanics should motivate personnel to work rapidly, but maintain quality standards. Porter and Dubin (1975) suggest that an incentive system should allow for different rewards to be given to people doing the same class of work, depending on their performance. The organizational psychology literature is consistent in its directive to tie rewards directly to good performance. Lawler (1971) indicates that when rewards are made contingent to good performance, motivation to perform increases.

It is generally recognized that individual incentives are received with greater enthusiasm by the worker than group incentives. Employees in larger groups often see less relationship between their performance and the reward. It appears that the worker in the military may be evaluated more in terms of comparisons with co-workers than in comparison to set job standards.

2.3.10 Selection, Placement and Training. The selection procedures and criteria must be documented in the organizations under study. It is possible that the military, due to the contextual factor of the human resources available, may have lower selection and placement standards than do non-military organizations. This will influence how the work is organized, the degree of formalization needed and the overall effectiveness of the maintenance organization.

Training requirements are dependent on the caliber of the personnel selected. Information concerning selection for training, amounts and degrees of training, proficiency testing, effectiveness of training, refresher training, and on-the-job training must be obtained to facilitate comparisons between military and non-military organizations. The military is noted for its extensive investment in training. It is possible, that maintenance personnel learn many skills they never use on the job. This may negatively influence their motivation and affect their performance.

2.4 Work Unit

2.4.1 Supervisor. Supervisory style influences organization effectiveness because it influences the motivation of the worker as well as satisfaction, turnover, and absenteeism (Lawler, 1973). Early studies of leadership (Katz, Mácoby, and Morse, 1950; Fleishman and Harris, 1962) identified two major leadership patterns; task or structure-oriented and employee or consideration-oriented. Likert (1959) states that the supervisor who is supportive, friendly, and sensitive will obtain higher productivity than supervisors who are not. Katz, et al (1950) and Korman (1965) found a relationship between consideration and productivity. Vroom (1964) indicates that the amount of consideration whon by a supervisor is positively related to work unit efficiency. Other research (Fiedler, 1964) suggests that the most effective style of leadership depends on situation factors.

The supervisor influences the giving of organizational rewards and punishments and also can influence the focal man's perceptions of what rewards and punishments should be, whether they are distributed based on performance, and whether the focal person is being fairly treated.

2.4.2 Co-Workers. Co-workers of the immediate work environment contribute to the rewards and punishments received on the job. Friendly co-workers can affect overall effectiveness of the work unit. The group norms establish effort levels for the group and serve to filter perceptions of the organization and its functioning. It is possible that military work units are closer knit and interact more off the job than non-military, due to the common living conditions often encountered in the military. Work group norms may be more potent in such situations since sanctions for violating the norms can extend off the job as well.

2.4.3 Work Environment. The environment in which a man works can directly affect his performance. Environmental effects on performance are exerted in two primary ways: (1) the environment may be such as to degrade a sensory modality directly, and (2) the environment may introduce physiological stresses which indirectly affect sensory or motor performance. Some of the environmental factors that have been found to influence performance include; level of illumination (Kopkinson and Collins, 1970; McCormick, 1970), noise (Jerison, 1959; Boggs and Simon, 1968; and Eschenbrenner, 1971), and weather conditions (Fox, 1967; and Axer, MacNail, and Levny, 1972). A comparison of organizational effectiveness should take into consideration differences in work environment between organizations.

The military, when engaged in national defense, is sometimes forced to work under more adverse conditions than non-military. For the organization to be studied, the work environment must be described and information sought to assess its probable impact on the work unit.

2.4.4 The Focal Person. The focal person is the maintenance person within the work unit. His behaviors and attitudes are influenced by a variety of factors including the supervisor and the co-workers of the unit. A particular supervisor may affect performance and satisfaction through supervisory style or the control of rewards. The co-workers are also an influential factor upon the focal person because this group acts to establish work norms, as referent to compare perceptions, for informal communication sources, and interpersonal gratifications. These interactions take place within a physical work environment, which itself influences the focal person's interactions with the other members of the work unit.

The cumulative and interactive effects of the supervisor, the co-workers, the organization inputs, and the man himself all affect the individual's subjective perceptions concerning the organization, the part he plays, and his performance. Individual's perceptions are more important than the objective reality of a situation. For example, a supervisor may be concerned about his workers, supports them and listens, but if the workers do not perceive this, they will act as if it were not so. If their job is critical to the efficient operation of the organization, but they perceive that it is meaningless and worth little, they will behave as they perceive. Discrepancies between what is, and what is perceived often point to problems in communication.

It is for this reason that the subjective perceptions of the focal person are so central to the investigation of organizations. In essence, his perceptions of the organizational inputs, and their interactions, as well as his perceptions of the work unit and the organizational outputs, must be assessed to truly understand the nature and impact of various incentives and disincentives existing in the organization.

2.4.5 Subjective Perceptions. The perception of individuals affects their attitudes and performance. Reality has its major impact through perceptions

of the reality. The focal person's perceptions of, and attitudes about, each of the factors identified in the model and subsequently uncovered during additional site visits, must be assessed. Comparisons can then be made between military and non-military organizations. The differences can be related to the objective reality of the situations and organizational effectiveness. In this way, incentives and disincentives can be isolated.

2.5 Organizational Outputs

2.5.1 Productivity, Job Attitudes, Counter-Productive Behavior. Productivity is defined along two dimensions; quantity (how much) and quality (how well). Satisfaction, a job attitude, is an internal subjective state of a particular individual. Satisfaction is generally conceived as a psychological feeling of contentment resulting from receiving enough of a desired object. More recent theories of satisfaction describe it as a function of the relationship between what a person wants from the job and what he perceives it is offering (Locke, 1969), or the difference between what a person thinks he should receive from the job and what he actually does receive (Porter, 1961). The relationship between satisfaction and performance is controversial in the literature. Many psychologists felt that satisfaction caused good performance, but reviews (i.e., Vroom, 1964) of this literature showed the relationship to be weak. Lawler and Porter (1967) postulate that performance causes satisfaction because good performance produces rewards that make individuals satisfied. Satisfaction will, therefore, be correlated with performance only when performance leads to equitable rewards. Satisfaction is strongly correlated (negatively) with turnover and absenteeism (Lawler, 1973). Turnover, absenteeism, grievances, and sabotage are elements of organizational output, called counter-productive behavior, and cannot be ignored when evaluating the overall effectiveness of an organization.

2.5.2 Organizational Effectiveness. Organizational effectiveness is the extent to which an organization obtains its specified goals. The determination

of effectiveness depends, in part, on how well the goals are defined and the validity of the instruments used to measure goal attainment. Productivity, satisfaction, and counter-productive behaviors are the major components in organizational effectiveness.

Various dimensions of organizational effectiveness have been identified in the literature (Campbell, 1973; Mahoney and Weitzel, 1969; Seashore and Yuchtman, 1967). The dimensions of Campbell (1973) provide a theoretical framework which encompasses the major elements found elsewhere in the literature:

(1) Overall effectiveness --achievement of objectives

(2) Quality--quality of service or product

(3) Productivity--quantity of product or service provided

(4) Readiness--probability that an organization could successfully perform a specified task if asked to do so

(5) Efficiency--ration of units produced to cost incurred to produce them

(6) Profit or return--percent of resources left over after cost obligations

(7) Turnover or retention--amount of voluntary terminations

(8) Absenteeism--frequency of unexcused absences on the job

(9) Morale--a group phenomenon involving extra effort, goal communicality and feelings of belonging

(10) Evaluations by external entities--evaluation by external individuals that have interacted with the organization

3. SITE VISITS AND INTERVIEWS

3.1 Method

3.1.1 Initial Site Visits. To provide a basis of information from which to develop meaningful data collection instruments, several initial vists were made to selected civilian and military helicopter maintenance organizations. Initial military site visits were made to the OH-58 System Manager of the Directorate for Weapon System Management, U.S. Army Aviation Systems Command (AVSCOM), St. Louis, Missouri. AVSCOM is responsible for management of the entire Army aviation fleet, including matters of aircraft acquisition, deployment effectiveness and utilization, cost and maintainability. The office of the OH-58 System Manager is specifically responsible for Army-wide OH-58 maintenance data reporting, fleet utilization, and costs of ownership.

For a preliminary view of maintenance groups and procedures in a military helicopter user organization, initial vists were made to Fort Ord, California, the home of the 7th Infantry Division, with both divisional and non-divisional helicopter units.

Initial vists to four civilian helicopter organizations also provided preliminary observations of maintenance practices by civilian users. Considerations of maintainability in the OH-58/206 design and maintenance technical support services were identified in a visit with the OH-58/206 helicopter manufacturer, Bell Helicopter Company, Ft. Worth, Texas. Visits with the Bell Helicopter Company Service Center, Van Nuys, California, and with the Los Angeles Department of Transportation, Van Nuys, California, Arizona Helicopters, Inc., Scottsdale, Arizona provided preliminary information on maintenance organizations and procedures from the point-of-view of civilian helicopter users and owners.

3.1.2 Development of Interview Forms The initial site visits, in addition to the model of organizational effectiveness outlined in Section 2 of this report, served as the basis for development of the interview form. The interview, itself, was semi-structured. Specific topic areas, corresponding to the elements of the organizational effectiveness model, were addressed. Specific lead questions were asked with the direction of subsequent questions being dictated by the answers given. This procedure allowed maximum flexibility with assurance that relevant topics would be addressed. The specific lead questions or areas are contained in Appendix A.

The interviews were designed to serve two purposes. First, they served to familiarize the project team with the organization and climate of military and civilian maintenance organizations. Second, they served to isolate and focus attention on potential organizational incentives and disincentives which might affect military maintenance efficiency and/or effectiveness. As such, they were not intended to yield precise quantitative data, but rather were intended to help formulate generalized qualitative descriptions and hypotheses.

3.1.3 In-Depth Interviews. In-depth interviews were conducted at the following military and civilian installations:

- 7th Infantry Division
  Fort Ord,
  Monterey, California

- III Corps, including the 2nd Armored Division, the
  1st Cavalry Division and the 6th Cavalry Brigade
  Fort Hood,
  Killean, Texas

- Helicopter Training Squadron #8
  Naval Air Station
  Whiting Field, Florida

- ERA Helicopters, Inc.
  Anchorage, Alaska

- Anchorage Helicopter Service
  Anchorage, Alaska

- Sea Airmotive
  Anchorage, Alaska

- Arizona Helicopters
  Scottsdale, Arizona

- Bureau of Transportation
  Los Angeles, California

Interviews were conducted at all levels of the maintenance organizations, from mechanics to commanding officers. No attempt was made to sample systematically or in a truly random fashion; instead, interviews were held on an "as available" basis. In all, 22 military and 10 civilian supervisory personnel were interviewed.

3.2 Findings

Based on the interviews conducted, and documents obtained, comparisons were made between civilian and military organizations. The dimensions of the model described previously in Chapter 2 are used to provide a format for organizing the comparisons. Where appropriate, references to other published data are integrated with the present comparison.

3.2.1 Objectives of Maintenance Organizations. Organizations develop to achieve specific goals and objectives. Goals and objectives are important in determining the structural and operational features of an organization. To a great extent, the differences between military and civilian organizations may be attributed to different goals and objectives.

The primary objective of military maintenance units is to support the overall mission requirements of the parent military unit. This support objective consists of insuring that aircraft are available when required. Present Department of the Army standards require 70% availability. Cost does not seem to be a major component in the evaluation of maintenance efficiency and effectiveness. From the observations made during the preliminary analysis, it would seem that a unit would be considered effective if it maintained the 70% availability standard no matter how many man-hours were expended, parts were consumed, or dollars were spent, within liberal limits. Thus, it would seem that the goal of meeting established availability standards, without much concern for cost, may be a major cause of higher military maintenance costs.

The primary objectives of civilian maintenance stress providing cost effective maintenance and supporting the objectives of the user organization, including maximizing profit and expansion of the market. In pursuit of this goal, civilian or ganizations stress efficiency rather than availability of aircraft.

Differences between military and civilian goals and objectives are most evident in the way jobs are designed, the emphasis placed on the task of maintenance, and the qualifications and skills required of the maintenance personnel.

3.2.2 Organizational Structure Variables. Military units are classified as divisional and non-divisional. Divisional units are integral parts of the potentially mobile forces and perform flight operations as part of the Division's missions and activities. Non-divisional units are assigned to the military post rather than the division itself, and perform general flight operations associated with post activities. In addition, the non-divisional units can be called upon to support and supplement divisional units.

Military maintenance is organized as a hierarchical structure, with more complex maintenance activities performed by maintenance groups at higher levels in the hierarchy. Currently five levels are used by the U.S. Army; Operational, Organizational, Direct Support, General Support, and Depot levels. In the near future, the Army will move some Direct Support functions to the Organizational level and combine it with Operational level to form a new Organizational level maintenance. Some General Support functions will move to the Depot level. The remaining Direct and General Support functions will be combined into a new Intermediate level maintenance. The result will be three levels (Organizational, Intermediate,and Depot) instead of five. An individual maintenance person is assigned to a work unit which performs maintenance duties of one specified level of maintenance. Normally, military maintenance personnel do not move from one level of the hierarchy to another.

Operational maintenance is performed by the operator of the equipment and includes routine, daily tasks such as visual inspections of controls and displays at the equipment operator's station. Since this level of maintenance does not include any specific maintenance training, technical manuals, or tools, the next level, the Organizational level, can be considered the first level of maintenance for which specifically-trained maintenance personnel are required. Organizational maintenance includes duties of preventive maintenance, troubleshooting, and minor repair actions. These duties, performed by a crew chief, usually include general aircraft cleaning and systematic inspection to discover and correct defects before serious damaage or failure occurs. Personnel of organizational maintenance units have daily contact with the aircraft, performing their maintenance duties before and after every flight. The objective of organizational maintenance is to provide operationally ready aircraft for mission support.

Maintenance at the Direct Support (DS) and General Support (GS) levels is performed in support of organizational maintenance units.

Although circumstances may vary depending upon the physical locations of the various maintenance units, DS and GS maintenance personnel do not usually have daily contact with any specific aircraft. Rather, aircraft are delivered to the DS or GS facility as maintenance needs arise for those aircraft. Activities performed at this level include repair, replacement, alignment, calibration, etc., of components or major aircraft systems. DS and GS level personnel may also be responsible for recovery and repair of downed aircraft in the field. These activities generally include those maintenance tasks which require skills or tools which are not available to an organizational level mechanic "on the flight line".

Direct Support and General Support maintenance is generally performed by uniformed military personnel of a division maintenance company for divisional units. For example, in the 7th Infantry Division, the 7th Aviation Maintenance Battalion is responsible for DS and GS maintenance of the OH-58 helicopters. However, for non-divisional units of an Army post, DS and GS level maintenance may be performed by civil service personnel through the office of the Director of Industrial Operations (DIO). DIO can also perform DS and GS maintenance services for divisional units when the latter are overloaded.

Depot level maintenance is performed off-base at a specialized repair depot. In the case of the OH-58, all depot repairs for all aircraft in the Army fleet are performed at one centralized location. Depot level maintenance includes such activities as overhaul and remanufacturing of major subsystems. In this regard, depot maintenance can be compared to civilian remanufacturing maintenance performed by an airframe manufacturer or specialized engine or transmission overhaul company. Because depot level maintenance is not performed by the user group, i.e., division or post, this level of maintenance is excluded from the present study.

Table 3-1 from the Organizational Maintenance Manual, Army Model OH-58A Helicopter (TM 55-1520-228-20), illustrates the types of maintenance activities to be performed and the maintenance level that is expected to perform each activity. The letters O, F, H, and D represent the maintenance levels of Organizational, Direct Support, General Support, and Depot, respectively. As indicated by the table, a greater percent of Organizational maintenance time is spent performing inspection tasks: whereas, the concentration of Direct Support and General Support maintenance effort is on repair and replacement tasks.

Civilian maintenance organizations, unlike those in the military, do not have hierarchical structures. In fact, civilian maintenance structures are centralized. That is, activities which would be performed by Organizational, Direct Support, or General Support levels in the military are all performed by a single maintenance group in civilian maintenance. This difference between military and civilian maintenance organizations is illustrated in Figure 3-1. Military personnel are assigned to one or another of the several levels, but do not move between levels. Civilian personnel work within the single maintenance level and would be expected to work anywhere within that group.

Not only are civilian organizations centralized, but also the maintenance personnel are less specialized. This lack of specialization and the centralized organization means that civilian maintenance personnel can be assigned to any task from routine inspections to repair of major subsystems. Military mechanics, on the other hand, can only perform maintenance tasks described by their Military Occupational Specialty (MOS) and the the Maintenance Allocation Chart.

Size of the functional work unit was not found to be dramatically different for military and civilian organizations. The military work unit size ranged from 25 to 115 people, while for the civilian, it ranged

TABLE 3-1. MAINTENANCE ALLOCATION CHART

(1) GROUP NO.	(2) FUNCTIONAL GROUP	(3) MAINTENANCE FUNCTION											(4) TOOLS AND EQUIPMENT	(5) REMARKS
		INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD		
	ROTOR AND TRANSMISSION SYSTEM (Cont)	a	b	c	d	e	f	g	h	i	j	k		
	Support Assembly, Collective	F							F	F				
	Transmission Assembly Main	O		O					F	O	D			
	Oil Pump Assembly	O							F		H			
	Input Drive Quill Seals	O							F					
	Drag Pin Assembly	O							F					
	Pylon Support	O							F	F				
	Oil Jets	F							F					
	Oil Filter Head Assembly	O							O	O				
	Temp Bulb	O							O					
	Thermo Switch	O							O					
	Filter	O							O					
	Screen	O							O					
	Valve Pressure	O							O					
	Chip Detector	O							O					
	Oil Cooler	O							O	H				
	Oil Transfer Tube	O							O					
	Tube, Filter to Cooler	O							O					
	Hoses and Lines	O							O					
	Duct Installation Transmission	O							O					
	Driveshaft Assembly Transmission	O		O					O	F				
	Seals	O							O					
	Freewheeling Assembly	O							F	F	D			
04	Valve Vent	O		O					%%					
	Tail Rotor Driveshaft Assembly	O					O	O	H					
	Disc Assemblies	O							O					
	Bearings and Hangers	O							O					
	Gear Box, 90°	O		O					O	F	D			
	Seals	O							F					
	Tail Rotor Hub & Blade Assembly	O			F_4				O_3	F				
	Tail Rotor Blades	O							F	F				
	Bearing	F							F					
	Tail Rotor Hub Assembly	O							F	F				
	Trunnion	F							F					
06	HYDRAULIC SYSTEM													
	Pump Assembly	O	O_1		O				O	F	H			
	Reservoir	O		O					O	O				
	Filter Assemblies	O							O	F				
	Filter Element	O		F_8					O					

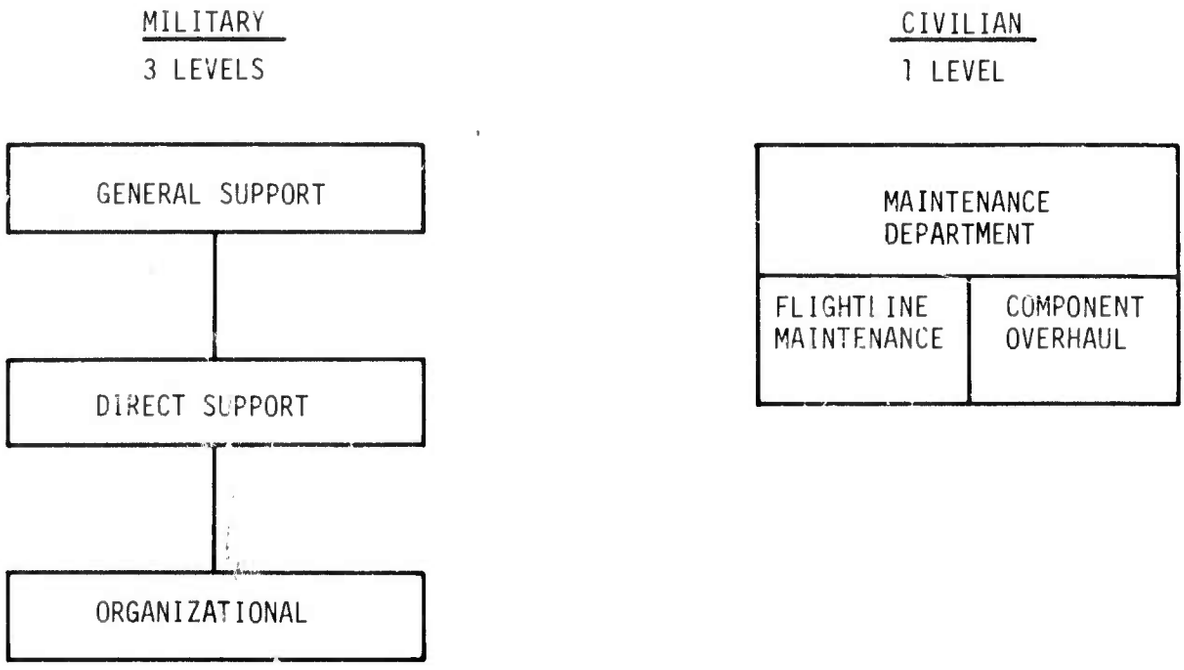

FIGURE 3-1. MAINTENANCE ECHELONS

from 15 to 100 people. Span of control, defined as the number of subordinates reporting directly to a supervisor, for both the military and civilian, was again found to be approximately the same with one supervisor for approximately six workers. The organizational chart for a typical maintenance operation is illustrated in Figure 3-2. As can be seen, similar positions exist within the military and civilian organizations.

The shape, referrring to the number of levels in an organizational hierarchy in relation to the size of the organization, is different for civilian and military units. In the civilian sites visited, there were few levels between the top and the mechanics on the line. Civilian organizations were less structured, had fewer rules and policies, and placed a strong emphasis on initiative. Observations of military operations showed the organization to be tall with many levels in the hierarchy. We found in our preliminary investigation that there were more rules and policies in the military and that perceptions of the people on top often did not match the situation on the line as described by those on the line.

