STOCK FUNDING OF DEPOT LEVEL REPARABLES: WIN, LOSE, OR DRAW?

A thesis presented to the Faculty of the U.S. Army
Command and General Staff College in partial
fulfillment of the requirements of the
degree

MASTER OF MILITARY ART AND SCIENCE

by

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B.S., Drexel University, Philadelphia, Pennsylvania, 1978

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The thirty-eight Defense Management Report Decisions (DMRDs) issued by the Department of Defense in late 1989 identified the potential to save nearly $40 billion during the five year period of fiscal years 1991 through 1995. This study investigates the effect of DMRD 904 on equipment availability within the nine active duty, US Army divisions that are based in the continental United States. Mean time to repair rates, equipment availability rates and the dollar value of depot level reparables requisitioned during the first nine months following full implementation of the Army's program were analyzed and trends identified. Based on this analysis, it appears that the stock funding of depot level reparables is adversely affecting equipment availability, especially for very complex weapon systems such as tanks, helicopters, and infantry fighting vehicles. It was also noted that even though the total dollar value of depot level reparables being requisitioned is now lower than it was before 1 April 1992, an upward trend is developing.

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The opinions and conclusions expressed herein are those of the student author and do not necessarily represent the views of the U.S. Army Command and General Staff College or any other governmental agency. (References to this study should include the foregoing statement.)

ABSTRACT

STOCK FUNDING OF DEPOT LEVEL REPARABLES: WIN, LOSE, OR DRAW? by MAJ Jean E. Fluevog, USA, 111 pages.

The thirty-eight Defense Management Report Decisions (DMRDs) issued by the Department of Defense in late 1989 identified the potential to save nearly $40 billion during the five year period of fiscal years 1991 through 1995.

This study investigates the effect of one of those decisions, DMRD 904, on equipment availability within the nine active duty, US Army divisions that are based in the continental United States. Equipment availability rates, mean time to repair rates and the dollar value of depot level reparables requisitioned during the first nine months following full implementation of the Army's program were analyzed and trends identified.

Based on this analysis, it appears that the stock funding of depot level reparables is adversely affecting equipment availability, especially for very complex weapon systems such as tanks, helicopters, and infantry fighting vehicles. It was also noted that even though the total dollar value of depot level reparables being requisitioned is now lower than it was before 1 April 1992, an upward trend is developing.

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TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

Figure | Page

Figure		Page

LIST OF TABLES

LIST OF ABBREVIATIONS

AMC	Army Materiel Command
AMDF	Army Master Data File
AR	Army Regulation
ARI	Automatic Return Item
CONUS	continental United States
DA	Department of the Army
DBOF	Defense Business Operating Fund
DLR	depot level reparable
DMR	Defense Management Review
DMRD	Defense Management Review Decision
DoD	Department of Defense
FORSCOM	US Army Forces Command
GAO	Government Accounting Office
HASC	House Armed Service Committee
LCA	US Army Materiel Command Logistics Control Activity
LIF	Logistics Intelligence File
LMI	Logistics Management Institute
MAC	Maintenance Allocation Chart
MILSTRIP	Military Standard Requisitioning and Issue Procedures
MRSA	US Army Materiel Command Materiel Readiness Support Activity

NTC	National Training Center
O&MA	Operations and Maintenance, Army
ODCSLOG	Office of the Deputy Chief of Staff, Logistics
PAA-2	Procurement Appropriation, Army Secondary
RC	Reserve Component
RIDB	Readiness Integrated Data Base
SAMS	Standard Army Maintenance System
SFDLR	Stock Funding of Depot Level Reparables
SLA	Strategic Logistics Agency
SLS	Strategic Logistics System
STA	Sparing To Availability
STAMIS	Standard Army Management Information System
TM	Technical Manual
UMMIPS	Uniform Materiel Movement and Issue Priority System
USAREUR	US Army Europe
WOLF	Work Order Logistics File

CHAPTER 1

INTRODUCTION

> **Modern times are distinguished from earlier times by the existence . . . of many nations and great governments related to one another in close intercourse. Peace is their normal condition; war is the exception. The ultimate object of all modern war is a renewed state of peace.**
>
> **General Order No. 100, 24 April 1863**