One of the major differences between military and civilian maintenance organizations is the spatial dispersion of the particular maintenance activities. Civilians typically work in one centralized location and all maintenance is performed at that location. This may be due, in part, to the skill level of the available mechanics. Civilian mechanics have Airframe and Powerplant (A & P) licenses and are trained to perform all maintenance activities. Hence, all maintenance activities can be performed at one location. Military maintenance, on the other hand, is highly decentralized and specialized, hence each level of maintenance must be performed at a different location where the specialists are located. Furthermore, each location is governed by its own management. Therefore, instead of being one organization with three levels, it is more

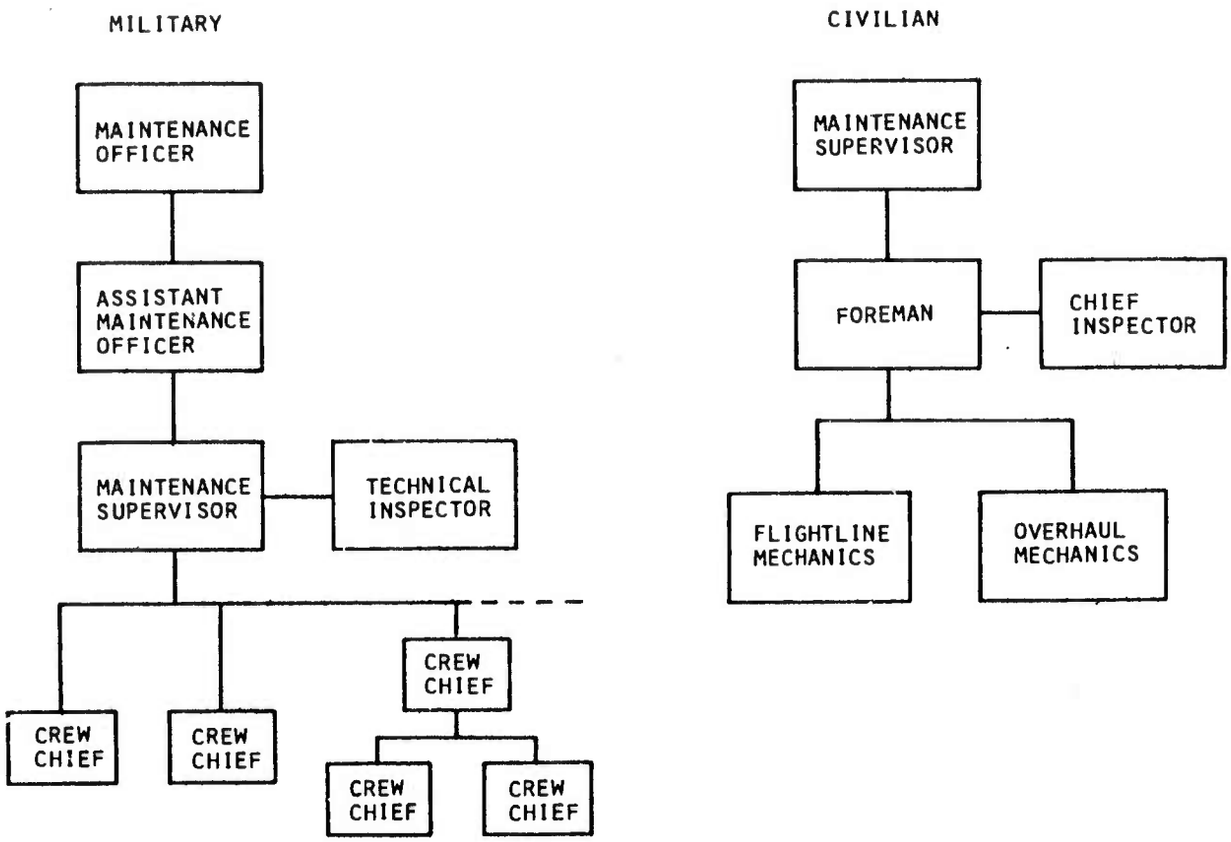

FIGURE 3-2. MAINTENANCE ORGANIZATIONAL STRUCTURE

like three separate organizations. It is possible that the goals of each unit often conflict. Civilian facilities, in comparison, are centralized, interrelated maintenance components working towards a single goal.

A conversation with an Organizational level maintenance supervisor illustrated the potential conflicts resulting from the military's maintenance structure. He indicated that for his unit to transfer an aircraft to a higher level of maintenance, all Organizational maintenance and paperwork had to be completed. The paperwork had to be signed by a maintenance officer whose office was located six miles from the flightline. The aircraft, along with the paperwork, was delivered to the Direct Support (DS) or to the General Support (GS) maintenance battalion. For maintenance to be performed that day, the aircraft had to be towed over before 10:00 a.m. If the aircraft arrived after 10:00 a.m., maintenance would be delayed until the next working day. He stated that on a few occasions, if DS or GS maintenance personnel discovered small, insignificant omissions in the paperwork, they would tow the aircraft back rather than calling and straightening out the deficiency or just sending back the paperwork. On several other occasions, the aircraft would sit outside the DS or GS maintenance hanger because they were out on field maneuvers.

3.2.3 Traditional Incentives. Incentives can be positive or negative or both. Positive rewards include salary, promotion, bonus, overtime pay, compensatory time off, suggestion awards, shift preference, field trips, task preference, advanced training schools, and praise. Negative incentives include termination, reduction in rank, suspension, extra duty, and reprimand. Table 3-2 shows the comparisons between military and civilian incentives that were identified during the initial site visits.

Salary in the military is generally lower than that found for civilians. This is exemplified in the commonly heard platitude "you're not going to

TABLE 3-2. PERFORMANCE INCENTIVES

	MILITARY	CIVILIAN
POSITIVE		
SALARY	RANK	PERFORMANCE
PROMOTIONS	TIME IN GRADE	PERFORMANCE
PAY BONUS	NONE	YES
OVERTIME PAY	NONE	YES
COMP TIME	YES	NO
SUGGESTION AWARD	YES	SOME
SHIFT PREFERENCE	?	YES
JOB PREFERENCE	NO	SOME
FIELD REPAIR TRIPS	NO	YES
ADVANCED TRAINING	NO	YES
PRAISE	YES	YES
NEGATIVE		
TERMINATION	NO	YES
REDUCTION IN RANK	YES	NO
SUSPENSION	NO	YES
EXTRA DUTY	YES	NO
REPRIMAND	YES	YES

get rich in the Army, but you'll never go hungry". Military pay, ranging from entry-level to experienced mechanics, is approximately $900 to $1300 a month. The pay range for civilian mechanics is from approximately $950 to $1450 per month. The pay figures for military, however, do not take into account the medical, housing, commissary, post exchange, meals and other benefits. Pay raises for military personnel come through promotions, longevity, and cost of living increases. Promotions are based primarily on time-in-grade. In civilian organizations, personnel raises are based on performance, as well as cost of living increases.

Civilian supervisors seem to motivate their personnel through other means, such as overtime pay, suggestions awards, shift preference, choices of task, field trips to repair downed aircraft, and advanced technical training schools. In comparison, very few of these performance rewards are apparently used by military supervisors. For instance, compensatory time is supposed to be given for working extra hours in the military instead of overtime pay. From our interviews, we found that compensatory time was accrued on the books but rarely given. Supervisors indicated that they wanted to give their men the time off they deserved, but work demands prevented it. One particular NCO said, "I still owe a man four days comp time from one year ago." This was not an isolated case, for we found this to be consistent throughout the military units interviewed. Military personnel received rewards for suggestions that save money as do civilian mechanics.

The interviews confirmed expectations that the principal incentives, or motivators are praise and verbal reprimand. These behavior modification techniques are used to a greater extent in the military. We asked a maintenance officer how he got his men to work many hours, often 12 hours per day, seven days a week, and still keep them motivated. He replied by saing, "I can motivate a crew chief to work sun up to sun down by saying,

'atta boy, you're doing a good job.'" This officer explained that he was able to do this because he believed the type of people that are currently joining the Army are security conscious, in search of a home, and look toward officers as father figures.

Military supervisors felt that those maintenance personnel that draw flight pay (e.g., Huey mechanics) had an added incentive and other non-flight pay status mechanics were envirous. Pro-pay was mentioned as a means for achieving equity. Civilian supervisors indicated that advanced maintenance training was considered a reward and was desirable to mechanics. In the military there is little opportunity for advanced maintenance training.

For the military, negative incentives include reduction in rank, extra duty, and reprimand; although supervisors expressed reluctance at using extra duty/detail assignments as a form of reward or punishment. One maintenance officer said that the only incentives over which he had direct control were of the negative type and usually in the form of "chewing a man out". Civilians use the threat of being fired, suspension without pay, and reprimand. By in large, there appeared to be more disincentives than incentives operating in the military situation.

3.2.4 Organization of Work. The interviews revealed major differences in job designs between military and civlian maintenance organizations. First, and most prevalent, is the prime responsibility of the maintenance personnel. In the military, a mechanic's responsibility is to be a soldier first, whereas in civilian organizations, it is to be a mechanic. Thus, scheduling of maintenance activities in the military can be haphazard, if not impossible, because a mechanic is required to perform many duties in addition to his aircraft maintenance duties. In some instances, these other duties, such as barracks cleanups and inspections, firing range practice, gas mask tests, burial detail, race relations courses, etc., may have

priority over the mechanic's maintenance duties. For example, one crew chief declared that "aircraft maintenance is something you do if you don't have anything else to do." The result of these other duties is uncertainty of schedules and delays in completion of maintenance. The call for personnel to fill extra duties, details, etc. are usually received in the morning of the day they are to be filled. Depending on the type of unit, the request will be for specific named individuals (TDA units) or just a general manpower requirement leaving the choice of specific individuals to the judgment of the supervisor (TO&E units). Both arrangements make it difficult for a supervisor to plan OJT or make long range manpower work assignment plans.

The apparent lack of local control over assignment to non-maintenance duties affects not only the schedule of the overall work unit, but also the working schedule of individual mechanics. According to discussions with military maintenance supervisors, it is not uncommon to pull a mechanic off a job to do other duties or to perform some other maintenance task. Another mechanic will then complete the original maintenance job. One mechanic said that, "all I want to do is work on my aircraft, but I hardly ever get to."

The normal working day for military personnel is 8 hours, but the day often extends upward to 12 hours. The apparent reason for the long working days is that helicopter maintenance must be completed, but because of its apparent low priority, it is done only after other military duties have been performed. Many supervisors reported that because of time requirements of other duties, they only get about 4 or 5 hours of maintenance work from a mechanic in a typical work day. These views were supported by an evaluation of the 7th Infantry during a USAAAVS Aviation Safety Assistance visit. Results of the evaluation are as follows: "Maintenance of aircraft in the 7th Infantry is limited to 3.5 to 4 hours per day, because of a higher priority given to other training. The fleet of sophisticated aircraft assigned demands additional maintenance time for safer operations".

The impression obtained from these initial observations suggests that scheduling markedly affects the effectiveness of a work unit. Ineffective local control of a mechanic's duties apparently leads to with (1) long working hours required to accomplish necessary maintenance, (2) mechanic's expressions of little identity with or pride in their work and, (3) duplication of effort when one person takes over an uncompleted task.

The inefficient use of mechanics' time leads to several consequences. OJT is less than adequate. Overtime is used to get an aircraft operationally ready. On some occasions the person is given compensatory time, but, often, because of the amount of work required, the person is never given an opportunity to take it. If an individual is pulled away for extra duty or detail, either the work he started is completed by someone else with an increased chance of error, or the work is left unfinished until he returns, resulting in a reduced OR rate.

It was the project team's opinion that the requirements for extra duties and details and the current procedures for administrating it are central components to many other problems expressed by the military during the interviews, including lack of technical competence, inefficiency, low morale and low job satisfaction.

In contrast, a civilian mechanic's prime responsibility is to perform maintenance tasks. As an apparent result, the organization of work is markedly different. Rather than some days of 12 hour shifts, the normal work schedule for civilians is 8 hours per day, five days per week. In all civilian sites visited, mechanics generally finished the jobs they started. Occasionally they would be pulled off for a high priority maintenance job, but would go back to complete the first job. Extra duties performed by civilian mechanics include cleanup duties;

from cleaning the cockpit bubble, to the hanger floor. However, in some facilities, managers stated that they did not think it was cost effective for mechanics to do general cleanup work, so other people were hired to perform that function.

3.2.5 Selection, Placement, Training and Promotion. Selection, placement, training and promotion in the military service is based primarily on the needs of the service. Thus, a person's technical specialty is largely determined by the needs of the Army at the time of selection. This is modified by several contingencies. On the one hand, the volunteer Army promises geographical location as an enlistment incentive. On the other hand, a new enlistee may choose a career field if his Army General Classification Test scores are sufficiently high in several career areas. Additionally, as an incentive for re-enlistment, a serviceman can request a change in career field. Following selection of an enlistee's technical specialty and completion of basic training, the enlistee is sent to a technical training school to be trained in a Military Occupational Specialty (MOS). Two specialties are utilized with Army helicopter maintenance; MOS 67 and MOS 68. Maintenance activities associated with MOS 67 include preventative maintenance, troubleshooting and minor repair actions. This is the classification held by a crew chief, who is the maintenance person at the Organizational level of maintenance. Maintenance activities at the Direct Support and General Support level are performed by persons with an MOS 68 classification. This specialty entails more specialized maintenance duties than MOS 67.

Job placement in the military was mentioned as a problem during our interviews. It was estimated that 10 to 15 percent of the mechanics are not working on the helicopter for which they were trained. Supervisors expressed the opinion that mechanics resent having to work on a helicopter for which they were not trained. Mechanics consider themselves "Cobra mechanics" or

"OH-58 mechanics" rather than as "helicopter mechanics". Civilians, on the other hand, consider themselves helicopter mechanics and do not feel they have the "luxury" of specialization. Some of this resentment among military personnel may come from expectations and role perceptions formulated during formal training.

Maintenance training courses for MOS 67 and MOS 68 last for six to eight weeks at the technical training school. These courses are designed to teach the basic knowledge associated with maintenance activities. Emphasis is primarily on verbal knowledge with a large portion of the instruction presented in a self-paced mode, supplemented by tutorial instruction as needed. Upon completion of technical training school, a person is still considered to be a trainee and is expected to further learn and refine his maintenance skills through on-the-job training (OJT). According to the statements of maintenance supervisors, this reliance on OJT is particularly true for hands-on experience with the helicopter.

There was almost universal agreement among those supervisors interviewed that mechanics straight out of technical schools are not competent enough to carry out their job without close supervision. Opinions regarding why technical school is inadequate centered around two points. Time in school is too short and there is not enough hands-on training included. Mechanics themselves complained that they do not learn enough from their technical school training; the major complaint being that they did not receive enough hands-on training. Technical school course descriptions allow for some hands-on training, but apparently because of budget constraints, training consists almost entirely of written material.

A second complaint of the mechanics, as well as the supervisors, was that mechanics rarely go back for renewal training. Additional training is supposed to take place in the field through scheduled on-the-job training

programs. However, the supervisors who were interviewed indicated that adequate OJT simply does not take place because they are too short of personnel tp provide field training as well as perform regular maintenance duties. The people we interviewed who were responsible for OJT felt that currently OJT is less than adquate. The reasons cited for this were that personnel are constantly being called away for extra duties, details, etc., and hence could not be given properly sequenced OJT. Instead, OJT is a hit and miss affair. Most people felt that there are not enough competent men in the operational units to give the quantity of good OJT required to bring new people up to competence. Many felt that there was too much work to be done to take time out for adequate OJT.

Because of the initial low level of competence of the personnel and the difficulties encountered in giving enough quality OJT, most supervisors estimated that it took over one year before a new mechanic could be trusted with routine maintenance without close supervision. One supervisor commented that just about the time a mechanic becomes proficient, he is shipped overseas. Another consequence of this slow learning curve is that some supervisors feel compelled to do the work of the mechanic to insure that it is done properly. This in turn reduced the trainee's capability to perform his job. His supervisor then fills in and so it goes up the line, each level filling in for the level below.

Some military units expressed manpower shortages, especially among Technical Inspectors (TI's) in their units. In one case there were only 3 TI's although 7 were allocated. In such cases, competent mechanics may serve as TI, although not formally trained for the job.

Another reason, some believe, for the lack of enough competent mechanics is the "up or out" policy of the military. Supervisors felt that many mechanics would like to remain mechanics and do not want to become supervisors. Yet, usually in order to advance beyond E5 the person must

move into a supervisory position. Supervisors believe that some mechanics leave the military at that point to join civilian helicopter maintenance organizations. The concept of an E6 master mechanic was mentioned as a mechanism to reward competent mechanics who do not wish to be supervisors.

The skill levels of workers also determine the degree of autonomy which is assigned to an individual mechanic. As discussed, the skill level of military mechanics is less than that of civilian mechanics. As an apparent direct result of this difference, a military mechanic has less autonomy. For example, the military maintenance technical manuals give specific details for performing each maintenance operation and the mechanic is required to "go by the book". This requirement applies both to the maintenance tasks that an individual is allowed or required to perform, as well as to the procedures by which he performs a task. On the other hand, according to the publications manager of the helicopter manufacturer, civilian maintenance manuals do not include detailed procedures for performing tasks. Rather, the manuals describe the helicopter systems, parts, and functions and give special instructions regarding unusual or irregular maintenance procedures. Writers of civilian maintenance manuals assume that civilian mechanics have the experience and skills to perform most tasks with only occasional guidance from a manual. This assumption was confirmed in discussions with civilian maintenance supervisors who stated that their mechanics were expected to be able to perform all maintenance tasks on the helicopter and that they consulted the maintenance manual primarily for torque values and new or unusual procedures.

The interviews indicated that selection and placement in civilian maintenance organizations is very different from military organizations. Civilian organizations hire mechanics who are trained and, in many cases, have several years of experience. A requirement for employment in all civilian organizations is an Airframe and Powerplant (A & P) mechanics license which is issued by the Federal Aviation Administration (FAA).

upon successful completion of a written examination and maintenance performance test. The A & P license exam is usually taken following completion of a two-year mechanics curriculum at a technical school. A holder of an A & P license has sufficient training to perform most, if not all, maintenance duties associated with most light and medium weight aircraft. The implication derived from the discussions with the military and civilian maintenance supervisors, is that a holder of an A & P license is significantly more skilled than an MOS 67 or MOS 68 qualified mechanic. In particular, an A & P mechanic is expected to be able to perform a wide variety of maintenance tasks, ranging from routine inspections and adjustment to the repair and replacement of major aircraft systems. On the other hand, an MOS 67 or MOS 68 mechanic has training in specialized areas and is not expected to be able to perform a variety of tasks.

In terms of the desired experience level of mechanics in civilian organizations, philosophies varied among groups. In some cases, the civilian organization only hired mechanics with several years of experience, whereas other organizations would hire newly-graduated A & P mechanics. This practice is apparently influenced not only by philosophy, but also by the experience level of the available labor pool. Interestingly, all civilian maintenance supervisors stated that they would not hire personnel who had been trained by the military. They felt that the training and experience in the military is too specialized and that an ex-military mechanic would not be able to perform the full variety of required maintenance tasks. For civilian mechanics, formal training does not end with the A & P license. The initial interviews indicated that civilian organizations send their mechanics to special technical schools to learn the maintenance procedures of specific aircraft. In the case of the Model 206 JetRanger, the helicopter manufacturer conducts courses in 206 maintenance at its factory in Ft. Worth. Several maintenance supervisors stated that they use the promise of attendance at technical schools as an

incentive for effective maintenance performance. In addition to off-site technical schools, many civilian organizations encourage further training through use of on-site training materials. The effectiveness of the encouragement to use these materials remains to be assessed.

3.2.6 Working Conditions. Another condition cited which reduces the amount of productive time is working conditions. In many of the organizational level units, maintenance work is carried out on the flight line with no tent or shelter. During the summer, the helicopter skins get so hot that no maintenance can be performed. In the winter it is so cold that manual dexterity is impaired and work is slowed. The flight line is often a considerable distance from tools and supplies. If a mechanic does not have a required tool or part to effect a repair, time is lost while he goes to get it. At the one Navy installation visited we found a potential remedy for this. Special "kits" were prepared for each type of maintenance task. The kit contained all required tools and parts for that repair. The mechanics did not have tool boxes, but rather checked out a kit to do the repair and then returned it. The Navy felt that this system, although costly to implement, reduced the number of lost tools, the amount of lost time to retrieve forgotten tools and parts, the incidence of using improper tools for a job, and chances of foreign object damage (FOD) to the aircraft.

3.2.7 Focal Person. On the basis of the interviews, it appears that differences in efficiency between civilian and military maintenance can be traced to differences in personnel, as well as to the differences in organizations that have been described above. In general, military maintenance personnel are younger, less experienced, and less skilled than their civilian counterparts. Certainly such differences can be attributed to the selection and training policies of the respective organizations. However, the subjective perceptions of the personnel are an important dimension which may contribute to each individual's effectiveness within and responsiveness to the maintenance organization. The individual's perceptions of their job and their place

in the organization can be expected to influence the effectiveness of any incentives which may be used. For example, the older civilian group may value autonomy and promotions, while the military mechanics may place higher emphasis on time off, vacations and verbal praise. The subjective perceptions of the individual mechanics are dealt with more extensively in the next section with the data elicited from the Organization Incentives Inventory.

3.2.8 Supervision. Cantrell, et al (1967) found that poor job supervision had a major negative impact on airmen's satisfaction and intent to reenlist. Results from that study recommend that supervisors should be very carefully selected, trained, and required to personally supervise the work of their subordinates. They should interact with subordinates in such a way as to provide recognition of sound, effective work, and censure for incomplete, unacceptable, or late work. Cantrell, et al, adds that mere rank or time-in-grade should not be used as the sole criterion for selecting supervisors. McIntire (1974) emphasized the need to teach modern management concepts in all military schools dealing with officers and supervisors. Furthermore, he posited that decentralization and trust in the lower echelons must filter down from the top military and defense leaders. Delegation of authority and responsibility to the lower echelons, he stated, may return the management functions to the levels where they can best be accomplished.

The level of supervision within a unit in this study is concerned with first level and sometimes second level supervisors, depending on the structural characteristics of a particular maintenance organization. Typical titles of these supervisory positions are maintenance supervisors, in the military, and foremen in civilian. It is possible for a civilian mechanic with less seniority, but with high technical competence and skill, to become a supervisor over someone with more seniority. In the military, supervision is based on rank which is primarily a function of seniority. Higher rank, by definition, means superordination regardless of supervisory ability. Technical competence was found to be generally very high with

civilian supervisors, but was more variable with military supervisors. This seems to support previous findings regarding the differential training and supervisor selection requirements.

3.2.9 Organizational Effectiveness. The effectiveness of an organization is often defined differently by individuals at different levels of the organization. At this point in our investigation, we are working on the premise that there is a finite number of parameters which, when weighed and combined, yield a perception or definition of organizational effectiveness. These finite parameters can be grouped under three broad classes--productivity, job attitudes, and counter productive behaviors. It is quite conceivable that different levels in the organizational hierarchy weigh the importance of these various parameters differently when assessing effectiveness. A policy or practice may be perceived at one level as reducing effectiveness because it negatively impacts on a parameter that is given a high importance weighting and positively impacts on a low importance parameter. At another level, however, the same policy acknowledged to have the same effects, might be considered as increasing effectiveness because at that level the relative importance weightings of the impacted parameters are reversed, the positive now outweighs the negative. One cannot hope to understand an organization unless the importance weighting of the people involved are assessed. It is conceivable also that importance weighting are not the same in civilian operations as they are in the military even at the same level. A major part of this project was to delineate the relevant parameters and assess the importance ratings of decision makers and evaluators at various levels of the organization.

At this juncture, we will briefly discuss the three major classes of parameters that are involved, to one degree or another, in definitions or organizational effectiveness.

Productivity. The Department of the Army has set standards of 70% availability for aircraft. Army Aviation Systems Command (AVSCOM), reports that the overall Army statistics for availability is 70%. It appears that a military organization would be effective if it maintained 70% availability no matter how many man-hours were expended, parts consumed, or dollars spent within liberal limits. Civilian organizations are also concerned about availability, but they are also very cost conscious. Other measures of productivity are maintenance man-hour per flight hour (MMH/FH) and direct maintenance costs. Both of these measures show civilians to be more efficient. The MMH/FH for the OH-58A for the military is 1.4 hours, (AVSCOM, 1975) while for civilians it is .5 hours (Bell Helicopter Co., 1977). Data show direct maintenance costs for the OH-58A for military to be $98.91 per flight hour (AVSCOM, 1975) compared to $33.23 for the 206B for civilian operators (Bell Helicopter Co., 1977). These figures, however, are based on different accounting methods and may not be precisely comparable.

The relative cost inefficiency of military is highlighted by the subjective impressions stated by the maintenance supervisors. Such impressions are reflected in the comment that, "If we were out to make a profit, we would be in receivership before grand opening."

Job Attitude. Job attitude refers to the subjective feelings of personnel about their jobs, co-workers, and work environment. It is conceivable that lower echelons in an organization are more concerned with the job attitudes of their men, while higher echelons are more concerned with the consequences of attitudes. The consequences of job attitudes are manifested in the third class of variables called counterproductive behavior. Based on our findings it seems that, in general, civilian maintenance personnel seem to have more favorable job attitudes than the military.

3.2.10 Summary of the Interview Findings. From our interviews, we uncovered a wide variance in the importance placed on helicopter maintenance by the

various organizations studied. There is not a clean cut military-civilian dichotomy. Within the military, the emphasis on helicopter maintenance varies greatly. Infantry units, we found, did not place as high priority on aircraft maintenance as did aviation units

It was our general impression, that civilians place fewer competing demands on their mechanics than do the military. In the Army, a mechanic is a soldier first, while in civilian organizations, he is a mechanic totally. This "solder first" attitude may materially affect the overall efficiency of military maintenance. There was a general concensus that mechanics resent extra duties and details because it takes them away from what they think is their primary responsibility, helicopter maintenance.

During our interviews, it became apparent that, at the risk of over simplifying, the military is motivated by considerations of effectiveness while civilians are more efficiency oriented. At the operational levels, in the military, the main criterion of successful performance is operational readiness (OR). Men are worked overtime in order to improve OR. Parts consumption appears secondary to OR. For civilians, on the other hand, successful performance is measured in terms of cost to the organization (i.e., man-hours, parts consumption) as well as maintenance quality.

Another important difference between civilian and military helicopter maintenance units is the skill level of the mechanics and the range of skills and tasks done by the individual mechanic. Civilian mechanics all have A & P licenses and usually one to three years of experience before they are hired. In addition, while they are employed they are often sent for advanced training. Military mechanics have only a few weeks formal training before starting. There is universal agreement among all those interviewed that mechanics fresh out of technical training are not competent to carry out maintenance except under close supervision.

The military divides the maintenance task into three levels so a complex repair might be passed through all three levels before it is completed. Personnel at each level are specialized. A civilian mechanic on the other hand, can and will do all phases and levels of maintenance. He more often finishes a job he starts, rather than passing it on to another person. One officer in the military indicated that mechanics in the military become frustrated when they are not allowed to perform a higher level of maintenance when they are capable of doing it.

As one civilian manager put it, he would not hire a mechanic straight out of the military because they are too specialized and they "think supply is a never empty shelf".

In summary, the interviews and site visits showed that civilian helicopter maintenance organizations differ from military organizations along the following dimensions:

(1) Relative importance placed on helicopter maintenance.

(2) Number of competing demands placed on mechanics time.

(3) Differential emphasis on effectiveness and efficiency.

(4) Skill level of personnel.

(5) Variety and range of skills used by the mechanics.

4. QUESTIONNAIRE - SURVEY DATA

4.1 Method

Based on the information obtained during the initial site visits, discussed in the previous Chapter, quantitative data instruments were designed. These instruments were tailored to characteristics of the maintenance organizations, including the terminology used by the personnel and the data records kept by the organizations. Questionnaires were used to assess the members' own impressions of their jobs and job environments. Survey instruments were used to obtain estimates of available manpower and maintenance efficiency/effectiveness.

Following the development of all data collection instruments, visits were conducted at military and civilian sites listed in Table 4-1. Two questionnaires were also administered during these site visits. The questionnaires were (1) the Organizational Incentives Inventory and (2) the Effectiveness Criteria Rating. The Weekly Performance Summary was given to the supervisor of each military organization.

4.1.1 Organizational Incentive Inventory. This questionnaire was given to the maintenance personnel in all organizations. A copy is contained in Appendix B. Section 1 of the questionnaire asks for basic biographical information. Sections 2, 3, 4, 5, and 6 are the short form of the Job Description Survey (JDS) developed by Hackman and Oldham (1974). Section 7 of the inventory asks the respondent to rate the degree to which various training experiences were helpful in providing skills and information necessary to successfully perform their job. Section 8 assesses the perceived relationship between performance (outstanding or poor) and various consequences (good and bad). Different items are included in the military and civilian forms (Appendix B). Section 9 contains 51 items not covered in the previous 8 sections of the inventory.

TABLE 4-1. DATA ACQUISITION SUMMARY

	Organizational Incentive Inventory	Effectiveness Criteria Rating	Weekly Performance Summary
Military			
III Corps Fort Hood Killeen, Texas	50	11	18
7th Infantry Div. Fort Ord Monterey, California	48	12	13
Helicopter Training Sqdn 8 Naval Air Station Pensacola, Florida	26	3	7
	124	26	38
Civilian			
ERA Anchorage, Alaska	5		
Anchorage Helicopter Anchorage, Alaska	0		
SeaAirmotive Anchorage, Alaska	5		
Arizona Helicopters Scottsdale, Arizona	8		
Bureau of Transportation Los Angeles, California	11		
	29		

The JDS portion itself assesses the following seven job dimensions and eight satisfaction/motivation components:

(1) Skill Variety. The degree to which a job requires a variety of different activities in carrying out the work, which involves the use of a number of different skills and talents of the employee.

(2) Task Identity. The degree to which the job requires completion of a "whole" and identifiable piece of work -- i.e., doing a job from beginning to end with a visible outcome.

(3) Task Significance. The degree to which the job has a substantial impact on the lives or work of other people -- whether in the immediate organization or in the external environment.

(4) Autonomy. The degree to which the job provides substantial freedom, independence, and discretion of the employee in scheduling the work and in determining the procedures to be used in carrying it out.

(5) Feedback from the Job Itself. The degree to which carrying out the work activities required by the job results in the employee obtaining direct and clear information about the effectiveness of his or her performance.

(6) Feedback from Agents. The degree to which the employee receives clear information about his or her performance from supervisors or from co-workers. (This dimension is

not, strictly speaking, a characteristic of the job itself. It is included to provide information to supplement that provided by the Feedback from the Job Itself dimension.)

(7) Dealing with Others. The degree to which the job requires the employee to work closely with other people in carrying out the work activities (including dealings with other organization members and with external organizational "clients").

(8) General Satisfaction. An overall measure of the degree to which the employee is satisfied and happy with the job.

(9) Internal Work Motivation. The degree to which the employee is self-motivated to perform effectively on the job -- i.e., the employee experiences positive internal feelings when working effectively on the job, and negative internal feelings when doing poorly.

(10) Satisfaction with Job Security.

(11) Satisfaction with Pay and Other Compensation.

(12) Satisfaction with Peers and Co-Workers (Social).

(13) Satisfaction with Supervision.

(14) Satisfaction with Opportunities for Personal Growth and Development on the Job (Growth).

(15) Growth Need Strength. Taps the strength of the respondent's desire to obtain growth satisfaction from his or her work.

Hackman and Oldham (1974) have shown the JDS to be a reliable and valid measure of these job and satisfaction dimensions.

The complete inventory was administered to 20 civilian and 124 military mechanics. In the military, this included both crew chiefs and DS-level mechanics. Both crew chiefs and DS mechanics will henceforth be referred to simply as "mechanics".

4.1.2 Effectiveness Criteria Rating. It was postulated that supervisors at different levels of an organization may have different models of how to define organizational effectiveness. It is possible, for example, that as we move up the organization, global criteria, such as availability of helicopters, become more important than specific criteria, such as turnover among personnel, waste (good parts replaced), or down time. Differences in definition and criteria, if they exist, may account for discrepancies in goals and procedures. The second questionnaire was designed to assess the relative importance placed on various criteria of effectiveness by three supervisory levels in the military maintenance organization; these were defined as follows:

Level 1: Commanding Officer. Duties of people at this level are to overview the maintenance activities in terms of accomplishing the overall mission, rather than directly supervising the day-to-day maintenance activities on the line.

Level 2: Maintenance Officer. People at this level are involved with the day-to-day problems of accomplishing maintenance. Their duties are to supervise maintenance activities and communicate with commanding officers concerning the overall effectiveness of their unit.

Level 3: Maintenance Supervisors. People at this level are non-commissioned officers responsible for the immediate activity of

the mechanics. They assign tasks and check on the quality of the work being done.

Each respondent was asked to rate, on an eight point scale, how important each of 24 criteria would be in his/her evaluation of the overall effectiveness of a helicopter maintenance unit. First, all the criteria were rated under the assumption of peacetime conditions, then all the criteria were rerated under the assumption of wartime conditions. A total of six questionnaires were obtained from Level 1 personnel, nine from Level 2 and seven from Level 3. Civilians did not complete this questionnaire. A copy of the Effectiveness Criteria Rating is contained in Appendix C.

4.1.3 Weekly Performance Summary. In addition to the survey questionnaires which provided a qualitative type of information, there was a need for more quantitative information with respect to an organization's performance. The purpose of the survey data forms was to draw relationships between the subjective opinions of the mechanics with the actual performance of the unit.

The Weekly Performance Summary form was developed to measure the actual available manpower and efficiency of military companies. It appears that units are staffed according to manpower surveys in relation to statistical data concerning how many men are required to perform maintenance on particular aircraft. Problems arise because the number of men allocated does not take into account the fact that personnel are constantly removed from their jobs to perform "other" training details. The Weekly Performance Summary form was developed to illustrate the relationship between manpower utilization and effectiveness measures. The Weekly Performance Summary form is shown in Appendix D. Unfortunately

civilian operators would not cooperate in filling out these forms. A total of ten military units returned forms for approximately a four week period.

4.1.4 Summary of DA Form 1352. The Department of the Army Form 1352 is a monthly status report for military maintenance units, indicating operational readiness measures. Our summary form of the 1352 was developed to provide overall effectiveness measures of military maintenance units as they are reported to higher levels of command. A copy of this summary is shown in Appendix E.

4.2 Results

4.2.1 Population Description. Comparison of our military and civilian samples shows only a few similarities. The attributes in common are:

(1) They are predominantly male (100% civilian, 90% military).

(2) Approximately one-half are married (59% civilian, 50% military).

(3) About one-third have dependents (45% civilian, 38% military).

The differences, however, are both more numerous and more significant in terms of probable impact on job performance. Compared to civilians the military personnel:

(1) Are seven years younger (31 years civilian, 24 years military).

(2) Have less formal education (24% of civilians have more than two years college, compared to 2% of the military).

(3) Have less specific helicopter maintenance training (13 weeks civilian, 10 weeks military).

(4) Do not have their A&P licenses (93% civilian, 3% military).

Our military sample had a mean of almost two years in grade (22.3 months), with almost five years in the service. This group, therefore, is not new to military life, and many have already re-enlisted at least once. Approximately 47% of our sample held a rank of corporal or higher. The highest rank of persons in our sample was Sergeant 1st Class.

A major incentive in any walk of life is to be doing what one has chosen to do. In our military sample, the majority (87%) were doing what they chose, that is, helicopter maintenance was either their first or second career choice. Related to this was the finding that 82% of the sample have first or second MOSs that match the helicopter they maintain, i.e., 67V for OH-58 helicopters. During our interviews, we were told that a mechanic often resents working on a helicopter for which he was not specifically trained, e.g., a 67N or 67Y working on an OH-58. Overall, however, it appears that mechanics were pretty well matched to helicopters.

The military, therefore, represents a younger, less educated, and less experienced group. Most (76%) of the civilian mechanics we sampled had been in the military for an average of 4.6 years. Of those who served in the military, 50% were helicopter mechanics and an additional 18% were aircraft mechanics. It appears, then, that a large percentage of civilian mechanics were trained in the military. This is consistent with the finding that among our military sample, 59% indicated that they planned to make helicopter maintenance their career, while only 37% indicated that they were planning to make the military their career. It seems that helicopter maintenance is attracting more men than is the military.

4.2.2 Training. Mechanics were asked to rate how helpful several types of training had been in providing them with the skills and information necessary to successfully perform their job. Each of five items was rated on a five point scale from 0 (not provided) to 5 (very great extent). Figure 4-1 shows the rank order for the five training experiences based on the mean ratings given by civilian and military personnel. There were no significant differences between civilian and military ratings on corresponding items.

Two things stand out. First, the consistent low placement of formal training by both civilian and military personnel. Second, the relatively high ranking given OJT in the military. From our interviews, we learned that is is difficult to give enough OJT because so many of the men are called away for extra duties. Further, there is the belief that there are not enough competent mechanics available to give the quantity and quality of OJT that some feel would lead to more effective military mechanics.

4.2.3 Job Perceptions. The job of a helicopter mechanic is perceived differently by the military and the civilian mechanic. The Job Description Survey (JDS) assesses seven job dimensions and eight satisfaction/motivation components. Out of all 15 scales, only one scale failed to show a significant ($p<.01$) difference between civilian and military personnel (supervisor satisfaction). Table 4-2 summarizes the data. (Normative data collected by Hackman and Oldham (1974) from a sample of 658 employees working on 62 heterogeneous jobs in seven organizations is also presented for comparison.)

Comparison of the first seven job dimensions indicates a clear advantage for civilian over military. Civilians perceive their jobs as having more variety in terms of the activities, skills and talents

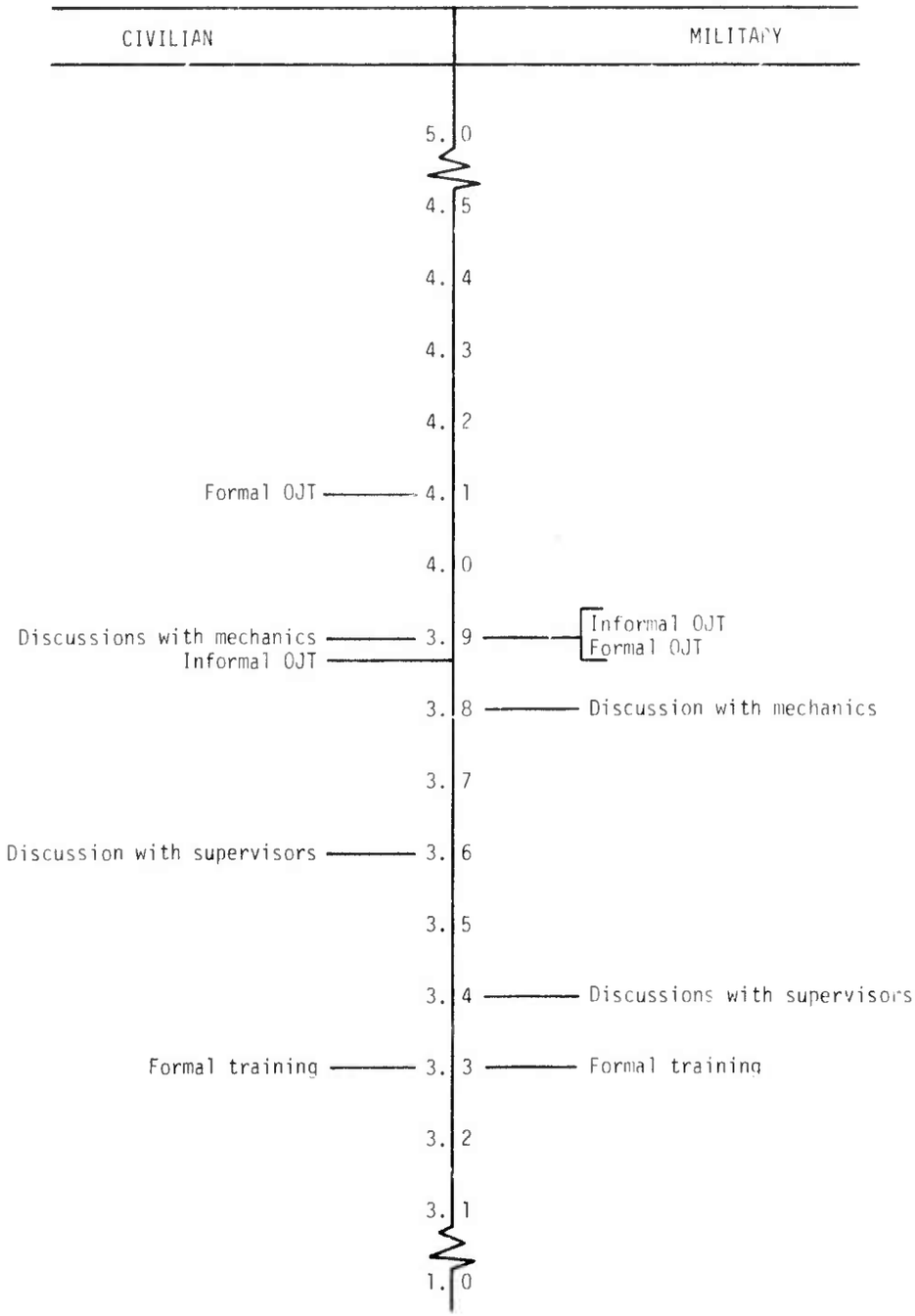

FIGURE 4-1. RANK ORDER OF IMPORTANCE OF TRAINING EXPERIENCES AS RATED BY CIVILIAN AND MILITARY PERSONNEL

TABLE 4-2. RESULTS OF THE INCENTIVE INVENTORY

	JOB DIMENSIONS	CIVILIAN MECHANICS	MILITARY MECHANICS	NORMATIVE
(1)	Skill Variety	5.9	4.1	5.1
(2)	Task Identity	5.2	3.5	5.2
(3)	Task Significance	6.5	4.2	5.8
(4)	Autonomy	5.1	3.7	4.9
(5)	Job Feedback	5.1	3.6	5.1
(6)	Agent Feedback	3.8	4.7	3.7
(7)	Dealing with Others	5.7	5.0	5.1
(8)	General Satisfaction	5.4	4.5	NA*
(9)	Internal Motivation	6.0	3.3	5.4
(10)	Pay Satisfaction	3.8	4.7	NA
(11)	Security Satisfaction	4.6	3.4	NA
(12)	Social Satisfaction	5.3	4.5	NA
(13)	Supervisor Satisfaction**	5.0	5.1	NA
(14)	Growth Satisfaction	5.2	4.2	NA
(15)	Growth Need	5.6	4.5	NA

* NA - Not Available

** Only Scale Not Showing Significant Difference Between Civilian and Military.

required to carry out the work than do military personnel. This is consistent with objective reality. A civilian mechanic will do many more maintenance tasks than will a military mechanic. The military divides maintenance into three levels; the civilians do not. Civilians also see their job more as requiring the completion of a whole and identifiable piece of work than do military personnel. This again, seems to match the facts. A military mechanic must often pass a repair job up the line after starting on it or identifying the problem. Civilians do this less often.

It was surprising that civilians saw their job as having a greater impact on the lives or work of other people than did military personnel. In both situations, pilots' lives are in danger if maintenance (even routine maintenance) is not done properly. In the military, however, this responsibility is shared with other levels in the maintenance organization. As would be expected, the military perceived themselves as having less autonomy in performing their job than did civilian personnel.

Civilian and military personnel apparently receive feedback about their job performance from different sources. Civilians receive more feedback from carrying out the work activities, while military personnel receive more feedback from outside agents, such as supervisors or co-workers. This may represent a fruitful area for change. Methods and/or procedures could be developed to increase feedback to the military mechanic from the task itself. Civilians see their job as requiring them to work more closely with other people than do military maintenance men. This was not readily apparent, from our observations.

A comparison of the military data with the normative data supplied by Hackman and Oldham (1974) reveals that the military scored lower on all dimensions except feedback from agents. The differences, however, were

not as great as those found when comparing military with civilian helicopter mechanics. These results indicate that there are areas which could be enriched for the job of military mechanic, e.g., increasing skill variety, task identity, task significance, autonomy and feedback from the job. As stated previously, the adoption of the three level maintenance concept may help to affect positive changes in these variables.