The fundamental role of the United States military is to deter war and, should deterrence fail, to defend our national interests against any potential foe.[1] In order to effectively perform this role, the 1992 National Military Strategy of the United States of America outlines four fundamental tasks that the Services must be able able to accomplish. The first two are to sustain a modern and responsive military force that is capable of providing a credible strategic deterrence and to maintain a forward military presence in regions that are vital to our national interests. The latter two include retaining the capability to respond to regional crises and ensuring our continued ability to reconstitute forces that will provide our nation with a global warfighting capability. With the collapse of the Soviet Union and the end of the Cold War, however, the size of the military forces available to perform these critical tasks is in the midst of becoming much smaller than it has been in many years. Ironically, successfully executing these complex missions will demand that this smaller force continue to maintain a high state of combat readiness as it concurrently makes significant improvements in its ability to deploy forces world-wide. Achieving success during this era of declining defense spending, although essential to preserving our national security, will not be easy by any stretch of the imagination.

To assist the Department of Defense (DoD) in its efforts to meet these and the myriad of other challenges facing it, the Secretary of Defense initiated the Defense Management Review (DMR) in 1989. The objective of this program, much like its predecessor the 1985 Blue Ribbon Commission on Defense Management, was to identify, develop and track initiatives that would improve the efficiency of DoD operations. By focusing its attention on reducing the costs associated with the defense infrastructure, the DMR committee attempted to identify various ways to reduce the cost of doing business In so doing, it sought to minimize the impact that future reductions in defense spending would have on military personnel and force structure.

In November 1989, a series of thirty-eight Defense Management Report Decisions (DMRDs) were issued. These decisions addressed a broad spectrum of topics ranging from base operations and facility management to automation and information management systems. In total, these decisions identified the potential to save almost $40 billion during the five year period of fiscal years 1991 through 1995.[2] Two of these decisions, DMRD 904 and DMRD 901, directed the Services to stock fund depot level reparables (DLRs) and to include all costs for, or directly related to, an item in the price that the customer pays for the item.

The Research Question

The purpose of this study is to determine what impact the stock funding of depot level reparables has had on equipment availability within the nine, continental United States based, active duty, US Army divisions since its full implementation on 1 April 1992. Arriving at this determination will be accomplished by first answering the following three subordinate research questions.

1. Have equipment availability rates changed since the Army fully implemented its program to stock fund DLRs? The sustainment of current equipment availability rates is not among the three objectives of the Army's Stock Funding of Depot Level Reparables (SFDLR) program. Given the ultimate mission of the military, however, if this newly adopted funding methodology is having an adverse impact on equipment availability, some changes to the current program should be identified and implemented. Furthermore, as the Navy has actually experienced some rather significant improvements in materiel availability since implementing

their own SFDLR program, a similar rise in the availability of Army equipment has been forecast by proponents of the program.

2. Has the time it takes to repair a piece of military equipment changed since 1 April 1992? The SFDLR program encourages units Army-wide to repair unserviceable DLRs at the appropriate maintenance level and only order a replacement component when the required repair is beyond the unit's authority, capability or capacity. Although this thrust of the SFDLR program is aimed at reducing the costs associated with maintaining military equipment, it will also serve to raise the number of manhours required to perform the many types of repair operations that involve DLRs. This increase in repair times will be a direct result of the additional time that will be needed for unit mechanics to accurately diagnose the cause of equipment malfunctions and then repair, rather than replace, the defective DLR component.

3. Have demands for DLRs declined now that the using unit is required to pay for all of the costs related to the item? Since DLRs are no longer funded under a procurement appropriation and issued at no cost to the requesting unit, a decline in the total dollar value of the DLRs being requisitioned by troop units in the field would be expected. This drop, like the rise in repair times, will be a direct reflection of the increased efforts to

repair items at the appropriate maintenance level and avoid the financial impact of requisitioning a new DLR.