Turning now to the satisfaction/motivation scales (last eight job dimensions), the differences between civilian and military are, on the whole, not as large as those found on the first seven job dimensions. This result indicates that job enrichment activities should not encounter undue resistence in the military (Hackman and Oldham, 1974). The valuation of "growth-needs" -- a prerequisite factor for implementing job enrichment activities -- is not unduly low in the military. Further, the extremely low level of military internal motivation indicates that there is much to be gained from job redesign. If they already had a high level of internal motivation, little would be gained from job enrichment.

The one area of satisfaction in which the military is surprisingly low in comparison to civilian is that of security. Although it is improbable that a military maintenance man will lose his job, there are other sources of insecurity. There is always the threat of reassignment to a new unit or location, or assignment to a new MOS position. It would be worthwhile to explore further the specific sources of security dissatisfaction with an eye towards possibly changing policies to reduce them.

In addition to the JDS survey, Section 9 of the questionnaire (Appendix B) presented fifty-one items dealing with job perceptions. Of these fifty-one items, 16 yielded significant differences between civilian and military personnel. These sixteen items were rationally clustered into four components. The first component deals with lost time and

interruptions. It shows that, compared to civilians, in the military (item numbers from Section 9 are shown in parentheses) more work time is lost through poor scheduling (7), more interruptions occur that take the mechanic away from their work (15), less time is spent performing helicopter maintenance (32). This seems to be a disincentive because compared to civilians, military mechanics would like to spend more time performing helicopter maintenance (24).

The second component deals with working conditions. In the military, working conditions are rated less satisfactory (13), less comfortable (45), and military personnel feel less attention is paid to their safety and comfort (23) than do civilians.

The third component, containing most of the items showing significant civilian-military differences, was labeled 'supervisory competance." Compared to civilian supervisors, military personnel perceive their supervisor as:

(1) being less able to plan and coordinate work group activities so that maximum performance is possible (14)

(2) more often giving assignments and directions that conflict with directives given by other supervisors (1)

(3) less often correcting behavior if a person is performing poorly on the job (10)

(4) less trusting of their subordinates' judgments (12)

(5) less often letting subordinate do the work in the way the subordinate thinks is best (33)

(6) less technically competent in helicopter maintenance (38)

The fourth component might best be referred to as pride in the unit (or organization). Compared to civilians, military personnel are less proud to say they work where they do (34) and, it bothers them less to have someone criticizing their unit, or comparing their unit unfavorably to other units (50). Further, military personnel in comparison to civilians, feel that their job is less important than they were led to believe in their initial training (42). This unmet expectation may be a contributing factor to the low proportion of military mechanics choosing the military as a career. Ample and consistent data from civilian industrial organizations (Wanous, 1977) shows that realistic job previews result in more realistic expectations which result in substantial reductions in turnover without materially effecting the number of applicants accepting employment. This reduction in turnover occurs even when the realistic expectations are negative. This suggests that additional research might be directed toward uncovering what and how expectations are generated during training, and, perhaps even during the recruitment process.

In summary, the portrait emerging of the military mechanic is one of a frustrated individual. In brief, military mechanics like the field of helicopter maintenance. They are, in comparison to civilian mechanics, generally satisfied with their pay, with their social environment, and even with their supervisors. However, they do not think much of their job as it is defined by the military. Compared to civilians, they think that it has little significance or task identity, and that is exercises few of their skills. They feel their autonomy is low, and that they receive minimal feedback from the job itself. Accordingly, they have little internal motivation to perform. They feel a need for growth, and in all probability will seek this growth outside the military, becoming yet another civilian mechanic with previous military experience.

Since the potential for improved motivation and performance is definitely present, it appears that there are considerable benefits to be gained by modifying incentive structures, particularly those related to job design, time scheduling, and training opportunities. Since these types of incentives act on effectiveness directly, as well as indirectly through motivation, their benefit-to-cost ratio is likely to be extremely high.

4.2.4 Traditional Incentives. The section of the questionnaire assessing the perceived relationship (instrumentality) between performance and specific consequences, revealed little substantive differences between military and civilian. Accordingly, only the military data are assessed here. A rank ordering of the perceived instrumentalities for the various consequences for military personnel, reveals clusters. This is shown in Figure 4-2. The highest instrumentalities were those relating outstanding performance to increased job responsibilities, and poor performance to reprimands and close supervision. (Although not directly assessed, it is possible that some individuals do not really value increased job responsibility. For those individuals for whom this is true, performing may well lead, with some degree of certainty, to a negative incentive.)

The second cluster of instrumentalities contains praise-related items (praise from supervisors, praise from co-workers, and letters of commendation). These items probably are of positive value to most individuals, and may be effective incentives for achieving outstanding performance. In this second cluster, however, is another item which is related to outstanding performance, but may carry negative value to some individuals, i.e., promotion. During our interviews we discovered that some mechanics like what they are doing. A promotion to many of them means that they must give up their present job and move into a supervisory role. Not everyone wants to be a supervisor.

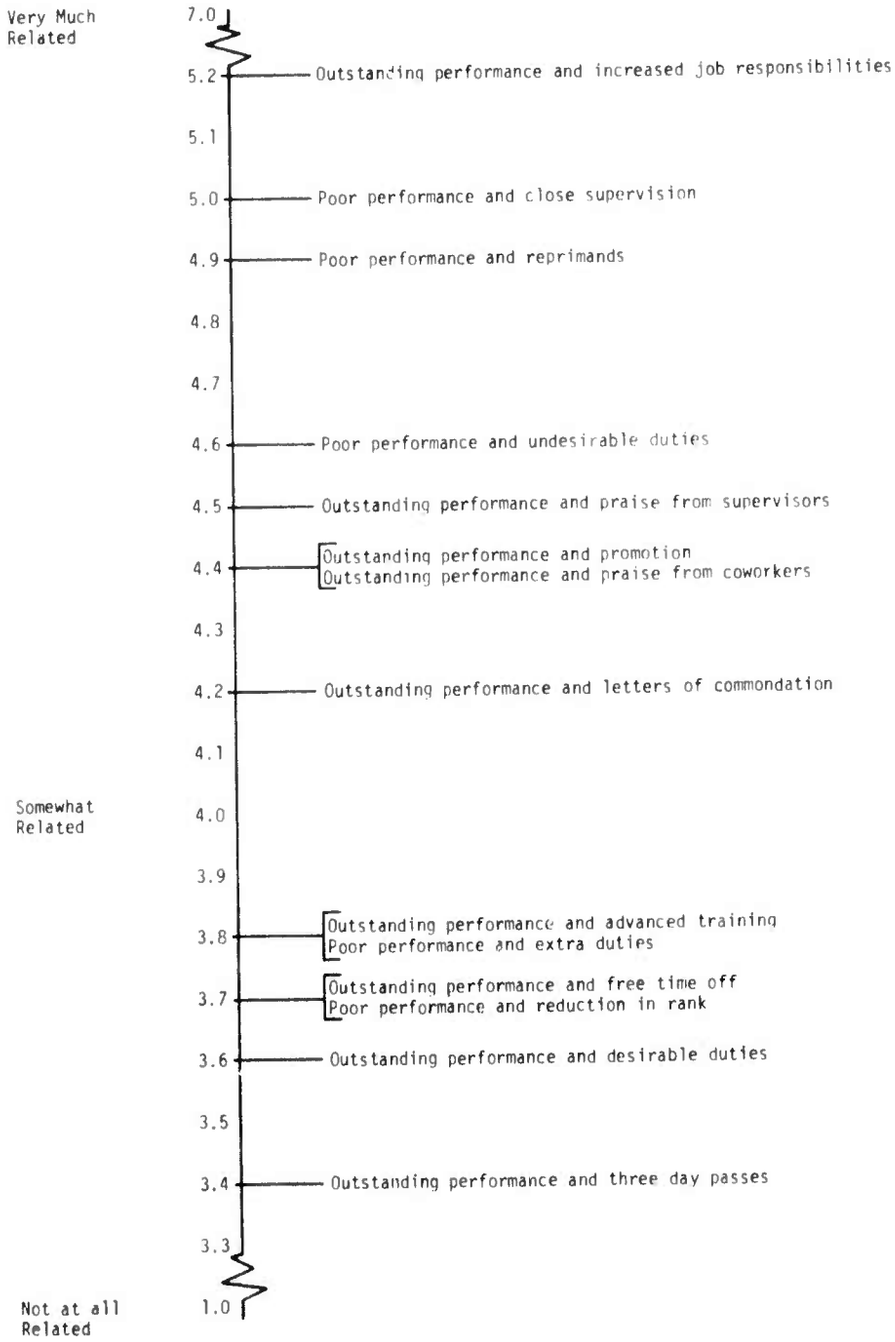

FIGURE 4-2. RANK ORDERING OF INSTRUMENTALITIES FOR MILITARY PERSONNEL

The third cluster contains items which are short-term in nature and can be used over and over again as incentives (desirable duty, free time off, less extra duties). Their relatively low instrumentalities suggest that they are not being used consistently as a reward for good performance. One item, advanced training, may be unique in that it may be both an incentive, and also contribute directly to job performance. In another part of the survey, military personnel were asked if they planned to get an A&P license, which requires two years of schooling. A full 60% of the respondents indicated that they were planning to get the license. It seems worthwhile to explore the possibility of allowing select mechanics to pursue part or all of the training for an A&P license through the military. This may encourage people to stay in longer, plus it will upgrade the skill level of the personnel at the same time. The payoff to the military may be high. Of the people in our sample who indicated they were not planning to make the military their career, over half (54%) said they planned to get an A&P license. If even half of these could be pursuaded to work toward an A&P license in the military, reenlistment rates might, if our data are any indication, increase from 37% to 55%!

4.2.5 Effectiveness Criteria Ratings. Twenty-four potential criteria for evaluating helicopter unit effectiveness were rated in terms of importance under peace time and war time conditions by Commanding Officers (N=8), Maintenance Officers (N=12), and Maintenance Supervisors (N=8).

Under peace time conditions only five of the 24 times showed a significant difference between the three responding groups. These items and their associated mean rating are shown in Table 4-3. All of the items except "Mean Time to Repair" show the same general pattern across levels. Commanding Officers give the lowest ratings with higher ratings given by Maintenance Officers and Supervisors. Mean Time to Repair, on the other hand, showed Maintenance Officers with the lowest ratings followed by Commanding Officers and Maintenance Supervisors.

TABLE 4-3. MEAN IMPORTANCE RATINGS UNDER PEACETIME CONDITIONS OF ITEM SHOWING SIGNIFICANT DIFFERENCES BETWEEN GROUPS

ITEM	COMMANDING OFFICERS	MAINTENANCE OFFICERS	MAINTENANCE SUPERVISORS
Morale**	5.87	7.17	7.50
Personnel Accident Rate*	5.12	7.00	7.00
Aircraft Cleanliness*	5.75	6.50	7.00
Man-Hrs. per Aircraft*	4.75	6.00	6.62
Mean Time to Repair*	6.62	5.25	6.37

* $p<.10$
** $p<.05$

It appears reasonable that morale and personnel accident rate would be rated higher by Maintenance Officers and Supervisors, as these items are of more "immediate" concern to their jobs.

The mean ratings given each of the 24 effectiveness items by the three responding groups were intercorrelated to determine the degree of correspondence between the groups in their relative rankings of the items. Under peace time corditions, Commanding Officers' ratings did not correlate significantly with either those of Maintenance Officers (r=.30), or Maintenance Supervisors (r=.33). The correlation between Maintenance Officers and Supervisors, however, was significant (r=.68). This indicates that Commanding Officers have somewhat different ideas about what is important in evaluating the effectiveness of helicopter maintenance units than do those more directly responsible for achieving effectiveness.

In order to more graphically depict the differences in rated importance of items between the three responding groups, the ten (10) highest ranked items for each group are shown in Figure 4-3.

A somewhat surprising finding was that "readiness", the one common metric used by all levels in the Army to evaluate effectiveness, was ranked third or fourth by all three groups. Commanding Officers rated downtime and man-hours per flight hour more important. Maintenance Officers and Supervisors rated morale, job satisfaction and accident rate (personnel or aircraft) as more important than readiness. Maintenance Supervisors on the average, considered aircraft cleanliness to be of equal importance to readiness.

The most important item, as seen by the Commanding Officers, i.e., Downtime, is not even among the top ten as seen by Maintenance Supervisors Similarly, the item rated most important by Maintenance Supervisors, i.e., morale, was not among the top ten as rated by the Commanding Officer.

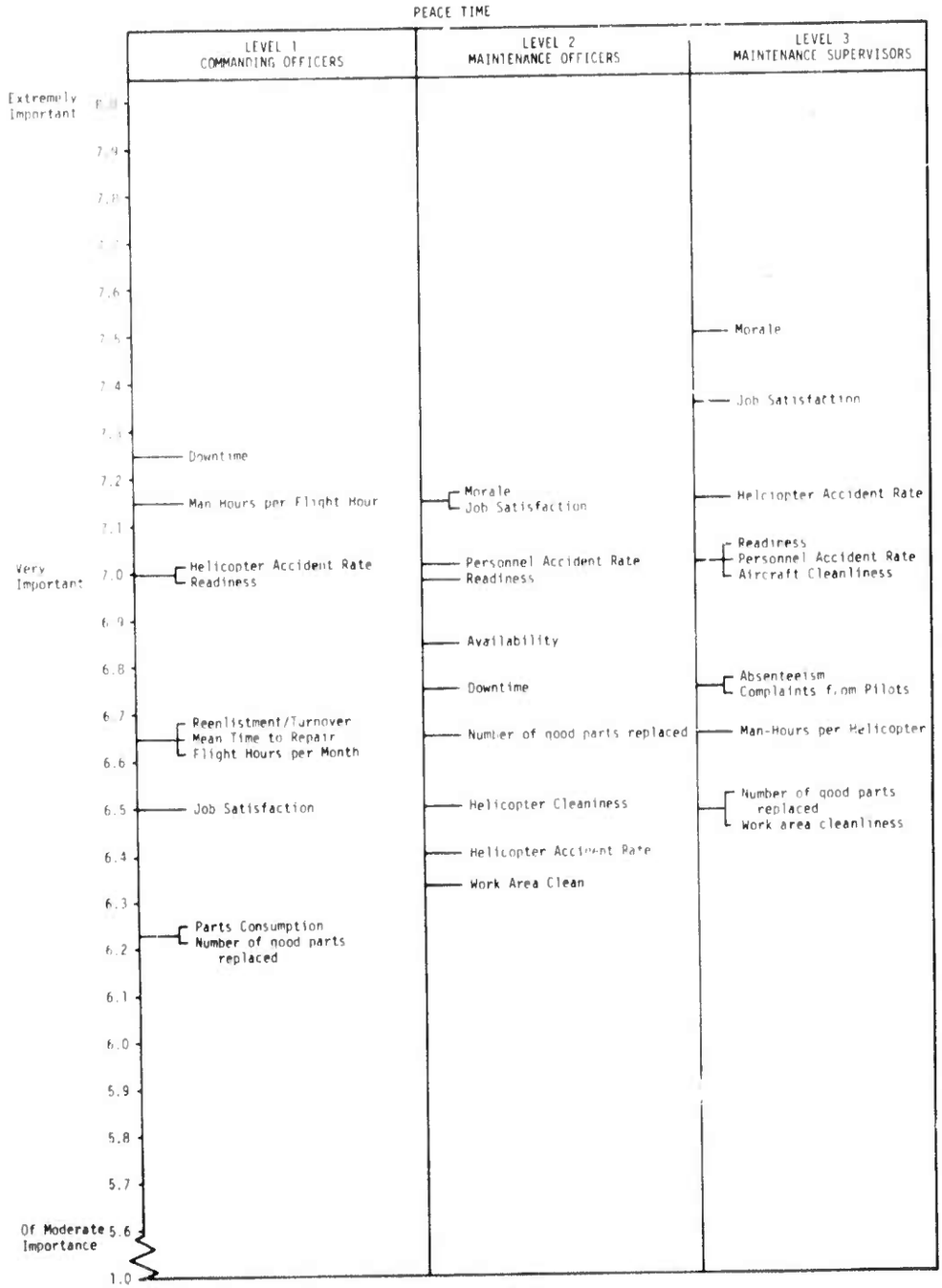

FIGURE 4-3. RANK ORDERING OF 10 MOST IMPORTANT ITEMS RATED BY THE THREE RESPONDING GROUPS UNDER PEACETIME CONDITIONS

Under war time conditions, ten of the 24 items showed a significant difference between the three responding groups. These items and their associated mean ratings are shown in Table 4-4. All the items show the same general pattern. Commanding Officers rate the items lower than either Maintenance Officers or Supervisors. The difference in mean ratings between Maintenance Officers and Supervisors is small for all items. Again, as was found under peace time conditions, those items dealing with more immediate aspects of the maintenance job (i.e., number of work orders completed, aircraft and work area cleanliness, morale, etc.) are rated higher by both Maintenance Officers and Supervisors than by Commanding Officers. In addition, a criterion more removed from the immediate working environment, i.e., availability, also shows significantly higher ratings by Maintenance Officers and Supervisors than by Commanding Officers.

Correlating the mean ratings for the three groups reveals a higher correlation between Commanding Officers and Maintenance Supervisors ($r=.44, p<.05$) than between Commanding Officers and Maintenance Officers ($r=.25, p<.10$). The highest correlation, as under peace time, was between Maintenance Officers and Maintenance Supervisors ($r=.79, p<.01$).

Figure 4-4 shows the ten highest rated items for each of the three responding groups under war time conditions. Readiness was rated of highest importance by both Maintenance Officers and Supervisors, but was rated third behind downtime and man-hours per flight hour by Commanding Officers. Availability, related to, but not the same as readiness, was rated in the top ten item by both Maintenance Officers and Supervisors but failed to make the top ten for Commanding Officers.

Parts consumption was considered of relatively high importance by Commanding Officers but was not among the top ten items for either Maintenance Officers or Supervisors.

TABLE 4-4. MEAN IMPORTANCE RATINGS UNDER WAR TIME CONDITIONS OF ITEMS SHOWING SIGNIFICANT DIFFERENCES BETWEEN GROUPS

ITEM	COMMANDING OFFICER	MAINTENANCE OFFICER	MAINTENANCE SUPERVISOR
Availability*	5.25	7.42	7.12
Mean Time to Repair*	5.75	5.92	7.37
Number of Work Orders Completed per Unit Time**	4.12	5.50	6.87
Aircraft Cleanliness	4.00	5.75	5.62
Work Area Cleanliness*	3.62	5.50	5.62
Personnel Accident Rate*	5.12	7.17	7.12
Morale***	6.12	7.25	7.62
Tardiness**	3.87	6.42	6.75
Absenteeism**	3.87	6.67	6.75
Grievances**	3.87	6.00	5.00

* $p<.10$
** $p<.05$
*** $p<.01$

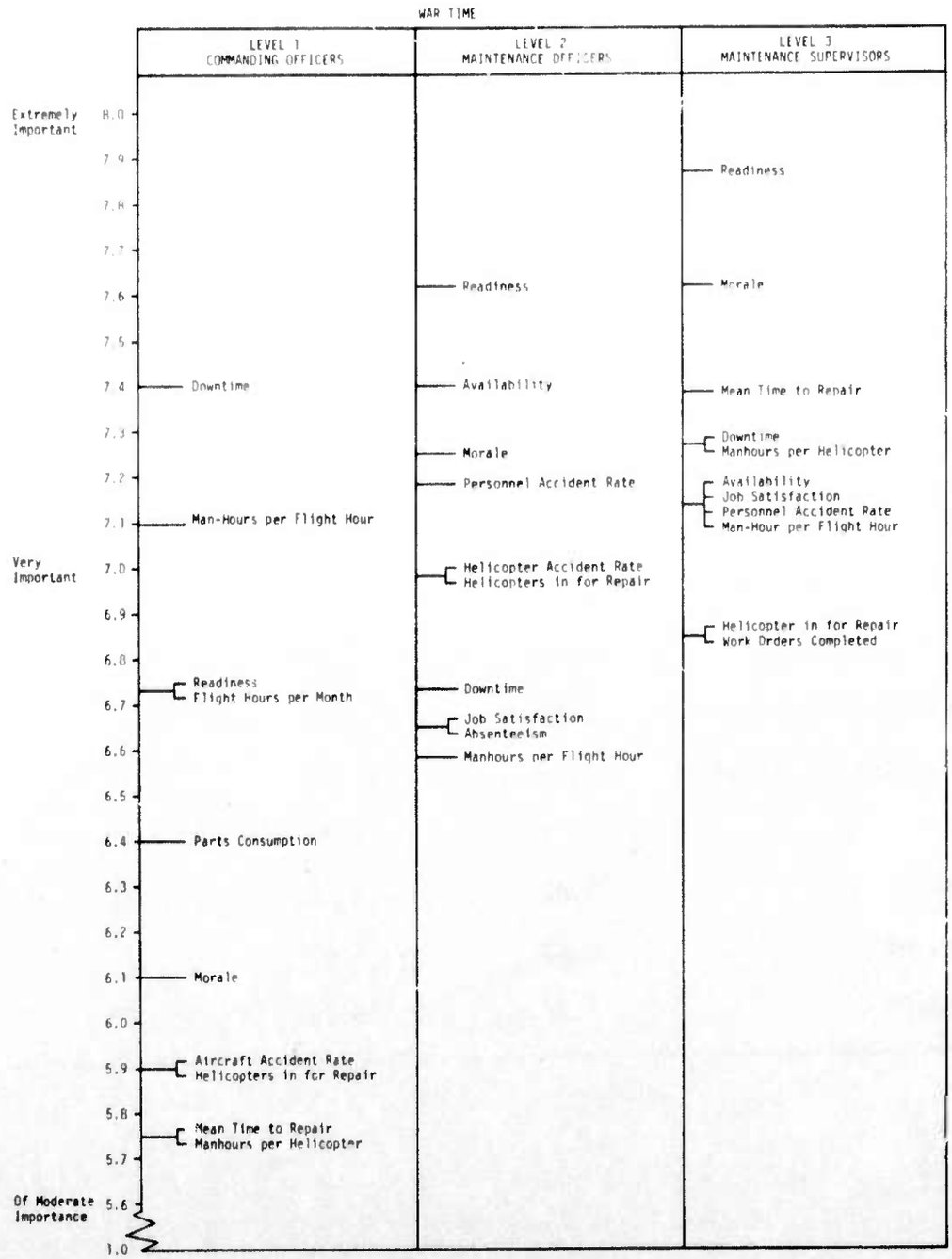

FIGURE 4-4. RANK ORDERING OF 10 MOST IMPORTANT ITEMS RATED BY THE THREE GROUPS RESPONDING UNDER WARTIME CONDITIONS

The correlation between the mean importance rating of Commanding Officers under peace and war time conditions was .71. This indicates comparatively little change in the relative rankings of the items between war and peace time conditions. Of the 24 items, only five showed significant differences between war and peace conditions for Commanding Officers. These items were:

Man-hours per aircraft	peace 4.75	war 5.75
Reenlistment/turnover	6.62	5.25
Grievances	5.12	3.87
Work area cleanliness	5.62	3.62
Aircraft cleanliness	5.75	4.00

As can be seen, only man-hours per aircraft showed a higher rating for war time than for peace time. The converse is true for the other four items. In perspective, these shifts from war to peace seem reasonable.

Comparing Figures 4-3 and 4-4 it can be seen that two items (down time and man-hours per flight hour) are considered the most important by Commanding Officers regardless of whether it is peace or war time. The same is not true for the other groups.

The correlation between the peace and war time mean ratings for Maintenance Officers ($r=.57$) is lower than found for Commanding Officers. This indicates that Maintenance Officers make a greater distinction between war and peace conditions than do Commanding Officers.

Although there were shifts in the relative importance of various items between war and peace time, only four items showed significant ($p<.10$) differences in their mean ratings. The items were:

Number of good parts replaced	peace 6.67	war 5.25
Parts consumption	6.25	4.50
Aircraft cleanliness	6.50	5.75
Work area cleanliness	6.33	5.50

In all cases these items were considered more important in peace time than in war time. It is of interest to note that even under peace time conditions parts consumption is considered of no more importance than aircraft or work area cleanliness to Maintenance Officers.

Comparing Figure 4-3 and 4-4, it can be seen that, for Maintenance Officers, the most important criteria in peace time are morale and job satisfaction, while under war time conditions, readiness and availability head the list. Further, in war time, Maintenance Officers see a distinction between morale and job satisfaction. Apparently, morale is more important and can exist even when the job itself in unpleasant.

There were major changes in the relative importance given the items under peace and war time conditions by Maintenance Supervisors. The correlation between peace and war time mean was only .38 ($p<.05$).

Of the 24 items, seven showed significant differences between peace and war time conditions. The items were:

Readiness	peace 7.00	war 7.87
Availability	5.87	7.12
Mean time to repair	6.37	7.37
Man hours per aircraft	6.62	7.25
Work orders completed	4.87	6.87
Work area cleanliness	6.50	5.62
Grievances	6.25	5.50

The items dealing with the effectiveness and/or efficiency of the unit (the first five items above) are rated of higher importance under war conditions than under peace time conditions. No such shifts, except man-hours p r aircraft for Commanding Officers, were found for the other responding groups.

In summary, this analysis, although based on a limited sample, indicates a differential emphasis on various criteria of effectivenss/ efficiency between levels in the organization and between war and peace time conditions. Maintenance Officers and Supervisors are more alike in their perceptions than either group is to Commanding Officers. The perceived importance of the various criteria change very little between war and peace time for Commanding Officers, but change greatly for Maintenance Supervisors. For Maintenance Supervisors, effectiveness/ efficiency criteria increase in importance during war time conditions.

These analyses and findings raise a number of intriguing questions; among them:

Are the differences between organizational levels acting antagonistically, or are they actually working in a synergistic fashion? Should organizational priorities and criteria be changed between peace and war time? If manpower and effort is expended on maintaining morale and keeping aircraft and work areas clean, what effect, if any, does this have on readiness and cost effecitveness? Is parts consumption high during wartime because it is not considered that important by those in the field (Maintenance Officers and Supervisors)? What effect does the relatively low level of importance given by Commanding Officers to such items as morale, aircraft and work area cleanliness, and number of work orders completed have on overall cost effectiveness in wartime? Are the differences between organizational levels natural and accepted, or are they due to a lack of communication?

4.2.6 Efficiency/Effectiveness Data. Two sources of data were collected from military installations surveyed during this project. Unfortunately, it was not possible to obtain similar data from civilian installations. Thus, all comparisons must be made between military units.

Four military units supplied sufficient questionnaire and effectiveness/efficiency data to be included in this part of the study. The units were:

1st Cavalry Division, Fort Hood, Texas
2nd Armored Division, Fort Hood, Texas
7th Division, Fort Ord, California
Naval Air Station, Whiting Field, Florida

The first source of data collected from each unit was Form 1352 which reports Operational Readiness (OR), Non-operational Readiness due to Supply, (NORS), and Non-operational Readiness due to Maintenance (NORM).

The second source of data came from the Weekly Performance Summary distributed to a sample of companies within each unit. Four weeks of data were forwarded to the project team for analysis. Each measure was converted to a daily average over the four week period (in some cases, less than four weeks data were obtained). From these data it was possible to compute the following measures:

Percent of Available People Working
Percent of Total Aircraft or
Percent of OR Aircraft flown
Man hours per Flight Hour
Man hours per Aircraft
Man hours per Aircraft Flown

Table 4-5 lists for each unit the means for these efficiency/effectiveness measures. Several interesting items should be noted in Table 4-5. First, except for the 7th Infantry, all the other units had high OR rates. Second, the OR rates do not, except for Naval Air Station, match the percent of aircraft OR. This is due to the manner by which the two measures are computed. The OR rate is computed as the number of hours aircraft or OR out of the total possible hours. The figures reported are from a 12 month period. The "percent of total aircraft that are OR" was computed over approximately four weeks using the actual number of aircraft OR per day. For example, an OR rate of 80% could be achieved by having all aircraft OR 80% of the time and no aircraft OR 20% of the time. The percent of total aircraft OR under such a condition would range from 100% to zero depending on which time period was sampled.

Third, except for the Naval Air Station which is a training base, only about 25% of the OR aircraft are flown per day. This low percentage may call into question the necessity for maintaining high OR levels under peace time conditions. Due to this low utilization rate, the number of job-hours per aircraft flown is orders of magnitude higher than the number of man hours per aircraft.

Fourth, except for the 1st Cavalry, over 80% of the assigned men work a full shift. This means that up to 20% of the men do not work full shifts. The principle reason why personnel do not work full shifts is because of extra duty assignments and training required of military personnel.

Questionnaire scales and items were identified that showed significant differences between the four military units. This was done in order to reduce the number of variables to be correlated with the effectiveness/efficiency measures.

TABLE 4-5. MEAN EFFICIENCY/EFFECTIVENESS MEASURES

	1st CAV.	2nd ARM.	7th INFR.	NAS
% Operational Readiness (OR)	84.80	86.25	71.10	84.33
% Non-OR due to Supply (NORS)	5.80	3.25	7.67	1.24
% Non-OR due to Maintenance (NORM)	9.40	10.50	18.61	14.44
% Available People Working	45	81	84	86
% Total Aircraft OR	91.05	76.10	76.46	84.03
% OR Aircraft Flown	23	20	27	63
Man-Hrs. per Flight Hour	17.53	12.01	18.59	11.64
Man-Hrs. per Aircraft	3.97	3.00	2.26	16.72
Man-Hrs. per Aircraft Flown	37.63	22.70	43.64	31.83

The following questionnaire variables showed significant differences between military units:

Identity
Significance
Feedback from the Job
Feedback for Agents
Pay Satisfaction
Social Satisfaction
Discussions with Supervisors (training helpfulness)

A total of 22 items from Section 9 of the questionnaire also showed significant differences between military units. All but three items could be rationally combined into the following four categories: (questionnaire items in parentheses)

Supervisor Competence (2, 3, 4, 6, 27, 37, 38, 43, 46, 47, 49)
Lost Work Time (7, 18, 30)
Working Conditions (17, 23)
Organization Pride (29, 34, 50)

The three items that could not be classified were:

21. Extent workers are under a lot of pressure to get jobs finished.

24. Extent you would like to spend more time performing helicopter maintenance.

30. Extent of time spent performing helicopter maintenance.

Table 4-6 contains the intercorrelations between these 14 job perception measures and the nine effectiveness/efficiency variables. It is not practical with a sample size of four to consider the statistical significance of each correlation. With N=4, a correlation must exceed .95 to be significant at the .05 level. Rather than run the risk of passing over potentially useful relationships, an arbitrary standard was adopted based on the percentage of variance accounted for by the correlation (r^2). It was felt that a correlation should account for at least 75% of the variance (r=.866) before it would be considered of practical importance. Fifteen correlations met or surpassed this criterion. They are circled in the table. Although statements can be made regarding those relationships meeting this criterion, due to the small sample size, statements can not so freely be made regarding a lack of relationship for those correlations not meeting the criterion.

Considering only those correlations above .866, the following picture emerges from the effectiveness/efficiency measures.

Units with high OR rates (as measured by Form 1352) tend to have a high perception of job identity, low perception of task significance and are not under pressure to finish jobs.

Units with high NORS rates tend to get more feedback from agents and have more lost time due to poor performance, paper work and lack of tools and supplies, and would like more time to do maintenance work.

Units with high NORM rates have lower pay satisfaction, lower organizational pride and spend less time doing maintenance work.

Units with high maintenance man hours per flight hour tend to get more feedback from agents. Unexplainedly, the opposite is true if efficiency is measured in maintenance man hours per aircraft. Units with high man

TABLE 4-6 . INTERCORRELATIONS BETWEEN JOB PERCEPTION MEASURES AND MEASURES OF EFFECTIVENESS/EFFICIENCY (N=4)

PERCEPTUAL MEASURES	EFFECTIVENESS MEASURES: OR	NORS	NORM	% WORKING	% AC OR	% OR FLOWN	MH/FLIGHT-HR.	MH/AC	MH?AC FLOWN
Identity	(.95)	-.70	-.82	-.44	.67	.29	-.56	.48	-.56
Significance	(-.87)	.57	.79	.58	-.81	-.27	.39	-.45	.38
Feedback From the Job	-.80	.62	.67	.49	-.83	-.44	.40	-.60	.30
Feedback From Agents	-.48	(.94)	.01	-.51	.00	-.85	(.87)	(-.91)	.53
Pay Satisfaction	.71	-.20	(-.87)	-.38	.04	-.58	-.33	-.40	-.73
Social Satisfaction	.49	.23	-.84	-.83	.43	-.73	.22	-.58	-.21
Discussion with Supervisor (Training Help)	.51	.21	-.84	(-.93)	.63	-.59	.26	-.44	-.10
Supervisor Competence	.56	.07	-.84	-.57	.13	-.75	-.04	-.59	-.50
Lost Work Time	-.57	(.95)	.13	-.35	.18	-.86	.84	(.94)	-.51
Working Conditions	.44	.29	-.80	-.90	.53	-.69	.31	-.55	-.09
Organizational Pride	.71	-.05	(-.95)	-.84	.61	-.46	.00	-.28	-.34
Pressure	(-.90)	.72	.73	.43	-.72	-.41	.54	-.58	-.48
Like More Time to Do Maintenance	-.71	(.95)	.32	-.15	-.35	-.78	.81	(-.89)	.54
Time Spent in Maintenance	.79	-.19	(-.97)	-.61	.34	-.51	-.23	-.32	-.61

Circled Values Account for at Least 75% of the Variance Between the Measures Correlated.

hours per aircraft tend to get less feedback from agents. They also have more lost time due to poor performance, paper work and lack of tools and supplies, and would like more time to do mainentance work.

4.3 Conclusion

The information obtained through interviews and the results of the surveys present a congruent description of the condition and circumstances of military helicopter maintenance personnel at the Organizational and Direct Support levels. The situation is brought into sharper focus when comparisons are made to civilian helicopter maintenance installations.

4.3.1 Organizational Priorities. The military appeared to be more concerned with effectiveness than efficiency. Cost appears to be a secondary concern to the primary goal of readiness. Within the military however, there were significant differences between organizational levels in the relative importance attached to various indicies of work unit effectiveness/efficiency. Maintenance supervisors and maintenance officers were more similar in their views than either group was to commanding officers. There was also evidence that importance ratings changed from peace to war time conditions. This change was greatest for maintenance officers and supervisors and much less so for commanding officers.

A central philosophical difference between military and civilian organizations is the relative importance placed by maintenance performance in the evaluation of a person's worth to the organization. In the case of civilians, an individual mechanic's worth to the organization is almost totally determined by his performance in the role of mechanic. In the military, on the other hand, a mechanic's maintenance performance is only one part of his total worth to the organization. He is expected to also be a soldier. His total worth, then is to a large part a function of his performance on non-maintenance soldiering tasks.

The basic philosophical attitude of "soldier first" surfaced in the interview and survey data numerous times. The demands for being a soldier (e.g., guard duty, parades, non-maintenance training) resulted in work disruption, less time available to do maintenance work, and increased scheduling problems.

4.3.2 Work Environment. The organizational structure in the military contains more levels than are found in civilian organizations. This is consistent with the manner in which tasks are allocated in the two environments. In the military, helicopter maintenance is highly specialized with specific tasks assigned to each level; the more complex tasks being done by the higher levels. This often necessitates passing work from level to level in order to complete the job. A civilian mechanic does the equivalent of all levels of military maintenance. This difference was reflected in the job perceptions of military and civilian mechanics. Military mechanics felt that their job required less skill variety and that they did not have as much opportunity to complete a whole and identifiable piece of work. This may account for the lower preceived impact of their limited job on the lives and work of others. The high level of specialization in the military may also account in part for the lower perceived autonomy in scheduling work and determining the procedures to be used in carrying it out in the military.

Civilians apparently get feedback about their performance primarily from the job itself, while in the military, feedback primarily comes from co-workers and supervisors. This, despite the finding that in the military mechanics perceive their supervisor as less competent both in terms of management skills and technical skills than do civilians.

Supervisors, both civilian and military, use verbal praise and reprimand as reward or punishment. It became apparent that civilians also used other forms of incentive that were not, or could not be, used in the military (e.g., advanc-d maintenance training, choice of work tasks, bonus, etc.).

The immediate working conditions in the military were often observed to be more uncomfortable than found in civilian installations. Indeed the relative perceptions of civilian and military mechanics confirmed this observation. In the military, most of the organizational maintenance is carried out on the flight line or in temporary shelters. Civilians typically carry out all maintenance activities in permanent hanger facilities.

4.3.3 Characteristics of Maintenance Personnel. The data support the widely accepted fact that military maintenance personnel are younger, less experienced and less well trained than their civilian counterparts. At the operational level in the military, there is universal agreement that formal helicopter maintenance training is inadequate. There is little opportunity for advanced maintenance training and OJT is considered by most to be less than adequate.

Civilians are required to have an A & P license, requiring two years of training, plus are given opportunities for advanced training. Most of the civilians were maintenance personnel in the military before becoming civilian mechanics.

The general job satisfaction of military mechanics is not low, but is lower than their civilian counterparts. Military mechanics have less pride in their units than civilian mechanics. Security satisfaction is low in the military. This is offset somewhat by a relatively high pay satisfaction and satisfaction with their supervisor. Despite a relatively high growth need strength, the job structure in the military apparently results in low growth need satisfaction.

4.3.4 Implications. These conclusions have several implications which may be contributing to the high cost and low efficiency of military maintenance. These include:

1. L w job skills
2. Less than adequate OJT
3. Low morale
4. Low internal motivation
5. High rates of turnover
6. Disruptions in normal work flow
7. Delays in task completion
8. More man-hours per task
9. Low quality work
10. High parts consumption

5. RECOMMENDATIONS

The results of this study revealed significant differences between military and civilian helicopter mechanics and their work environments. The data and observations made during the study suggested a number of recommendations for future study and/or modification of military procedures. The model of the maintenance organization discussed in Section 2.0 of this report provides a good vehicle for organizing the discussion of these recommendations.

5.1 Organizational Inputs

Organizational inputs are comprised of structural and operational factors. Structural factors are difficult to change in large organizations. From our interviews, however, we came across a structural factor which might be contributing to the attrition of skilled mechanics in the military. To advance in the military, a mechanic must move into a supervisory position. The opinion was expressed by many of those interviewed that some mechanics, often the best, do not desire supervisory positions. These people, it is believed, leave the military to work in civilian organizations where they can be given salary increases without taking on supervisory duties. Our data showed that most civilian helicopter mechanics were trained in the military. This leads to the first recommendation:

RECOMMENDATION 1. Provide the Opportunity for Advancement Within Specialty. (The Master Mechanic Concept)

It should be possible for a mechanic to be an E6 or E7 and remain a mechanic by increasing the range and level of maintenance tasks he/she can perform. Although the concept seems simple, it is recognized that implementation will be complex and will impinge on other elements of the system. A further study would have to be made of both the costs and potential benefits of such a change.

Organizational factors include selection, placement and training.

RECOMMENDATION 2. Assess Training Effectiveness Using Job Skill Tests.

RECOMMENDATION 3. Modify Formal Maintenance Training to Improve Its On-The-Job Utility.

The data suggest that mechanics consider the formal training they get to be the least helpful in carrying out their jobs. Supervisors interviewed felt, unanimously, that the formal training given mechanics is inadequate and is a major contribution to the lower efficiency of the military.

Recommendations 2 and 3 will require a detailed analysis of what mechanics need to know and what training media are most appropriate for teaching it. The observations of this study suggest that insufficient hands-on experience during formal training is a principal reason for the lack of adequacy of training graduates. This should be investigated and cost/benefits analyses made to determine whether money and time devoted to improving initial training effectiveness will be cost effective.

RECOMMENDATION 4. Make Provisions for Obtaining an A&P License in the Military.

Data were presented that showed that over half of the people who were not planning to make the military their career were planning to get an A&P license. An A&P license requires approximately two years of schooling. Mechanics should be selected to pursue the license based on their job performance. Schooling for the A&P license could be started in the third or fourth year thus requiring the mechanic to reenlist in order to finish the license in the military. The result might be higher reenlistment rates and a more skilled work force.

5.2 Work Unit

The work unit of the organizational model is comprised of the immediate work environment, supervisor, coworkers, focal person, workload demands and supply. Several recommendations concern the state of the work unit.

RECOMMENDATION 5. Improve Working Conditions.

It was expressed during the interviews that time is lost because repairs must often be made on the flight line with no shelter in severe weather conditions. Questionnaire data showed a clear superiority of civilian working conditions over military working conditions, suggesting that there is room for improvement in the military. The importance of good clean working conditions is underscored by Maintenance Officers and Supervisors who considered it one of the top ten criteria of a units' effectiveness under peace time conditions. Clean work areas, it was believed, reduces the probability of foreign object damage (FOD) to the aircraft. Implementation of improvements in the working conditions might improve efficiency and quality of maintenance.

RECOMMENDATION 6. Assess Supervisory Training Needs.

Military mechanics rated discussions with supervisors lower than discussions with other mechanics in terms of training helpfulness. The questionnaire data revealed significant differences between civilian and military, and between military units on items dealing with supervisor competence. The items dealt both with the perceived technical competence of the supervisor and his supervisory competence. This suggests that some supervisors may need additional training in basic supervisory skills; planning, motivating, setting performance standards, etc. The recommendation here is to assess systematically the training needs of supervisors to determine areas in need of improvement. Training courses could then be developed to fill the needs identified.

Subjective perceptions play an important role in generating job attitudes and counter productive behaviors. The next two recommendations deal with subjective perceptions of the focal person.

RECOMMENDATION 7. Explore Specific Sources of Security Dissatisfaction And Assess Their Impact on Organizational Effectiveness.

The questionnaire data revealed an unusually low security satisfaction score among military mechanics. It was hypothesized that this may be due to insecurity concerning duty assignment and location. It was felt that such dissatisfaction may have an impact on retention and reenlistment rates, absenteeism and morale. This is only an hypothesis which, it is recommended, should be verified.

RECOMMENDATION 8. Explore What Job Expectations Are Generated And How They Are Generated During the Recruitment, Indoctrination And Training Process.

There is ample evidence that unrealistic job expectations (i.e., job expectations which are not met) are a major cause of personnel turnover. Military personnel in comparison to the civilians sampled felt that their job was less important than they were led to believe in their initial training. From interviews we learned that mechanics consider themselves mechanics first rather than soldiers first and that they resent working on helicopters for which they did not receive preliminary training. All of these bits of information point to the hypothesis that mechanics are not developing realistic expectations about their job and its environment. By pinpointing the source(s) of these expectations, it might be possible to develop more realistic expectations and increase retention and reenlistment rates.

RECOMMENDATION 9. Assess the Feasibility And Cost-Effectiveness of The Repair Kit Concept of Maintenance.

The supply function was not the focus of this project, however, an interesting concept was encountered at the Naval Air Station (Pensacola, Florida) which is related to the supply function in the immediate work unit. Special kits (tools and parts) are prepared for each major type of maintenance task. The concept appears costly to implement initially, but may lead to fewer lost tools, less FOD, lower incidence of using improper tools for a particular job and less time lost to retrieve forgotten tools. The concept may be cost-effective and merits further study and possibly even limited experimental tryout.

5.3 Organizational Outputs

A portion of the present study explored the relative importance placed on different aspects of organizational effectiveness by three levels of command under peace and war time conditions. Large differences were found which might have implications for overall organizational effectiveness. The results were only exploratory in nature and were neither aimed at discovering the reasons for the differences found nor their implications to the organization.

RECOMMENDATION 10. Study in More Depth The Relative Importance Placed on Measures of Organizational Effectiveness by Different Levels in Peace and War Time and The Implications of Differences and Similarities Found.

The recommended study would address such questions as; whether the differences between organizational levels are acting antagonistically or synergistically, whether organizational priorities and criteria should be changed between peace and war time, whether the differences are natural as accepted or are due to a lack of communication, etc.