Background

The Army Stock Fund (ASF) is a revolving capital fund designed to finance the supply pipeline between the user and the vendor. It operates much like most commercial enterprises, in that as supplies are sold to customers, the proceeds from the sales are used to buy more supplies as well as pay overhead and operating expenses. Prior to the full implementation of DMRDs 901 and 904, the ASF provided capital to purchase and stock inventories of relatively inexpensive spare and repair parts, clothing and textiles, general supplies, common hardware and similar consumable items. When a unit requisitioned a stock funded item, they would pay for it with funds from their annual allocation of the Operations and Maintenance, Army (O&MA) appropriation. The more expensive, non-consumable and reparable components and subassemblies that were used in the repair of major end items were procured by the Army with funds provided by the Procurement Appropriation, Army Secondary (PAA-2) and issued to the user at no cost.

On 1 October 1990, the Army began implementing its program to stock fund DLRs. Two changes in the old DLR methodology went into effect on that date. First, all wholesale level DLRs were capitalized into the ASF. This was essentially nothing more than an accounting exercise, whereby the amount of funding authority granted to the ASF was increased by the value of all of the DLRs currently in inventory at the wholesale level. Secondly, an additional increase in the amount of funding authority allocated to the ASF was provided, and an offsetting decrease made in the PAA-2 appropriation, so that future acquisitions of DLRs could be made by the ASF. However, since the full implementation date was still over a year away, a temporary withdrawal credit authorization program was also created. This interim phase of the implementation was needed so that Army retail customers could continue to requisition and receive DLRs on a free issue basis pending the necessary conversion of various automated management and information systems.

On 1 April 1992, this eighteen month transition period ended and DLRs became fully stock funded. Retail level stocks of DLRs, as well as all of the DLRs currently on backorder, were capitalized into the ASF. An additional allocation of O&MA funding was distributed and Army units in the field became totally responsible for paying for their DLRs. Now a unit could only requisition a new DLR if they had adequate funding left in their annual O&MA allocation. A return credit procedure was also implemented at this time so that a portion of the cost of each DLR would be refunded to the requesting unit when the unserviceable DLR was returned to the supply system. The exact amount of this credit is determined by several factors, but it is intended to be the difference between the standard Army Master Data File (AMDF) price of a new item and the cost to repair the unserviceable DLR. The ultimate objective of this aspect of the SFDLR program is for the customer unit to actually pay only those "costs" that are directly associated with repairing the unserviceable DLR.

Although the primary purpose of the Army's SFDLR program is to meet the requirements of DMRDs 901 and 904, the formal implementation plan also details three enabling objectives. They include: providing improvements in supply discipline, inventory management and asset visibility, attaining the benefits of funding both the procurement and wholesale level maintenance of secondary items under a single funding source and enhancing the Army's ability to link costs to specific weapon systems. When you consider that 37,000 DLRs accounted for approximately $6 billion in annual sales as of the end of Fiscal Year 1990,[3] the potential for savings in this area is substantial.

But, if the "price" that the Army has to "pay" for reducing DLR costs is lower equipment availability rates or a significantly reduced operating tempo, will the savings be worth it? Minimizing the cost of maintaining a viable military force in today's era of shrinking defense budgets is important, but maintaining the Army's combat readiness, and ultimately, its ability to defend our national interests is paramount. If the Army's program to stock fund DLRs is not meeting its goals or if it is having an adverse impact on combat readiness, changes to the current methodology must be identified and implemented.

Assumptions

The analysis of data presented in Chapter 4 and the validity of the conclusions drawn in Chapter 5 are founded on the following four assumptions.

1. The frequency and complexity of direct support level maintenance work orders is, for the most part, evenly distributed throughout the entire year when viewed from the vantage point of a "division roll-up" perspective. This assumption recognizes that training tempo can have a major impact on maintenance actions at the battalion level, but that the practice of rotating training priorities among the subordinate units of a division tends to equalize the distribution of the division's total maintenance workload. Since this study will investigate equipment availability and repair rates as well as DLR expenditures over time, this standard baseline is essential. The validity of this assumption is based on the fact that most divisions rotate their subordinate units through some variation of a "red, amber, green" training cycle which serves to prevent any extreme peaks or valleys in maintenance workloads when viewed from the division-level perspective over time.

2. All CONUS based divisions have implemented the SFDLR program in accordance with the Army's implementation plan. This assumption is based on the extensive amount of official guidance that has been provided to Army units on how to implement the SFDLR program. This guidance included a comprehensive written implementation plan, a large number of supplemental electronic messages which clarified issues or answered questions that had been raised by units in the field and various other official written documents. A more extensive discussion of many of these items can be found in the literature review of this study which is located in Chapter Two. Making this assumption allows for different levels of performance within CONUS units to be attributed to some factor other than variations in how they have implemented the Army's SFDLR program.