5.4 Total System

Two recommendations do not fit neatly into just one particular area of the organizational model, but rather are so pervasive that they involve several elements of the model. It is the authors' opinion that these two recommendations are central to the efficiency of military helicopter maintenance. The benefits to be derived from the successful implementation of the following two recommendations may also accrue in other high technology maintenance fields.

RECOMMENDATION 11. Institute Job Enrichment Activities to Modify the Job of Helicopter Mechanics at Both the Organizational and Direct Support Levels.

Job enrichment is the term used to describe modifications to a job that improve factors believed to increase worker motivation. These factors include skill variety, autonomy, task significance, task identity, and responsibility. Our data indicate that job enrichment should increase motivation of Army helicopter mechanics and should, if properly instituted, be widely accepted by the mechanics themselves.

First, our data showed that military mechanics displayed a relatively high growth need. This is believed to be a necessary prerequisite to successful implementation of job enrichment. Job enrichment is aimed at satisfying growth needs and unless such needs exist, the benefits of job enrichment will be lost.

In the comparison of civilian and military mechanics, military mechanics displayed lower skill variety, task identity, task significance, autonomy and job feedback. This indicates that the work of helicopter mechanics is not by its very nature, low on critical motivating dimensions. It is doubtful whether the job of military mechanics can be modified to equal that of civilians. There is, however, obviously room for improvement within the military.

Military mechanics showed a relatively high level of general satisfaction and satisfaction with their supervisors. Hackman and Oldham (1974) indicate that the implementation of job enrichment will go smoother, encountering less resistence, if general and supervisor satisfactions are high. With high supervisor satisfaction, the supervisor can be given a central role in the implementation and it will be accepted more readily by the subordinates.

The payoff to the organization from job enrichment appears to be high. Our data show that mechanics currently have a low level of internal motivation which job enrichment is designed to increase. If internal motivation were already high, the payoff from job enrichment might be more doubtful. Higher internal motivation is usually associated with higher quality work, lower absenteeism and turnover, and less internal strife.

It was discovered in our data that more military mechanics want to make helicopter maintenance their career (59%) than they want to make the military their career (37%). Job enrichment and the anticipated increase in internal motivation, might increase the reenlistment rate and encourage more mechanics to pursue a career in helicopter maintenance in the military. In addition, our data revealed a high correlation between the task identity expressed by a unit and their OR rate. Although no cause and effect relationship can be established, it can be hypothesized that increasing task identity through job enrichment may improve OR rates.

Job enrichment impacts many components of the organizational model. It can be considered an operational factor which influences the immediate work environment, changing the relationships between supervision, coworkers and the focal person. It has ramifications for workload demand and supply and can change organizational outputs.

To successfully implement job enrichment requires considerable time, study and constant monitoring of the system and its outputs. Our data suggest that job enrichment could have a high payoff and should be given high priority for future study.

RECOMMENDATION 12. Reduce the Impact of Disruptions on Maintenance Effectiveness and Efficiency.

Interviews with military maintenance personnel revealed an almost universal belief that maintenance efficiency was being adversely affected by required non-maintenance duties and activities. These include such things as guard duty, garden and lawn maintenance, burial duty, parades, barricks inspection, and other training (CBR, race relations, etc.) One unit visited had compiled data from a two week period showing over 50% of the available man hours were lost to non-maintenance activities. Although it might be possible to reduce the amount of duties through the establishment of MOS classifications to handle some of the routine assignments (e.g., military police to handle all guard duty), it is unlikely that this would become reality nor is it likely to materially reduce the overall time requirement for all non-military duties. Nevertheless, every effort should be make to reduce the total non-maintenance time committments required of mechanics.

It seems likely, that without major system disruptions, a procedure could be developed to reduce the impact of such time committments on the overall efficiency of the units. Currently it is difficult for maintenance supervisors to make long term manpower-task allocations because they do not know what non-maintenance committments will have to be filled, and who will be available. Extra duties or training classes that require a half day effectively preclude any work for the whole day. If it were possible to schedule training and extra duties more effectively, it would be possible to reduce the total maintenance time lost.

The data show that military mechanics would like to spend more time doing maintenance. This indicates that, through better scheduling, any extra maintenance time would probably be put to constructive use by the mechanics. Further, with better scheduling, it might be possible for supervisors to plan systematic on-the-job training, with some assurance of who would be available on a given day. Military mechanics rated OJT as the most helpful form of training, yet supervisors complained that it was difficult to provide OJT because of the instability of their daily work force.

Our data suggest that the more time that is spend doing maintenance, and the less time lost, the lower the NORM, NORS and man hours per aircraft figures. This, of course, makes sense. Reducing the impact of disruptions by reducing the amount, and through rescheduling, of disruptions may yield high pay offs in efficiency and effectiveness.

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APPENDIX A

SUPERVISORY INTERVIEW QUESTIONNAIRE

BASE _____

MAINTENANCE UNIT _____

POSITION _____

TENURE _____

DATE _____

SUPERVISORY INTERVIEW QUESTIONS

1. Organizational chart? Number of maintenance people (supervisors, TI's, mechanics, support)? MOS's?

2. What is the relative importance given helicopter maintenance by higher levels in the organization?

3. Can you keep your people from having to do details? Do you know ahead of time when your men are going to be pulled off their job for details? Who is responsible for pulling away mechanics from aviation maintenance?

4. Where do most of your mechanics come from? Training school or reassignment? How skilled are they? Do you have any trouble getting qualified people to fill particular skill level vacancies?

5. What kind of training do they receive once assigned?

6. What factors will influence how much work you will have? P.E.'s? Unscheduled maintenance? Can you predict maintenance load? Is there free time?

7. Do the maintenance men work individually or in teams? If teams, how many per team? Competition?

8. Do the mechanics socialize off the job?

9. What are the standards of performance? How do you assess performance? Are there ratings of proficiency levels? Are there ratings of personnel evaluation?

10. How can you reward a good worker? Conversely, how can you reprimand a poor worker?

11. What is the work routine? Hours? Days? Shifts? Overtime (Comp time)?

12. How is work divided and assigned? Do mechanics generally finish the jobs they begin?

13. What maintenance paperwork is done? Mechanics? IT's? Supervisors? Is the paperwork inflated to make the men or unit look good?

14. Do the men take time off for personal matters? How often?

15. What percent of time do mechanics spend performing aviation maintenance?

16. Do the mechanics go on test flights? Flight status?

17. What are the channels of communications for personnel requests? Grievances? Advice?

18. How many men is a supervisor responsible for?

19. Do supervisors perform any maintenance or is all their time spent in leadership activities? What is the supervisors interaction with the mechanics?

20. Do the maintenance personnel get feedback about their work from their supervisors? Positive? Negative?

21. How concerned are supervisors about the neatness of the men (hair cuts, shined shoes, etc.) and work area? Inspections?

22. Do you have any problems or conflicts with groups outside your immediate unit? Other maintenance echelons? Supply? Other?

23. How easily obtainable are supplies? Cannibalization?

24. Is the equipment satisfactory? Up to date?

25. Working environment and working conditions?

26. In your opinion how do you think efficiency could be improved? Budget? Contraints?

27. Do mechanics like working on helicopters?

28. What are the major things that you feel motivate men to do good work?

29. What things seem to annoy the mechanics the most?

30. What the the things from above that create problems for you in completing your goals?

APPENDIX B

ORGANIZATIONAL INCENTIVES INVENTORY

(CIVILIAN AND MILITARY QUESTIONNAIRES
ARE IDENTICAL EXCEPT FOR SECTIONS 1 AND 8)

ORGANIZATIONAL INCENTIVE INVENTORY

THIS QUESTIONNAIRE WAS DEVELOPED AS PART OF A PERCEPTRONICS STUDY OF INCENTIVES AND OTHER ORGANIZATIONAL INFLUENCES ON PERSONNEL PRODUCTIVITY AND JOB SATISFACTION.

ON THE FOLLOWING PAGES YOU WILL FIND SEVERAL DIFFERENT KINDS OF QUESTIONS ABOUT YOUR JOB. SPECIFIC INSTRUCTIONS ARE GIVEN AT THE START OF EACH SECTION. PLEASE READ THEM CAREFULLY.

THE QUESTIONS ARE DESIGNED TO OBTAIN <u>YOUR</u> PERCEPTIONS OF YOUR JOB AND <u>YOUR</u> REACTIONS TO IT.

THERE ARE NO "TRICK" QUESTIONS. YOUR INDIVIDUAL ANSWERS WILL BE KEPT COMPLETELY CONFIDENTIAL. PLEASE ANSWER EACH ITEM AS HONESTLY AND FRANKLY AS POSSIBLE.

THANK YOU FOR YOUR COOPERATION

SECTION 1 (Civilian)

1. AGE AT LAST BIRTHDAY? _____

2. SEX MALE _____ FEMALE _____

3. MARRIED? YES _____ NO _____

4. DO YOU HAVE DEPENDENT CHILDREN AT HOME? YES _____ NO _____

5. WHAT IS YOUR HIGHEST LEVEL OF EDUCATION? *check one*

   DID NOT FINISH HIGH SCHOOL _____
   HIGH SCHOOL GRADUATE _____
   1-2 YEARS COLLEGE _____
   3-4 YEARS COLLEGE _____
   MORE THAN 4 YEARS COLLEGE _____

6. DO YOU HAVE AN A & P LICENSE? YES _____ NO _____
   IF NOT, DO YOU PLAN TO GET ONE? YES _____ NO _____

7. WERE YOU IN THE MILITARY? YES _____ NO _____
   IF YES, ANSWER THE FOLLOWING:
   MILITARY BRANCH? *(check one)* ARMY ____ NAVY ____ AIR FORCE ____ MARINES ____
   YEARS OF SERVICE? _____
   WHAT WAS YOUR MILITARY OCCUPATION? _____

8. HOW LONG HAVE YOU BEEN IN YOUR PRESENT JOB? _____

9. DID YOU HAVE PREVIOUS EXPERIENCE WITH HELICOPTER MAINTENANCE BEFORE COMING TO WORK HERE?
   YES _____ NO _____
   IF YES, HOW MUCH EXPERIENCE? _____

10. PLEASE LIST ALL HELICOPTER TRAINING SCHOOLS/COURSES YOU HAVE ATTENDED AND THE AMOUNT OF TIME IN EACH (MILITARY AND CIVILIAN).

NAME	LENGTH OF TRAINING (WEEKS)

11. HOW LONG AFTER TECHNICAL TRAINING SCHOOL DID IT TAKE BEFORE YOU WERE PROFICIENT AT YOUR JOB? *check one*

    IMMEDIATELY _____
    1-3 MONTHS _____
    4- 6 MONTHS _____
    7-12 MONTHS _____
    MORE THAN 12 MONTHS _____
    STILL DO NOT FEEL PROFICIENT _____

12. DO YOU PLAN TO MAKE HELICOPTER MAINTENANCE A CAREER? YES _____ NO _____

SECTION 1 (Military)

1. AGE AT LAST BIRTHDAY ? _____

2. SEX MALE _____ FEMALE _____

3. MARRIED? YES _____ NO _____

4. DO YOU HAVE DEPENDENT CHILDREN AT HOME? YES _____ NO _____

5. WHAT IS YOUR HIGHEST LEVEL OF EDUCATION? *check one*

   DID NOT FINISH HIGH SCHOOL _____ 3-4 YEARS COLLEGE _____
   HIGH SCHOOL GRADUATE _____ MORE THAN 4 YEARS COLLEGE _____
   1-2 YEARS COLLEGE _____

6. DO YOU HAVE AN A & P LICENSE? YES _____ NO _____
   IF NOT, DO YOU PLAN TO GET ONE? YES _____ NO _____

7. WHAT IS YOUR RANK? *check one*

   PRIVATE _____ SPEC 4 _____ SPEC 5 _____ SPEC 6 _____ SPEC 7 _____
   PRIVATE 1ST CLASS _____ CORPORAL _____ SGT _____ S SGT _____ SGT 1ST CLASS _____

8. TIME IN GRADE? YEARS _____ MONTHS _____

9. HOW MANY YEARS IN THE MILITARY? YEARS _____

10. WAS HELICOPTER MAINTENANCE ONE OF YOUR MILITARY CAREER CHOICES? *check one*

    1ST CHOICE _____ 2ND CHOICE _____ 3RD CHOICE _____ NOT ONE OF MY CHOICES _____

11. WHAT IS YOUR MOS? *(number and description)*

    PRIMARY _____

    SECONDARY _____

12. DID YOU HAVE PREVIOUS EXPERIENCE WITH HELICOPTER MAINTENANCE BEFORE JOINING THE MILITARY?

    YES _____ NO _____

13. HAVE YOU DONE HELICOPTER MAINTENANCE IN THE MILITARY BEFORE COMING TO YOUR PRESENT JOB?

    YES _____ NO _____

14. PLEASE LIST ALL HELICOPTER TRAINING SCHOOLS/COURSES YOU HAVE ATTENDED AND THE AMOUNT OF TIME IN EACH.

NAME	LENGTH OF TRAINING (WEEKS)

M

15. How long after technical training did it take before you were proficient at your job? *check one*

Immediately _____ 4- 6 months _____ More than 12 months _____
1-3 months _____ 7-12 months _____ Still do not feel proficient _____

16. Do you plan to make the military a career? Yes _____ No _____

If so, why so? If not, why not? _____

_____

_____

_____

17. Do you plan to make helicopter maintenance your career either inside or outside the military?

Yes _____ No _____

SECTION 2

THIS PART OF THE QUESTIONNAIRE ASKS YOU TO DESCRIBE YOUR JOB, AS OBJECTIVELY AS YOU CAN.

PLEASE DO NOT USE THIS PART OF THE QUESTIONNAIRE TO SHOW HOW MUCH YOU LIKE OR DISLIKE YOUR JOB. QUESTIONS ABOUT THAT WILL COME LATER. INSTEAD, TRY TO MAKE YOUR DESCRIPTIONS AS ACCURATE AND AS OBJECTIVE AS YOU POSSIBLY CAN.

A SAMPLE QUESTION IS GIVEN BELOW.

A. TO WHAT EXTENT DOES YOUR JOB REQUIRE YOU TO WORK WITH MECHANICAL EQUIPMENT?

1——— 2——— 3——— 4——— 5——— (6) ——— 7

VERY LITTLE; THE JOB REQUIRES ALMOST NO CONTACT WITH MECHANICAL EQUIPMENT OF ANY KIND.	MODERATELY	VERY MUCH; THE JOB REQUIRES ALMOST CONSTANT WORK WITH MECHANICAL EQUIPMENT.

YOU ARE TO CIRCLE THE NUMBER WHICH IS THE MOST ACCURATE DESCRIPTION OF YOUR JOB.

IF, FOR EXAMPLE, YOUR JOB REQUIRES YOU TO WORK WITH MECHANICAL EQUIPMENT A GOOD DEAL OF THE TIME -- BUT ALSO REQUIRES SOME PAPERWORK -- YOU MIGHT CIRCLE THE NUMBER SIX, AS WAS DONE IN THE EXAMPLE ABOVE.

1. TO WHAT EXTENT DOES YOUR JOB REQUIRE YOU TO WORK CLOSELY WITH OTHER PEOPLE (IN RELATED JOBS IN YOUR OWN ORGANIZATION)?

1——— 2——— 3——— 4——— 5——— 6——— 7

VERY LITTLE; DEALING WITH OTHER PEOPLE IS NOT AT ALL NECESSARY IN DOING THE JOB.	MODERATELY; SOME DEALING WITH OTHERS IS NECESSARY.	VERY MUCH; DEALING WITH OTHER PEOPLE IS AN ABSOLUTELY ESSENTIAL AND CRUCIAL PART OF DOING THE JOB.

2. HOW MUCH AUTONOMY IS THERE IN YOUR JOB? THAT IS, TO WHAT EXTENT DOES YOUR JOB PERMIT YOU TO DECIDE ON YOUR OWN HOW TO GO ABOUT DOING THE WORK?

1——— 2——— 3——— 4——— 5——— 6——— 7

VERY LITTLE; THE JOB GIVES ME ALMOST NO PERSONAL "SAY" ABOUT HOW AND WHEN THE WORK IS DONE.	MODERATE AUTONOMY; MANY THINGS ARE STANDARDIZED AND NOT UNDER MY CONTROL, BUT I CAN MAKE SOME DECISIONS ABOUT THE WORK.	VERY MUCH; THE JOB GIVES ME ALMOST COMPLETE RESPONSIBILITY FOR DECIDING HOW AND WHEN THE WORK IS DONE.

3. TO WHAT EXTENT DOES YOUR JOB INVOLVE DOING A "WHOLE" AND IDENTIFIABLE PIECE OF WORK? THAT IS, IS THE JOB A COMPLETE PIECE OF WORK THAT HAS AN OBVIOUS BEGINNING AND END? OR IS IT ONLY A SMALL PART OF THE OVERALL PIECE OF WORK, WHICH IS FINISHED BY OTHER PEOPLE OR BY AUTOMATIC MACHINES?

1——— 2——— 3——— 4——— 5——— 6——— 7

MY JOB IS ONLY A TINY PART OF THE OVERALL PIECE OF WORK; THE RESULTS OF MY ACTIVITIES CANNOT BE SEEN IN THE FINAL PRODUCT OR SERVICE.

MY JOB IS A MODERATE-SIZED "CHUNK" OF THE OVERALL PIECE OF WORK; MY OWN CONTRIBUTION CAN BE SEEN IN THE FINAL OUTCOME.

MY JOB INVOLVES DOING THE WHOLE PIECE OF WORK, FROM START TO FINISH; THE RESULTS OF MY ACTIVITIES ARE EASILY SEEN IN THE FINAL PRODUCT OR SERVICE.

4. HOW MUCH VARIETY IS THERE IN YOUR JOB? THAT IS, TO WHAT EXTENT DOES THE JOB REQUIRE YOU TO DO MANY DIFFERENT THINGS AT WORK, USING A VARIETY OF YOUR SKILLS AND TALENTS?

1——— 2——— 3——— 4——— 5——— 6——— 7

VERY LITTLE, THE JOB REQUIRES ME TO DO THE SAME ROUTINE THINGS OVER AND OVER AGAIN.

MODERATE VARIETY

VERY MUCH; THE JOB REQUIRES ME TO DO MANY DIFFERENT THINGS, USING A NUMBER OF DIFFERENT TOOLS, USING A NUMBER OF DIFFERENT SKILLS AND TALENTS.

5. IN GENERAL, HOW SIGNIFICANT OR IMPORTANT IS YOUR JOB? THAT IS, ARE THE RESULTS OF YOUR WORK LIKELY TO SIGNIFICANTLY AFFECT THE LIVES OR WELL-BEING OF OTHER PEOPLE?

1——— 2——— 3——— 4——— 5——— 6——— 7

NOT VERY SIGNIFICANT; THE OUTCOMES OF MY WORK ARE NOT LIKELY TO HAVE IMPORTANT EFFECTS ON OTHER PEOPLE.

MODERATELY SIGNIFICANT.

HIGHLY SIGNIFICANT; THE OUTCOMES OF MY WORK CAN AFFECT OTHER PEOPLE IN VERY IMPORTANT WAYS.

6. TO WHAT EXTENT DO MANAGERS OR CO-WORKERS LET YOU KNOW HOW WELL YOU ARE DOING ON YOUR JOB?

1——— 2——— 3——— 4——— 5——— 6——— 7

VERY LITTLE; MANAGERS OR CO-WORKERS ALMOST NEVER LET ME KNOW HOW WELL I AM DOING.

MODERATELY; SOMETIMES MANAGERS OR CO-WORKERS MAY GIVE ME "FEEDBACK"; OTHER TIMES THEY MAY NOT.

VERY MUCH; MANAGERS OR CO-WORKERS PROVIDE ME WITH ALMOST CONSTANT "FEEDBACK" ABOUT HOW WELL I AM DOING.

7. TO WHAT EXTENT DOES <u>DOING THE JOB ITSELF</u> PROVIDE YOU WITH INFORMATION ABOUT YOUR WORK PERFORMANCE? THAT IS, DOES THE ACTUAL <u>WORK ITSELF</u> PROVIDE CLUES ABOUT HOW WELL YOU ARE DOING -- ASIDE FROM ANY "FEEDBACK" CO-WORKERS OR SUPERVISORS MAY PROVIDE?

1——— 2——— 3——— 4——— 5——— 6——— 7

VERY LITTLE; THE JOB ITSELF IS SET UP SO I COULD WORK FOREVER WITHOUT FINDING OUT HOW WELL I AM DOING.

MODERATELY; SOMETIMES DOING THE JOB PROVIDES "FEEDBACK" TO ME; SOMETIMES IT DOES NOT.

VERY MUCH; THE JOB IS SET UP SO THAT I GET ALMOST CONSTANT "FEEDBACK" ABOUT HOW WELL I AM DOING.

SECTION 3

LISTED BELOW ARE A NUMBER OF STATEMENTS WHICH COULD BE USED TO DESCRIBE A JOB.

YOU ARE TO INDICATE WHETHER EACH STATEMENT IS AN ACCURATE OR AN INACCURATE DESCRIPTION OF YOUR JOB.

ONCE AGAIN, PLEASE TRY TO BE AS OBJECTIVE AS YOU CAN IN DECIDING HOW ACCURATELY EACH STATEMENT DESCRIBES YOUR JOB -- REGARDLESS OF WHETHER YOU LIKE OR DISLIKE YOUR JOB.

WRITE A NUMBER IN THE BLANK BESIDE EACH STATEMENT, BASED ON THE FOLLOWING SCALE:

HOW ACCURATE IS THE STATEMENT IN DESCRIBING YOUR JOB?

1	2	3	4	5	6	7
VERY INACCURATE	MOSTLY INACCURATE	SLIGHTLY INACCURATE	UNCERTAIN	SLIGHTLY ACCURATE	MOSTLY ACCURATE	VERY ACCURATE

1. THE JOB REQUIRES ME TO USE A NUMBER OF COMPLEX OR HIGH-LEVEL SKILLS . .....____
2. THE JOB REQUIRES A LOT OF COOPERATIVE WORK WITH OTHER PEOPLE. .....____
3. THE JOB IS ARRANGED SO THAT I DO NOT HAVE A CHANCE TO DO AN ENTIRE PIECE OF WORK FROM BEGINNING TO END. .....____
4. JUST DOING THE WORK REQUIRED BY THE JOB PROVIDES MANY CHANCES FOR ME TO FIGURE OUT HOW WELL I AM DOING. .....____
5. THE JOB IS QUITE SIMPLE AND REPETITIVE . .....____
6. THE JOB CAN BE DONE ADEQUATELY BY A PERSON WORKING ALONE -- WITHOUT TALKING OR CHECKING WITH OTHER PEOPLE. .....____
7. THE SUPERVISORS AND CO-WORKERS ON THIS JOB ALMOST NEVER GIVE ME ANY "FEEDBACK" ABOUT HOW WELL I AM DOING IN MY WORK. .....____
8. THIS JOB IS ONE WHERE A LOT OF OTHER PEOPLE CAN BE AFFECTED BY HOW WELL THE WORK GETS DONE.____
9. THE JOB DENIES ME ANY CHANCE TO USE MY PERSONAL INITIATIVE OR JUDGMENT IN CARRYING OUT THE WORK. .....____
10. SUPERVISORS OFTEN LET ME KNOW HOW WELL THEY THINK I AM PERFORMING THE JOB. .....____
11. THE JOB PROVIDES ME THE CHANCE TO COMPLETELY FINISH THE TASKS I BEGIN. .....____
12. THE JOB ITSELF PROVIDES VERY FEW CLUES ABOUT WHETHER OR NOT I AM PERFORMING WELL. .....____
13. THE JOB GIVES ME CONSIDERABLE OPPORTUNITY FOR INDEPENDENCE AND FREEDOM IN HOW I DO THE WORK. .....____
14. THE JOB ITSELF IS NOT VERY SIGNIFICANT OR IMPORTANT IN THE BROADER SCHEME OF THINGS. .....____

SECTION 4

NOW PLEASE INDICATE HOW YOU PERSONALLY FEEL ABOUT YOUR JOB.

EACH OF THE STATEMENTS BELOW IS SOMETHING THAT A PERSON MIGHT SAY ABOUT HIS OR HER JOB. YOU ARE TO INDICATE YOUR OWN, PERSONAL FEELINGS ABOUT YOUR JOB MY MARKING HOW MUCH YOU AGREE WITH EACH OF THE STATEMENTS.

WRITE A NUMBER IN THE BLANK FOR EACH STATEMENT, BASED ON THIS SCALE:

HOW MUCH DO YOU AGREE WITH THE STATEMENT?

1	2	3	4	5	6	7
DISAGREE STRONGLY	DISAGREE	DISAGREE SLIGHTLY	NEUTRAL	AGREE SLIGHTLY	AGREE	AGREE STRONGLY

1. MY OPINION OF MYSELF GOES UP WHEN I DO THIS JOB WELL. .....____

2. GENERALLY SPEAKING, I AM VERY SATISFIED WITH THIS JOB. .....____

3. I FEEL A GREAT SENSE OF PERSONAL SATISFACTION WHEN I DO THIS JOB WELL. .....____

4. I FREQUENTLY THINK OF QUITTING THIS JOB. .....____

5. I FEEL BAD AND UNHAPPY WHEN I DISCOVER THAT I HAVE PERFORMED POORLY ON THIS JOB. .....____

6. I AM GENERALLY SATISFIED WITH THE KIND OF WORK I DO IN THIS JOB. .....____

7. MY OWN FEELINGS GENERALLY ARE NOT AFFECTED MUCH ONE WAY OR THE OTHER BY HOW WELL I DO ON THIS JOB. .....____

SECTION 5

NOW PLEASE INDICATE HOW SATISFIED YOU ARE WITH EACH ASPECT OF YOUR JOB LISTED BELOW. ONCE AGAIN, WRITE THE APPROPRIATE NUMBER IN THE BLANK BESIDE EACH STATEMENT.

HOW SATISFIED ARE YOU WITH THIS ASPECT OF YOUR JOB?

1——— 2——— 3——— 4———5——— 6——— 7

EXTREMELY DISSATISFIED	DISSATISFIED	SLIGHTLY DISSATISFIED	NEUTRAL	SLIGHTLY SATISFIED	SATISFIED	EXTREMELY SATISFIED

1. THE AMOUNT OF JOB SECURITY I HAVE. .....____
2. THE AMOUNT OF PAY AND FRINGE BENEFITS I RECEIVE. .....____
3. THE AMOUNT OF PERSONAL GROWTH AND DEVELOPMENT I GET IN DOING MY JOB. .....____
4. THE PEOPLE I TALK TO AND WORK WITH ON MY JOB. .....____
5. THE DEGREE OF RESPECT AND FAIR TREATMENT I RECEIVE FROM MY SUPERVISOR. .....____
6. THE FEELING OF WORTHWHILE ACCOMPLISHMENT I GET FROM DOING MY JOB. .....____
7. THE CHANCE TO GET TO KNOW OTHER PEOPLE WHILE ON THE JOB. .....____
8. THE AMOUNT OF SUPPORT AND GUIDANCE I RECEIVE FROM MY SUPERVISOR. .....____
9. THE DEGREE TO WHICH I AM FAIRLY PAID FOR WHAT I CONTRIBUTE TO THIS ORGANIZATION. .....____
10. THE AMOUNT OF INDEPENDENT THOUGHT AND ACTION I CAN EXERCISE IN MY JOB. .....____
11. HOW SECURE THINGS LOOK FOR ME IN THE FUTURE IN THIS ORGANIZATION. .....____
12. THE CHANCE TO HELP OTHER PEOPLE WHILE AT WORK. .....____
13. THE AMOUNT OF CHALLENGE IN MY JOB. .....____
14. THE OVERALL QUALITY OF THE SUPERVISION I RECEIVE IN MY WORK. .....____

SECTION 6

LISTED BELOW ARE A NUMBER OF CHARACTERISTICS WHICH COULD BE PRESENT ON ANY JOB. PEOPLE DIFFER ABOUT HOW MUCH THEY WOULD LIKE TO HAVE EACH ONE PRESENT IN THEIR OWN JOBS. WE ARE INTERESTED IN LEARNING HOW MUCH YOU PERSONALLY WOULD LIKE TO HAVE EACH ONE PRESENT IN YOUR JOB.

USING THE SCALE BELOW, PLEASE INDICATE THE DEGREE TO WHICH YOU WOULD LIKE TO HAVE EACH CHARACTERISTIC PRESENT IN YOUR JOB.

NOTE: The numbers on this scale are different from those used in previous scales.

4 ——— 5 ——— 6 ——— 7 ——— 8 ——— 9 ——— 10

WOULD LIKE HAVING THIS ONLY A MODERATE AMOUNT (OR LESS)	WOULD LIKE HAVING THIS VERY MUCH	WOULD LIKE HAVING THIS EXTREMELY MUCH

1. HIGH RESPECT AND FAIR TREATMENT FROM MY SUPERVISOR. .....____
2. STIMULATING AND CHALLENGING WORK. .....____
3. CHANCES TO EXERCISE INDEPENDENT THROUGHT AND ACTION IN MY JOB. .....____
4. GREAT JOB SECURITY. .....____
5. VERY FRIENDLY CO-WORKERS. .....____
6. OPPORTUNITIES TO LEARN NEW THINGS FROM MY WORK. .....____
7. HIGH SALARY AND GOOD FRINGE BENEFITS. .....____
8. OPPORTUNITIES TO BE CREATIVE AND IMAGINATIVE IN MY WORK. .....____
9. QUICK PROMOTIONS. .....____
10. OPPORTUNITIES FOR PERSONAL GROWTH AND DEVELOPMENT IN MY JOB. .....____
11. A SENSE OF WORTHWHILE ACCOMPLISHMENT IN MY WORK. .....____

SECTION 7

PLEASE RATE THE CONTRIBUTIONS WHICH EACH OF THE FOLLOWING MADE IN PROVIDING YOU WITH THE SKILLS AND INFORMATION NECESSARY TO SUCCESSFULLY PERFORM YOUR JOB BY PUTTING THE APPROPRIATE NUMBER IN THE SPACE PROVIDED. IF THE TYPE OF TRAINING IS NOT, OR WAS NOT PROVIDED, PLACE A ZERO ("0") BESIDE THE ITEM.

0 ——— 1 ——— 2 ——— 3 ——— 4 ——— 5

Not Provided	Very Little Extent	Little Extent	Some Extent	Great Extent	Very Great Extent

1. To what extent was formal training school helpful? .....____
2. To what extent is formal on-job-training helpful? .....____
3. To what extent is informal on-job-training helpful? .....____
4. To what extent are discussions with your supervisor helpful? .....____
5. To what extent are informal discussions with fellow mechanics helpful? .....____

SECTION 8 (Civilian)

LISTED BELOW ARE A NUMBER OF OUTCOMES WHICH MIGHT RESULT IF YOU PERFORM YOUR JOB WELL OR POORLY. YOU ARE TO RATE HOW STRONG A RELATIONSHIP YOU FEEL CURRENTLY EXISTS BETWEEN OUTSTANDING AND POOR PERFORMANCE AND ATTAINMENTS OF EACH OF THE OUTCOMES. PLACE THE APPROPRIATE NUMBER FROM THE SCALE ON THE SPACE PROVIDED FOR EACH OUTCOME.

1——— 2——— 3——— 4——— 5——— 6———7

NOT AT ALL RELATED — SOMEWHAT RELATED — VERY MUCH RELATED

1. OUTSTANDING PERFORMANCE AND A PROMOTION .....____
2. OUTSTANDING PERFORMANCE AND INCREASED JOB RESPONSIBILITY .....____
3. OUTSTANDING PERFORMANCE AND PRAISE FROM FELLOW MECHANICS .....____
4. OUTSTANDING PERFORMANCE AND A LETTER OF COMMENDATION .....____
5. OUTSTANDING PERFORMANCE AND PRAISE FROM YOUR SUPERVISOR .....____
6. OUTSTANDING PERFORMANCE AND MORE FREE TIME OFF-THE-JOB FOR PERSONAL BUSINESS .....____
7. OUTSTANDING PERFORMANCE AND BEING SENT TO ADVANCED TRAINING SCHOOLS .....____
8. OUTSTANDING PERFORMANCE AND BEING ASSIGNED TO DESIRABLE DUTIES .....____
9. OUTSTANDING PERFORMANCE AND GETTING A BONUS .....____
10. POOR PERFORMANCE AND BEING VERBALLY REPRIMANDED .....____
11. POOR PERFORMANCE AND BEING ASSIGNED TO UNPOPULAR DUTIES .....____
12. POOR PERFORMANCE AND BEING TERMINATED .....____
13. POOR PERFORMANCE AND BEING LAID OFF .....____
14. POOR PERFORMANCE AND BEING SUSPENDED WITHOUT PAY FOR SOME PERIOD OF TIME (ONE WEEK) .....____
15. POOR PERFORMANCE AND BEING MORE CLOSELY SUPERVISED .....____

SECTION 8 (Military)

LISTED BELOW ARE A NUMBER OF OUTCOMES WHICH MIGHT RESULT IF YOU PERFORM YOUR JOB WELL OR POORLY. YOU ARE TO RATE HOW STRONG A RELATIONSHIP YOU FEEL CURRENTLY EXISTS BETWEEN OUTSTANDING AND POOR PERFORMANCE AND ATTAINMENTS OF EACH OF THE OUTCOMES. PLACE THE APPROPRIATE NUMBER FROM THE SCALE ON THE SPACE PROVIDED FOR EACH OUTCOME.

1——— 2——— 3——— 4——— 5——— 6———7

NOT AT ALL RELATED — SOMEWHAT RELATED — VERY MUCH RELATED

1. OUTSTANDING PERFORMANCE AND A PROMOTION .....___
2. OUTSTANDING PERFORMANCE AND INCREASED JOB RESPONSIBILITY .....___
3. OUTSTANDING PERFORMANCE AND PRAISE FROM FELLOW MECHANICS .....___
4. OUTSTANDING PERFORMANCE AND A LETTER OF COMMENDATION .....___
5. OUTSTANDING PERFORMANCE AND PRAISE FROM YOUR SUPERVISOR .....___
6. OUTSTANDING PERFORMANCE AND A 3-DAY PASS .....___
7. OUTSTANDING PERFORMANCE AND MORE FREE TIME OFF-THE-JOB FOR PERSONAL BUSINESS .....___
8. OUTSTANDING PERFORMANCE AND BEING SENT TO ADVANCED TRAINING SCHOOLS .....___
9. OUTSTANDING PERFORMANCE AND BEING ASSIGNED TO DESIRABLE DUTIES .....___
10. POOR PERFORMANCE AND BEING MORE CLOSELY SUPERVISED .....___
11. POOR PERFORMANCE AND BEING VERBALLY REPRIMANDED .....___
12. POOR PERFORMANCE AND BEING ASSIGNED TO UNDERSIRABLE DUTIES .....___
13. POOR PERFORMANCE AND BEING REDUCED IN RANK .....___
14. POOR PERFORMANCE AND BEING ASSIGNED EXTRA DUTY .....___

SECTION 9

THIS SECTION INVOLVES VARIOUS ASPECTS OF YOUR JOB. YOU ARE TO RATE TO WHAT EXTENT YOU BELIEVE THE FOLLOWING ITEMS ARE TRUE BY PUTTING THE APPROPRIATE NUMBER ON THE RATING SCALE IN THE SPACE PROVIDED.

1 ——— 2 ——— 3 ——— 4 ——— 5

VERY LITTLE EXTENT	LITTLE EXTENT	SOME EXTENT	GREAT EXTENT	VERY GREAT EXTENT

1. TO WHAT EXTENT DO SUPERVISORS GIVE ASSIGNMENTS OR DIRECTIONS THAT CONFLICT WITH DIRECTIVES GIVEN BY OTHER SUPERVISORS? .....____
2. TO WHAT EXTENT DO YOU RECEIVE CLEAR JOB INSTRUCTIONS FROM YOUR SUPERVISOR? .....____
3. TO WHAT EXTENT DOES YOUR SUPERVISOR ASK YOUR OPINION WHEN A PROBLEM REALTED TO YOUR WORK ARISES? .....____
4. TO WHAT EXTENT DOES YOUR SUPERVISOR SET A GOOD EXAMPLE FOR HIGH PERFORMANCE? .....____
5. TO WHAT EXTENT IS IT DIFFICULT TO GET PROBLEMS RESOLVED BECAUSE THOSE IN AUTHORITY DO NOT RESPOND TO OR MAKE PROMPT DECISIONS OR RECOMMENDATIONS? .....____
6. TO WHAT EXTENT DOES YOUR SUPERVISOR PROPERLY MONITOR YOUR WORK PERFORMANCE? .....____
7. TO WHAT EXTENT IS WORK TIME LOST THROUGH POOR SCHEDULING AND PLANNING? .....____
8. TO WHAT EXTENT ARE WORKERS REWARDED IN PROPORTION TO THE QUALITY AND QUANTITY OF THEIR WORK? .....____
9. TO WHAT EXTENT DOES THIS UNIT HAVE DETAILED REPORTING PROCEDURES FOR ALMOST ALL ACTIVITIES AND FUNCTIONS? .....____
10. TO WHAT EXTENT DOES YOUR SUPERVISOR CORRECT YOUR BEHAVIOR IF YOU PERFORM POORLY IN YOUR JOB? .....____
11. TO WHAT EXTENT IS INFORMATION CONCERNING REASONS WHY THINGS ARE DONE THE WAY THEY ARE COMMUNICATED TO MECHANICS? .....____
12. TO WHAT EXTENT DOES YOUR SUPERVISOR TRUST THE JUDGMENTS OF SUBORDINATES? .....____
13. TO WHAT EXTENT ARE YOUR WORKING CONDITIONS SATISFACTORY? .....____
14. TO WHAT EXTENT IS YOUR SUPERVISOR ABLE TO PLAN AND COORDINATE YOUR WORK GROUP'S ACTIVITIES SO THAT MAXIMUM PERFORMANCE IS POSSIBLE? .....____
15. TO WHAT EXTENT DO INTERRUPTIONS OCCUR IN YOUR DAILY ROUTINE THAT TAKE YOU AWAY FROM HELICOPTER MAINTENANCE? .....____
16. TO WHAT EXTENT IS YOUR SUPERVISOR RESPONSIBLE TO THE NEEDS OF HIS SUBORDINATES? .....____

1 ——— 2 ——— 3 ——— 4 ——— 5

VERY LITTLE EXTENT	LITTLE EXTENT	SOME EXTENT	GREAT EXTENT	VERY GREAT EXTENT

17. TO WHAT EXTENT DOES MANAGEMENT TRY TO IMPROVE WORKING CONDITIONS? .....____

18. TO WHAT EXTENT DOES THE LACK OF REQUIRED TOOLS AND SUPPLIES INTERFERE WITH JOB PERFORMANCE? .....____

19. TO WHAT EXTENT DO YOU ENJOY PERFORMING HELICOPTER MAINTENANCE? .....____

20. TO WHAT EXTENT DOES YOUR GROUP WORK WELL TOGETHER AS A TEAM? .....____

21. TO WHAT EXTENT ARE WORKERS HERE UNDER A LOT OF PRESSURE TO GET JOBS FINISHED? .....____

22. TO WHAT EXTENT DO GOOD IDEAS FROM WORKERS GET SERIOUS CONSIDERATION FROM MANAGEMENT? .....____

23. TO WHAT EXTENT IS ENOUGH ATTENTION PAID TO THE SAFETY AND COMFORT OF MEACHNICS IN THIS UNIT? .....____

24. TO WHAT EXTENT WOULD YOU LIKE TO SPEND MORE TIME PERFORMING HELICOPTER MAINTENANCE? .....____

25. TO WHAT EXTENT DOES THE PERFORMANCE OF YOUR JOB CONTRIBUTE TO THE EFFECTIVENESS OF YOUR HELICOPTER UNIT'S MISSION? .....____

26. TO WHAT EXTENT ARE LINES OF AUTHORITY CLEARLY DEFINED IN THIS UNIT? .....____

27. TO WHAT EXTENT DOES YOUR SUPERVISOR EMPHASIZE HIGH MAINTENANCE STANDARDS? .....____

28. TO WHAT EXTENT DOES YOUR SUPERVISOR MAKE CLEAR TO YOU WHAT ASPECTS OF YOUR PERFORMANCE HE CONSIDERS TO BE MOST IMPORTANT? .....____

29. TO WHAT EXTENT DOES THIS UNIT HAVE A GOOD IMAGE WITH PEOPLE YOU KNOW? .....____

30. TO WHAT EXTENT DOES THE AMOUNT OF PAPER WORK YOU DO IN CONNECTION WITH YOUR JOB KEEP YOU FROM PERFORMING THE ACTUAL MAINTENANCE WORK? .....____

31. TO WHAT EXTENT DOES YOUR SUPERVISOR ENCOURAGE YOU TO HELP IN DEVELOPING WORK METHODS AND JOB PROCEDURES? .....____

32. TO WHAT EXTENT IS YOUR TIME SPENT PERFORMING HELICOPTER MAINTENANCE? .....____

33. TO WHAT EXTENT DOES YOUR SUPERVISOR LET YOU DO YOUR WORK IN THE WAY YOU THINK IS BEST? .....____

34. TO WHAT EXTENT CAN A WORKER BE PROUD TO SAY HE WORKS HERE? .....____

35. TO WHAT EXTENT DO DISCUSSIONS WITH OTHER MEMBERS OF YOUR WORK GROUP ASSIST YOU IN PERFORMING YOUR JOB? .....____

1	2	3	4	5
VERY LITTLE EXTENT	LITTLE EXTENT	SOME EXTENT	GREAT EXTENT	VERY GREAT EXTENT

36. TO WHAT EXTENT DO WORKERS IN YOUR WORK GROUP TRUST AND HAVE CONFIDENCE IN YOUR SUPERVISOR? .....____

37. TO WHAT EXTENT DO YOUR FELLOW OPERATORS ENCOURAGE SUPERIOR PERFORMANCE? .....____

38. TO WHAT EXTENT DO YOU FEEL YOUR SUPERVISOR IS TECHNICALLY COMPETENT IN HELICOPTER MAINTENANCE? .....____

39. TO WHAT EXTENT ARE YOUR JOB DUTIES CLEARLY DEFINED BY YOUR SUPERVISOR? .....____

40. TO WHAT EXTENT IS YOUR WORK ENVIRONMENT CONDUCIVE TO THE EXPRESSION OF INDIVIDUAL OPINIONS AND IDEAS? .....____

41. TO WHAT EXTENT ARE TRADITIONS SO STRONG HERE THAT IT IS DIFFICULT TO MODIFY ESTABLISHED PROCEDURES OR UNDERTAKE NEW PROGRAMS? .....____

42. TO WHAT EXTENT IS YOUR JOB AS IMPORTANT AS YOU WERE LED TO BELIEVE IN YOUR INITIAL TRAINING? .....____

43. TO WHAT EXTENT IS INFORMATION COMMUNICATED QUICKLY TO YOU CONCERNING CHANGES IN PROCEDURES, POLICIES, ETC.? .....____

44. TO WHAT EXTENT IS YOUR SUPERVISOR CONCERNED WITH THE QUALITY OF WORK YOU TURN OUT IN YOUR PRESENT JOB? .....____

45. TO WHAT EXTENT ARE WORKING CONDITIONS HERE COMFORTABLE? .....____

46. TO WHAT EXTENT DOES YOUR SUPERVISOR ENCOURAGE THE DEVELOPMENT OF CLOSE RELATIONSHIPS WITHIN THE GROUP? .....____

47. TO WHAT EXTENT WILL YOUR SUPERVISOR GO OUT OF HIS WAY TO HELP YOU DO AN OUTSTANDING JOB? .....____

48. TO WHAT EXTENT IS YOUR SUPERVISOR MORE CONCERNED ABOUT MEETING SCHEDULES THAN HE IS ABOUT THE WELFARE OF HIS WORKERS? .....____

49. TO WHAT EXTENT IS YOUR SUPERVISOR SUCCESSFUL IN HIS INTERACTIONS WITH HIGHER LEVELS OF COMMAND? .....____

50. TO WHAT EXTENT DOES IT BOTHER YOU TO HEAR (OR READ ABOUT) SOMEONE CRITICIZING THIS UNIT OR COMPARING THIS UNIT UNFAVORABLY TO OTHER UNITS? .....____

51. TO WHAT EXTENT MUST A WORKER GET APPROVAL FOR DECISIONS WHICH HE SHOULD BE ABLE TO MAKE ALONG? .....____

1——————2——————3——————4——————5

Very Little Extent	Little Extent	Some Extent	Great Extent	Very Great Extent

52. To what extent does your supervisor properly monitor your work performance? .....____

53. To what extent are your working conditons satisfactory? .....____

54. To what extent are workers here under a lot of pressure to get jobs finished? .....____

APPENDIX C

EFFECTIVENESS CRITERIA RATING

Questionnaire: Criteria used to judge the effectiveness of helicopter maintenance units

When someone compares two or more helicopter maintenance units, in order to determine their relative overall effectiveness, he compares the units in terms of several criteria. Different people, however, may use different criteria or may weight the importance of various criteria differently from each other.