3. All nine CONUS based divisions were conducting their supply and maintenance operations in accordance with current Army doctrine and regulatory guidance during the fifteen month period under investigation. This assumption is necessary as several of the factors being evaluated could be affected if non-doctrinal or unauthorized supply and maintenance procedures were being employed by the maintenance activity involved in the repair of DLRs. The validity of this assumption is based on the existence of various programs that were designed and implemented to ensure that Army units comply with regulatory and doctrinal

guidance. Three of the most significant such programs are the Command Supply Discipline Program as outlined by Army Regulation (AR) 710-2, Supply Policy Below the Wholesale Level, unit-level Command Inspection Programs and field visits by personnel from all levels of the Office of the Inspector General.

4. The final assumption is that the activities which occurred during the fifteen month period covered by this study are representative of what Army units can expect to encounter in the immediately foreseeable future. This recognizes the fact that the operating tempo of the nine divisions is not identical, and that it has fluctuated due to a variety of factors such as equipment modernization and major unit re-stationing efforts. It also acknowledges that the fluid nature of the military's mission will cause similar deviations from the norm for several years to come. It is almost certain that tomorrow's leaders in the Army, Navy and Air Force will have to continue to contend with further force reductions, base closures and the upgrading of combat weapon systems as they strive to maintain a level of combat readiness that will enable them to meet a variety of world-wide contingency missions. As the three Services, along with DoD in general continue to draw down, more change, rather than less must be anticipated, and ways of coping with these changes must be developed.

Definitions of Terms

The following definitions are provided to ensure a common understanding of various key terms that are used throughout this study.

The Army Stock Fund (ASF) is a revolving capital fund designed to finance the supply pipeline between the user and the vendor. It operates much like any commercial business in that as supplies are sold to customers, the proceeds from the sales are used to buy more supplies and pay operating costs.[4] Additionally, the ASF is divided into two levels, wholesale and retail.

Depot level reparable items are those subassemblies of an end item that can only be completely overhauled at the depot level. They include all items that are listed on the AMDF with a maintenance repair code (MRC) of D or L, as well as other reparables (MRCs O, F or H) with an Automatic Return Item (ARI) code of C, E, R or S.[5] Transmissions, engines, and rotor blades are several common examples.

The standard price is the amount that is charged to a unit's O&MA account when it requisitions a new DLR. As a result of DMRD 901, it includes not only the acquisition cost of the item, but several surcharges as well. These surcharges are added to the unit price in order to recover all costs that are directly associated with the DLR such as first and second destination transportation, overhead costs and even depot level inventory losses.[6]

The net price is the actual or estimated cost to repair the DLR plus a surcharge for items that are beyond repair and the surcharges included in the standard price.[7]

The standard credit value is the amount that a unit receives back when they turn in a reparable DLR. It is the difference between the standard price and the net price.[8] This standard credit value is intended to reimburse the requisitioning unit so that they only pay for the cost to repair an unserviceable DLR and serves to motivate units to return unserviceable DLRs to the supply system so that they can be repaired and reissued. If a unit fails to turn-in an unserviceable DLR, they will not receive this credit.

The coefficient of determination is a numerical value that is calculated during regression analysis. It is a quantitative measure of how strongly variations in the dependent variable are attributed to a change in the independent variable. For example, if a calculation is made to determine the linear relationship between mean time to repair and equipment availability rates, with the former as the independent variable and the latter as the dependent variable, the coefficient of determination measures what percentage of a change in availability can be attributed to a change in mean time to repair.

Limitations

The two most significant constraints that have limited this study effort are the amount and validity of the data selected for analysis. The amount of available data is restricted by the fact that the Army SFDLR program was just fully implemented on 1 April 1992. As a result of this constraint, only nine months of post-implementation historical data had accumulated by the time that the data collection phase of this research effort was ended and the data analysis phase initiated. Additionally, the validity of the data that was used to analyze equipment availability and repair rates is somewhat susceptible to manipulation by the originating unit as these two factors are frequently monitored by a unit's higher headquarters as indicators of how well the subordinate unit is performing. While no specific evidence was discovered during the course of this study to indicate the intentional falsification of data by field units, the reporting of "excessively" high repair rates or "unacceptably" low equipment availability rates is inadvertently discouraged since these data elements are commonly used as performance indicators.

A somewhat less significant factor that restricts the value of comparisons between the units involved in this study is that not all nine of the divisions are organized and equipped identically. Included in this limitation is the fact that a wide variance exists in the age of the equipment fleets within the different divisions. This factor does have a limited impact on the complexity and type of direct support level maintenance operations needed to keep a particular weapon system operational. This does not, however, have any impact on the ability to identify trends within a specific unit and it has only a nominal impact on the identification of trends for a specific weapon system that is authorized in more than one division.

Finally, the relative newness of the overall SFDLR concept combined with the apparent lack of an equivalent program in civilian industry also serves to limit the availability of historical information in general. Despite these limitations, this investigation is both necessary and worthwhile due to the potentially significant impact that the stock funding of DLRs could have on the US Army.

Delimitations

The following are self-imposed constraints that were used to promote data validity and keep the scope of this research within reasonable bounds, thereby ensuring its timely conclusion.

1. The decision to limit this study to the nine CONUS based active duty divisions was based on the three following factors. By using such a large sample size, over half of the remaining active duty US Army forces, the statistical validity of any conclusions drawn as a result of this research is greatly increased. However, a study of all units within the US Army Forces Command (FORSCOM) was intentionally avoided as this would have classified certain elements of the study and significantly restricted the

availability of the results. Additionally, this constraint helped to minimize the impact of a variety of factors that affect supply and maintenance operations, such as: order to shipment times and different requisitioning priorities under the Uniform Materiel Movement and Issue Priority System (UMMIPS).

2. This study will be limited to an examination of only six months worth of historical data prior to the full implementation of the Army's SFDLR program on 1 April 1992. This limitation is imposed due to the heavy involvement of several of the CONUS divisions in Operations Desert Shield and Desert Storm. The Gulf War was clearly not "business as usual" for the units involved. The resulting volume, complexity and frequency of maintenance actions, as well as the war's impact on equipment availability rates is beyond the scope of this study and would severely limit the value of comparisons between divisional units. Additionally, the stock funding of DLRs is essentially a peacetime program, and military units involved in a similar conflict sometime in the future would, in all likelihood, be exempted from the financial limitations that the SFDLR program imposes.

3. This study will not investigate the effect of the SFDLR program on active duty Army divisions that are stationed outside of the continental United States. This constraint, which is similar to the first one, is imposed for two reasons. First, the US Army Europe (USAREUR) did

not implement their program in the same manner as FORSCOM, especially in regards to the level at which SFDLR funds are managed. Additionally, most of the US Eighth Army forces in Korea were involved in an extensive proof of principle test that attempted to validate the SFDLR implementation plan prior to 1 April 1992. These two factors would have significantly skewed the available data if these additional data sources were included.

4. This study will not investigate the effect of SFDLR on Reserve Component (RC) Army units in light of the different operating tempos that exist between active duty and RC units as well as in consideration of their different funding methodologies.

5. This study will not investigate the effect of SFDLR on the US Navy or the US Air Force. Although all three Services are affected by DMRD 904, their different organizational structures, missions and functions as well as the different implementation dates for each Service's SFDLR program create too many variables to permit the development of viable data for comparison within the time constraints of this research effort.

Significance of the Study

Stock funding of DLRs is here to stay. Although the current objectives of the Army's SFDLR program are primarily monetary in nature, the combat readiness of our military forces is a factor that must always be considered when implementing new programs. The Navy has already realized substantial savings as a result of their SFDLR program, but there are no guarantees that the Army will enjoy the same success. If the Army program is not meeting its objectives, or if the current program methodology is in fact having an adverse impact on the combat readiness of Army units, changes must be identified and implemented in the immediate future.