What we want you to do is rate each of the criteria listed on the next page in terms of how important each would be in your determination of the overall effectiveness of a helicopter maintenance unit during peace time.

We realize that many of these criteria are not available in an actual situation. We want you, however, to rate each criteria on the assumption you could get such information about a helicopter maintenance unit.

Place a number beside each item according to the rating scale to show:

How important each criteria would be in your evaluation of the overall effectiveness of a helicopter maintenance unit under peace time conditions

If there are any criteria in use or some you would think relevant that we have not listed, please write them in at the end of the list and rate them according to the scale.

1	2	3	4	5	6	7	8
OF NO IMPORTANCE	OF VERY LITTLE IMPORTANCE	OF LITTLE IMPORTANCE	OF SOME IMPORTANCE	OF MODERATE IMPORTANCE	OF CONSIDERABLE IMPORTANCE	VERY IMPORTANT	EXTREMELY IMPORTANT

Organizational Effectiveness/Efficiency Criteria (Peace Time)

1. Maintenance man hours per aircraft....._____
2. Maintenance man hours per flight hour....._____
3. Availability....._____
4. Readiness....._____
5. Mean time to repair....._____
6. Down time....._____
7. Parts consumption....._____
8. Missions flown per month....._____
9. Flight hours per month....._____
10. Number of helicopters in for repair at any one time....._____
11. Number of complaints from pilots or from the unit to which the aircraft belongs....._____
12. Number of good parts replaced....._____
13. Number of work orders completed per day/week/month....._____
14. Aircraft accident rate (i.e., flight hours between accidents)....._____
15. Personnel accident rate....._____

16. Job satisfaction....._____
17. Reenlistments/turnover....._____
18. Morale....._____

19. Absenteeism....._____
20. Tardiness....._____
21. Sick call....._____
22. Amount of grievances....._____
23. Aircraft cleanliness....._____
24. Hanger or work area cleanliness....._____

Below are the same list of criteria and rating scale as before. This time, however, we want you to rate each one of the items to show:

How important each criteria would be in your evaluation of the overall effectiveness of a helicopter maintenance unit under war time conditions

Again, assume information would be available about the maintenance unit. List any other criteria and rate them.

OF NO IMPORTANCE
OF VERY LITTLE IMPORTANCE
OF LITTLE IMPORTANCE
OF SOME IMPORTANCE
OF MODERATE IMPORTANCE
OF CONSIDERABLE IMPORTANCE
VERY IMPORTANT
EXTREMELY IMPORTANT

1-------2-------3-------4-------5-------6-------7-------8

Organizational Effectiveness/Efficiency Criteria (War Time

1. Maintenance man hours per aircraft....._____
2. Maintenance man hours per flight hour....._____
3. Availability....._____
4. Readiness....._____
5. Mean time to repair....._____

6. Down time....._____

7. Parts consumption....._____

8. Missions flown per month....._____

9. Flight hours per month....._____

10. Number of helicopters in for repair at any one time....._____

11. Number of complaints from pilots or from the unit to which the aircraft belongs....._____

12. Number of good parts replaced....._____

13. Number of work orders completed per day/week/month....._____

14. Aircraft accident rate (i.e., flight hours between accidents)....._____

15. Personnel accident rate....._____

16. Job satisfaction....._____

17. Reenlistments/turnover....._____

18. Morale....._____

19. Absenteeism....._____

20. Tardiness....._____

21. Sick call....._____

22. Amount of grievances....._____

23. Aircraft cleanliness....._____

24. Hanger or work area cleanliness....._____

APPENDIX D

WEEKLY PERFORMANCE SUMMARY

WEEKLY PERFORMANCE SUMMARY

NAME OF MAINTENANCE UNIT_____
MAINTENANCE SUPERVISOR_____
WEEK OF_____ RETURN BY_____

PERFORMANCE MEASURES	MON	TUES	WED	THURS	FRI	SAT	SUN
NUMBER OF OH-58 MAINTENANCE PERSONNEL							
NUMBER OF OH-58 MAINTENANCE PERSONNEL WHO WORKED THE FULL SHIFT							
NUMBER OF HOURS WORKED FOR THAT SHIFT							
NUMBER OF WORK ORDERS RECEIVED							
NUMBER OF WORK ORDERS COMPLETED							
NUMBER HELICOPTERS FLOWN							
NUMBER OF FLIGHTS							
NUMBER OF FLIGHT HOURS							
NUMBER OF HELICOPTERS OPERATIONALLY READY							

D-1

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APPENDIX E

SUMMARY OF DA FORM 1352

BASE _____

UNIT _____

MONTH/YR	# OH58	TOTAL # OF HRS AVAIL	OR	NORS	NORM	# FLT/HRS	# LANDINGS
JAN							
FEB							
MAR							
APR							
MAY							
JUNE							
JULY							
AUG							
SEP							
OCT							
NOV							
DEC							

APPENDIX F

ORGANIZATIONAL INCENTIVES INVENTORY
(SECTIONS 1 TO 6)

APPENDIX F1

ORGANIZATIONAL INCENTIVES INVENTORY (SECTION 1 TO 6)

N =	124	6	21	23	26	48	29	11	8	10
DESCRIPTION	All Military	1st Cav.	2nd Arm.	6th Cav.	NAS	7th Infr.	All Civilian	L.A. OOT	Arizona Heli.	Alaska Operations
Variety	4.15	4.33	4.27	3.86	4.24	4.17	5.87	6.00	5.96	5.67
Identity	3.46	4.00	3.81	3.07	3.97	3.16	5.18	5.57	5.00	4.90
Significance of Task	4.21	3.61	3.97	4.65	3.74	4.44	6.48	6.58	6.46	6.40
Autonomy	3.70	3.83	3.67	3.77	3.76	3.65	5.07	5.09	4.46	5.53
Feedback from Job Itself	3.56	3.11	3.49	3.62	3.12	3.85	5.11	4.91	5.04	5.40
Feedback from Agents	4.73	4.94	4.70	4.66	4.33	4.96	3.77	3.84	4.21	3.33
Dealing with Others	5.05	5.28	5.32	5.20	4.69	5.01	5.69	5.97	5.87	5.23
General Satisfaction	4.48	4.44	4.35	4.49	4.45	4.55	5.37	6.00	4.33	4.70
Internal Motivation	3.30	2.67	3.14	3.40	3.48	3.31	5.92	5.95	5.84	5.95
Pay Satisfaction	4.73	5.17	5.45	4.14	4.75	4.65	3.84	4.77	3.00	3.50
Security Satisfaction	3.39	3.58	3.38	2.96	3.52	3.51	4.59	6.00	3.94	3.55
Social Satisfaction	4.51	5.67	5.19	4.48	4.09	4.33	5.33	5.09	5.58	5.40
Supervisor Satisfaction	5.09	4.33	5.12	5.03	5.02	5.11	5.01	5.57	5.29	4.17
Growth Satisfaction	4.23	5.12	4.49	3.87	4.12	4.24	5.22	5.23	5.31	5.15
Growth Need	4.55	4.73	4.82	4.17	5.02	4.42	5.61	5.66	5.85	5.37

APPENDIX F2

ORGANIZATIONAL INCENTIVES INVENTORY (SECTION 7)

N =	121	6	21	21	25	48	29	11	8	10
OESCRIPTION	All Military	1st Cav.	2nd Arm.	6th Cav.	NAS	7th Infr.	All Civilian	L.A. OOT	Arizona Heli.	Alaska Operations
Formal Training	3.04	3.50	3.00	3.30	2.81	3.00	3.32	3.45	3.25	3.22
Formal OJT	3.87	3.83	3.90	3.90	4.00	3.76	4.12	4.10	4.62	3.57
Informal OJT	3.94	4.50	4.14	3.86	3.96	3.80	3.86	3.82	4.12	3.67
Oiscussion with Supervisor	3.36	4.50	3.76	3.37	3.11	3.15	3.57	3.27	3.75	3.78
Oiscussion with Fellow Mechanics	3.81	3.83	3.95	3.86	3.80	3.73	3.93	4.09	3.87	3.80

APPENDIX F3
ORGANIZATIONAL INCENTIVES INVENTORY (SECTION 8)

N =	123	6	21	23	26	47	29	11	8	10
OESCRIPTION	All Military	1st Cav.	2nd Arm.	6th Cav.	NAS	7th Infr.	All Civilian	L.A. OOT	Arizona Heli.	Alaska Operations
Outstanding Performance and:										
Promotinn	4.40	5.17	4.86	4.13	4.50	4.17	4.65	3.91	5.00	5.20
Responsibility	5.19	5.67	5.24	4.65	5.65	5.13	4.59	4.36	4.62	4.80
Praise from Coworkers	4.45	4.17	4.71	4.65	4.35	4.34	4.38	4.00	4.62	4.60
Letters of Commodation	4.24	4.67	4.67	4.35	4.19	3.96	2.79	3.00	2.75	2.60
Praise from Supervisor	4.48	5.33	4.86	4.56	4.38	4.21	4.07	4.27	3.75	4.10
Free Time Off	3.70	4.67	3.38	3.74	3.77	3.67	2 65	2.36	3.62	2.20
Advanced Training	3.84	4.33	4.05	3.91	4.46	3.30	4.59	4.54	5.00	4.30
Oesirable Outy	3.67	3.67	4.00	3.87	3.96	3.28	4.24	3.54	5.62	3.90
Three Oay Pass	3.39	4.00	3.86	3.39	3.46	3.06	NA	NA	NA	NA
Bonus	NA	NA	NA	NA	NA	NA	3.55	2.54	4.50	3.90
Poor Performance and:										
Reprimand	4.89	4.67	4.86	5.09	5.11	4.70	4.97	4.82	4.87	5.20
Undesirable Outy	4.62	3.50	5.00	4.78	4.69	4.47	3.79	3.00	4.37	4.20
Close Supervision	5.03	5.33	4.95	4.96	4.81	5.19	4.97	5.00	5.25	4.70
Reduction in Rank	3.73	2.67	3.71	3.69	4.58	3.43	NA	NA	NA	NA
Extra Duties	3.76	2.67	3.38	4.17	4.42	3.51	NA	NA	NA	NA
Termination	NA	NA	NA	NA	NA	NA	5.03	3.82	6.37	5.30
Laid Off	NA	NA	NA	NA	NA	NA	4.72	3.36	5.25	5.80
Suspension Without Pay	NA	NA	NA	NA	NA	NA	3.72	5.00	2.25	3.50

APPENDIX F4

ORGANIZATIONAL INCENTIVES INVENTORY (SECTION 9)

	N =	121	6	21	23	26	45	29	11	8	10
DESCRIPTION		All Military	1st Cav.	2nd Arm.	6th Cav.	NAS	7th Infr.	All Civilian	L.A. DOT	Arizona Heli.	Alaska Operations
Item 1		2.69	3.33	2.90	2.39	2.84	2.58	3.40	4.00	3.50	2.90
2		3.27	3.83	3.62	2.87	3.23	3.27	3.34	3.73	3.50	2.80
3		2.87	2.83	3.71	2.74	2.77	2.60	2.93	3.18	3.00	2.60
4		3.12	3.33	3.67	2.65	3.27	3.00	3.34	3.73	3.87	2.50
5		2.86	3.33	3.43	2.74	2.65	2.71	2.90	3.36	2.62	2.60
6		3.02	3.83	3.43	2.56	2.96	3.00	3.28	3.18	3.75	3.00
7		2.38	3.33	2.38	2.45	2.69	2.04	3.00	3.36	3.37	2.30
8		2.41	2.67	2.71	2.22	2.46	31	2.14	1.91	2.12	2.40
9		3.04	3.00	3.29	3.30	2.73	2.98	2.93	2.91	3.37	2.60
10		3.45	3.00	3.62	3.65	3.35	3.40	2.83	2.91	3.00	2.60
11		2.61	3.17	3.00	2.61	2.34	2.51	2.76	2.73	3.12	2.50
12		2.93	2.83	3.33	2.83	2.88	2.84	3.41	3.36	3.75	3.20
13		2.88	3.17	2.57	2.78	2.85	3.07	3.52	3.91	3.50	3.10
14		2.94	3.50	3.33	2.87	2.85	2.78	3.41	3.64	3.75	2.90
15		2.51	3.33	2.57	2.39	2.77	2.29	3.83	4.00	4.12	3.40
16		3.37	3.33	3.40	3.26	3.04	3.50	3.31	3.64	3.37	2.90
17		2.42	3.33	2.57	1.82	2.46	2.51	2.79	2.82	2.75	2.80
18		2.67	2.17	2.71	2.65	3.27	2.38	2.69	2.91	2.62	2.50
19		3.97	3.83	4.43	4.04	3.36	4.07	4.21	4.09	4.50	4.10
20		3.69	4.00	3.95	3.65	3.50	3.64	3.83	3.82	4.12	3.60
21		2.35	2.67	2.52	2.00	2.69	2.20	2.69	3.09	2.12	2.70
22		2.56	3.17	3.00	2.04	2.38	2.64	2.79	3.09	2.37	2.80
23		2.92	3.50	3.52	2.48	2.69	2.91	3.38	3.36	3.50	3.30
24		3.78	3.83	3.76	3.52	3.19	4.27	3.07	2.91	3.29	3.10
25		3.92	4.33	3.95	4.00	3.73	3.91	4.07	4.09	4.25	3.90
26		3.35	4.00	3.52	3.04	3.42	3.31	3.59	3.64	3.87	3.30
27		3.79	4.00	4.24	3.48	3.46	3.91	3.97	4.36	4.00	3.50
28		3.12	3.50	3.48	3.00	2.92	3.09	3.07	3.00	3.37	2.90
29		2.92	3.67	3.62	2.90	2.73	2.62	3.28	3.82	2.62	3.20
30		3.20	2.50	3.25	2.86	3.65	3.18	3.52	3.73	3.12	3.60
31		2.77	3.00	3.19	2.56	2.61	2.73	2.86	2.91	3.37	2.40
32		2.98	3.50	3.52	2.96	2.92	2.71	4.17	4.27	3.87	4.30
33		3.03	3.17	3.33	3.00	3.04	2.89	3.62	3.64	3.25	3.90
34		2.62	4.00	3.14	2.35	2.69	2.29	3.45	3.91	3.50	2.90
35		3.49	3.67	3.71	3.56	3.42	3.36	3.65	3.54	3.75	3.70
36		3.27	4.17	3.43	2.96	3.27	3.23	3.62	4.00	3.87	3.00
37		3.21	3.50	3.48	3.22	2.77	3.31	3.39	3.54	3.29	3.30
38		3.52	3.83	4.09	3.26	3.19	3.54	4.14	4.27	4.50	3.70
39		3.26	3.33	3.71	2.96	3.23	3.22	3.55	3.82	3.75	3.10
40		2.81	3.00	3.00	2.70	2.65	2.84	2.93	2.91	3.12	2.80
41		2.91	2.67	3.19	2.61	3.15	2.82	2.76	2.64	3.12	2.60
42		3.36	4.17	3.67	3.52	2.96	3.24	3.83	3.91	4.25	3.40
43		2.74	3.50	3.24	2.78	2.58	2.47	3.07	3.09	3.25	2.90
44		3.72	3.33	4.00	3.65	3.54	3.78	4.10	4.27	4.25	3.80
45		2.57	3.00	2.33	2.09	2.77	2.76	3.38	3.45	3.50	3.20
46		2.85	3.33	3.52	2.35	2.65	2.84	2.69	2.64	2.87	2.60
47		3.12	4.00	3.52	2.70	3.11	3.02	3.14	3.18	3.37	2.90
48		2.81	3.17	2.57	2.78	3.19	2.67	3.07	3.54	2.37	3.10
49		2.91	3.50	3.40	2.64	2.73	2.60	3.10	3.36	3.25	2.70
50		2.74	4.17	3.48	2.17	2.85	2.42	3.45	3.73	3.37	3.20
51		2.88	2.83	3.00	3.17	2.96	2.64	2.97	3.18	2.75	2.90

APPENDIX G

MEAN EFFECTIVENESS RATING FOR PEACE AND WARTIME CONDITIONS FOR THREE LEVELS OF MILITARY PERSONNEL

APPENDIX G

MEAN EFFECTIVENESS RATING FOR PEACE AND WAR TIME CONDITIONS FOR THREE LEVELS OF MILITARY PERSONNEL

	Commanding Officers	Maintenance Officers	Maintenance Support	
1. Maintenance Man-hrs. per Aircraft	4.75	6.00	6.62	Peace
	5.75	6.50	7.25	War
2. Maintenance Man-hrs. per Flight Hour	7.12	6.25	6.37	Peace
	7.12	6.58	7.12	War
3. Availability	5.00	6.83	5.87	Peace
	5.25	7.42	7.12	War
4. Readiness	7.00	6.92	7.00	Peace
	6.75	7.58	7.87	War
5. Mean Time to Repair	6.62	5.25	6.37	Peace
	5.75	5.92	7.37	War
6. Down Time	7.25	6.75	6.37	Peace
	7.37	6.75	7.25	War
7. Parts Consumption	6.25	6.25	6.12	Peace
	6.37	4.50	5.50	War
8. Missions Fown per Month	5.25	4.25	5.25	Peace
	5.25	5.08	5.87	War
9. Flight Hours per Month	6.62	4.67	5.87	Peace
	6.75	5.75	6.25	War
10. Number of Copters in for Repair at Any One Time	5.62	6.25	5.87	Peace
	5.87	7.00	6.87	War
11. Number of Complaints from Pilots or from the Unit to Which the Aircraft Belongs.	5.25	6.08	6.75	Peace
	5.12	6.25	6.00	War

	Commanding Officers	Maintenance Officers	Maintenance Support	
12. Number of Good Parts Replaced	6.25	6.67	6.50	Peace
	5.37	5.25	5.62	War
13. Number of Work Orders Completed per Unit Time	3.75	5.08	4.87	Peace
	4.12	5.50	6.87	War
14. Aircraft Accident Rate	7.00	6.42	7.12	Peace
	5.87	7.00	6.75	War
15. Personnel Accident Rate	5.12	7.00	7.00	Peace
	5.12	7.17	7.12	War
16. Job Satisfaction	6.50	7.17	7.37	Peace
	5.50	6.67	7.12	War
17. Reenlistments/Turnover	6.62	6.25	5.00	Peace
	5.25	5.58	5.37	War
18. Morale	5.87	7.17	7.50	Peace
	6.12	7.25	7.62	War
19. Absenteeism	5.25	6.25	6.75	Peace
	3.87	6.67	6.75	War
20. Tardiness	5.00	6.00	6.25	Peace
	3.87	6.42	6.75	War
21. Sick Call	4.87	5.17	5.50	Peace
	4.25	5.92	6.12	War
22. Amount of Grievances	5.12	5.92	6.25	Peace
	3.87	6.00	5.50	War
23. Aircraft Cleanliness	5.75	6.50	7.00	Peace
	4.00	5.75	5.62	War
24. Hanger or Work Area Cleanliness	5.62	6.33	6.50	Peace
	3.62	5.50	5.62	War

APPENDIX H

INTERCORRELATIONS BETWEEN SELECT JOB PERCEPTION MEASURES (N=4)

APPENDIX H

INTERCORRELATIONS BETWEEN SELECT JOB PERCEPTION MEASURES. (N=4)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	Identity		-.97	-.95	-.50	.50	.42	.51	.39	.63	.41	.69	.99	-.78	.66
2.	Significance			.98	.39	-.41	-.46	-.59	-.35	-.54	-.48	-.72	-.98	.71	-.62
3.	Feedback from Job				.49	-.24	-.29	-.45	-.17	-.64	-.33	-.59	.98	.79	-.46
4.	Feedback from Agents					.12	.53	.48	.40	-.98	.57	.27	-.55	.92	.15
5.	Pay Satisfaction						.81	.69	.96	-.08	.72	.80	.37	-.09	.95
6.	Social Satisfaction							.97	.93	-.42	.99	.94	.32	.23	.90
7.	Discussion with Supervisor (Thoughtfulness)								.83	-.34	.99	.97	.44	.13	.86
8.	Supervisor Competence									-.34	.87	.86	.26	.18	.95
9.	Lost Work Time										-.44	-.11	.69	-.98	-.09
10.	Working Conditions											.94	.33	.24	.85
11.	Organizational Pride												.61	-.09	.94
12.	Pressure													-.83	.55
13.	Like More Time to Do Maintenance														-.13
14.	Time Spent in Maintenance														

APPENDIX I

INTERCORRELATION BETWEEN MEASURES OF EFFECTIVENESS/EFFICIENCY (N=4)

APPENDIX I

INTERCORRELATION BETWEEN MEASURES
OF EFFECTIVENESS/EFFICIENCY (N=4)

		1	2	3	4	5	6	7	8	9
1.	OR		-.73	-.88	-.32	.43	.12	-.68	.33	-.78
2.	NORS			.32	-.33	-.08	-.67	.95	-.78	.75
3.	NORM				.66	-.51	.31	.30	.10	.59
4.	% Working					-.81	.43	-.46	.32	-.22
5.	% Aircraft OR						.19	.18	.29	.22
6.	% OR Flown							-.50	.98	-.02
7.	MH/FT.-HR								-.61	.87
8.	MH/AC									-.18
9.	MH/AC Flown									