Summary

This chapter has provided an introduction to this study effort which is intended to determine what effect the stock funding of DLRs has had on equipment availability within the nine CONUS based, active duty divisions of the US Army. Some background information about the Army's SFDLR program and the Army Stock Fund was provided in order to establish the extensive impact that this new funding methodology has already had, and will continue to have, on Army operations. Several key assumptions and definitions were provided to enhance the reader's understanding of the remainder of this study. Finally, the scope and importance of this research was established through the identification of limitations, delimitations and a brief discussion of the significance of the research question.

CHAPTER 2

LITERATURE REVIEW

> **History sometimes yields lessons of direct applicability which too often go unrecognized and unheeded and sometimes deliberately ignored, presumably on the naive assumption that "this time everything is different."**
>
> **Army Materiel Command Board**

Introduction

This chapter provides a comprehensive review of relevant literature concerning the stock funding of DLRs within DoD. Due to the relative immaturity of the three Services' SFDLR programs however, the amount of literature available, though adequate to support this research effort, is quite limited. Most of the literature that is available has been developed by the United States Government or its employees and can be grouped into three broad categories: official guidance or policy; formal published studies or reports; and unofficial studies, articles and reports.

Other Programs Within DoD

Research into the benefits of stock funding DLRs began in the late 1970s and resulted in opposing positions among the three Services. The US Navy's initial study was completed in August 1978. It concluded that improvements in operational readiness as well as cost savings could be achieved by "financing DLR procurement and repair in the stock fund"[9] Based on the results of this study, the Navy implemented their SFDLR program in the early eighties with extremely favorable results.

> In addition to the decrease in demands and reductions in procurement costs, Navy has also enjoyed reductions in the level of required inventory, and in warehousing and transportation costs, while experiencing increased materiel availability, reduced backorders, reduced customer wait time, and increased carcass return rates.[10]

The US Air Force conducted its first investigation into the possibilities of adopting the SFDLR methodology in 1979, but came to a far different conclusion. It found that no substantial benefits would be realized by changing to the stock funding methodology.[11] A second Air Force study in 1983 reached the same conclusions as the first and again recommended against the implementation of a program to stock fund DLRs.

In her 1991 Masters thesis, "The Effect of Defense Management Review Decision 904, Stock Funding of Depot Level Reparables, On Cash Flow Within the Reparable Support Division of the Air Force Stock Fund," Captain Deborah Elliot provides a possible explanation for these divergent positions. She suggests that the higher levels of funding that the Navy enjoyed during their test of procedures to stock fund DLRs, "could have, by itself, resulted in the improved system performance ratings."[12] She goes on to note that the Air Force's opposing conclusions and their decision to not implement the stock funding of DLRs could have been influenced by the fact that, unlike the Navy, the Air Force was not having trouble maintaining accountability of their unserviceable DLR assets.

On 9 November 1989, with the release of DMRD 904, these conflicting positions were resolved as both the Army and Air Force agreed to adopt a stock funding methodology for DLRs. The Services estimated that this change would generate initial savings of $700 million and subsequent annual savings of $100 million.[13] The Deputy Secretary of Defense, however, approved an alternative estimate that projected savings of $13.4 billion during the five year period of fiscal years 1991 through 1995 and reduced the Services' budget submission by $3,491.2 million for fiscal year 1991.[14] DMRD 904 was revised on 14 December 1989, to reflect the impact of the other DMRDs and related policy changes on the decision to stock fund DLRs. This change, known as DMRD 904C, reduced the amount of projected savings to $10.3 billion, adjusted the reduction in the Services' Total Obligation Authority for 1991 to $3,348.4 million and provided an offsetting increase in the 1991 ASF Obligation Authority in the amount of $3,498.8 million.[15]

SFDLR and the Army

Information on the Army's SFDLR program includes the formal implementation plan, a number of officially published works, several minor studies and a few articles in professional publications as summarized below.

The US Army's initial investigation into the possible benefits related to the stock funding of DLRs came in response to a 1978 directive from the Deputy Assistant Secretary of Defense. In 1980, an ad hoc Army Staff team completed a study to determine if stock funding DLRs would improve the return rates for unserviceable items. The study concluded that there was no strong evidence that it would. It did, however, recommend that low dollar value items as well as those DLRs with a low annual issue value be transferred to the stock fund. Specifically, the study recommended that the Army continue to fund all DLRs with a unit cost of over $3,000 via procurement appropriations and that the problem of low return rates for unserviceable DLRs be addressed through intensive management using current or improved management procedures.[16]

In 1982, the US Army Materiel Command (AMC) conducted a subsequent study with significantly different results. This investigation concluded that stock funding DLRs would reduce secondary item inventory costs, increase materiel availability and provide the wholesale level with greater flexibility to respond to changing requirements.[17] It went on to recommend the realignment of all secondary items into the stock fund and even provided a completely developed implementation plan as part of its final report.

It would appear, however, that the Army did not accept the study's findings nor implement the plan.

The General Accounting Office (GAO) has conducted several recent investigations into how well the Army was managing its DLR assets prior to the full implementation of the SFDLR program. The underlying theme throughout the conclusions of these research efforts was that there is considerable room for improvement in a variety of problem areas. One report that was provided to the House Armed Services Committee (HASC) on 25 September 1991, found that the Army could have reduced procurement costs by at least $369 million if it had simply met its existing goal of getting 85 percent of the reparable DLRs that are in the field returned to a depot for repair.[18]

A subsequent report to the HASC in December 1991, addressed the status of the Army's efforts to transfer DLRs to the ASF. Specifically, it discussed the criticality of ongoing efforts to develop new, or modify existing, asset tracking and financial information and management systems. The GAO found that unless these new systems were in place and operating effectively by the scheduled implementation date of 1 April 1992, the financial incentive that the SFDLR program provides to return unserviceable assets would be diminished.[19] It also warned that the Army could expect to experience many of the same types of problems as had initially plagued the Navy's program.

To assist in the implementation of DMRD 904, the Assistant Deputy Chief of Staff for Logistics directed that the Strategic Logistics System (SLS) Task Force provide oversight responsibility for SFDLR implementation within the Army. After two reorganizations and name changes in 1990, the Strategic Logistics Agency (SLA) published the Army's initial SFDLR implementation plan in August 1991. An updated plan was later issued in April 1992 and a final edition was released, almost six months after the start of the program, in September 1992. This plan discusses the SFDLR concept, explains current policy and describes the procedures that units were to follow in the implementation of the SFDLR program. In addition to the implementation plan, electronic message traffic from the Army Staff has been used to provide Army units with additional guidance and issue clarification on an as needed basis.

From February 1991 through March 1992, the Army conducted a prototype test of their SFDLR implementation plan in Korea. The test was conducted under a contract with TRESP Associates, Inc., and the Eighth U.S. Army provided the test units. In October 1992, the Logistics Management Institute (LMI) issued a report which evaluated the performance of the contractor, validated the data that had been gathered during the test and identified lessons learned for incorporation into the SFDLR implementation plan. This report indicated that although the test did serve to increase command interest and attention throughout Korea as well as raise general SFDLR awareness, it did not meet all of the test objectives due to the contractor's heavy reliance on simulated procedures.[20] Among the many things that the test failed to do, the following are a few of the most significant. It failed to test the automated systems changes needed to integrate SFDLR into the Standard Army Management Information System (STAMIS). It failed to produce sufficient test data to permit the development of valid conclusions concerning the test objectives. And it did not fully validate the implementation plan, assess the savings expected as a result of the decision to stock fund DLRs or provide a comprehensive guide for the impending Army-wide implementation of the SFDLR program.[21]

In March 1992, the US Army Quartermaster Center and School published a pocket-sized "Commander's Guide to SFDLR." This guide provides individuals that are involved in the management of SFDLRs with a convenient reference document. It focuses on the commander's responsibilities, and discusses the automated systems and management reports that are available within the areas of financial, supply and maintenance management from the company through the wholesale level.

A 1990 study by Janet McLendon investigated the effect of DMRD 904 on training costs and combat readiness. As the SFDLR program had not yet been fully implemented, her analysis was based entirely on cost projections and unfortunately, her conclusions and recommendations provided more questions than answers.

Kenneth Moore's article in the July-August 1991 issue of Army Logistician provides an excellent overview of the SFDLR concept in general and the Army's program in particular. Mr. Moore discusses the impact that SFDLR will have on a variety of areas, to include: supply, finance, transportation and maintenance. He also points out that the success of the program will be highly dependant upon the ability of units to adequately train their personnel on SFDLR specific issues in advance of the 1 April 1992 implementation date. The article was published while the Army's implementation procedures were undergoing validation (see the earlier discussion of the Korea test) and it concludes that the program will meet its objectives.[22] But, when you consider that the author was an operations research analyst in the employment of the agency that had developed the Army's SFDLR implementation plan, any other conclusions would have been quite surprising.

Summary

This chapter has provided a review of relevant literature concerning the stock funding of DLRs within DoD. It has discussed the results of the early investigations into the benefits of stock funding DLRs that were started during the late 1970s, as well as the divergent positions taken by the three Services on the matter. It has also outlined the development of the Army's SFDLR program and summarized the results of several unofficial studies and reports.

CHAPTER 3

RESEARCH DESIGN

> **If all difficulties were known at the outset of a long journey, most of us would never start out at all.**
>
> **Dan Rather, I Remember**

Introduction

This chapter presents a discussion of the research methodology used to address the thesis topic. It describes the four step process that was used to answer the primary research question: what impact has the stock funding of depot level reparables had on equipment availability within the nine CONUS based, active duty, US Army divisions since its full implementation on 1 April 1992? The specific steps that the research process followed were: a review of relevant literature, the collection of data, an analysis of that data to identify trends and finally, the development of conclusions and recommendations based upon those trends.

Methodology

Arriving at an answer to the primary research question was accomplished by initially finding answers to the three subordinate research questions that were presented in Chapter One. Specifically:

1. Have equipment availability rates changed since the Army fully implemented its program to stock fund DLRs?

2. Has the time it takes to repair non-operational pieces of military equipment changed since 1 April 1992?

3. Have demands for DLRs declined now that the using unit is required to pay for them?

When considered together, the answers to these supporting questions provide the answer to the primary research question. The remainder of this chapter is devoted to a discussion of the process that was used to arrive at the answers.

Literature Review

The review of relevant literature was conducted with a three-fold objective in mind. It served initially to establish what research had already been conducted in regards to the stock funding of DLRs. This was necessary to ensure that the study effort being undertaken would in fact qualify as original research. Secondly, it assisted in establishing a sound understanding of the overall scope of the SFDLR issue in general and how the Army planned to implement its program in particular. This knowledge was essential to the successful initial development, and subsequent refinement, of the research question prior to the start of the data collection process. Finally, the literature review identified the objectives of the Army's SFDLR program as well as many of the effects that it was expected to have on Army units. In so doing, it guided the determination of what data should be collected and analyzed in order to accurately answer the primary and subordinate research questions. The specific results of the literature review are discussed in detail in Chapter Two.

Data Collection

During the process of developing and refining the primary and subordinate research questions, it became apparent that the analysis of three related sets of data would provide the required answers. These three data sets were: equipment availability rates, the average number of manhours required to repair a piece of equipment that was in a non-operational condition and the dollar value of DLRs requisitioned by US Army units. Once this requirement had been established, the next logical step was to determine the best method of collecting the required data. In all three instances, there were essentially two alternative methods available for obtaining the data. It could either be requested directly from the nine CONUS divisions being studied or it could be extracted from a central, historical database. The strengths and weaknesses of each of these two competing approaches were considered and a decision made in favor of the latter source for all three data categories. A further discussion of the strengths and weaknesses of this data collection methodology is provided later in this chapter.

Data Analysis

Once the required data was obtained, a four phase analysis process was initiated. The first phase consisted of reviewing all three categories of data to identify any immediately obvious trends when division-level totals were considered. The second phase involved a more detailed investigation of only equipment availability rates and average repair times for twenty-seven items of equipment that were fairly common to all of the nine CONUS divisions. During this phase, the twenty-seven items were grouped into one of three general categories, combat systems, support systems and aircraft. They were then analyzed as a group to determine if the implementation of the SFDLR program was having a more pronounced impact on a particular type of equipment. The third step evaluated the same twenty-seven items of equipment, but on an individual weapon system basis. During each of these phases, bar graphs were used to facilitate the process of visually identifying trends. Following this identification, the observed trends were compared with the expected trends to determine whether or not the SFDLR program was having the anticipated impact on the three factors under investigation. The final phase, regression analysis, was performed using a commercial computer software application. This analysis was done to determine whether or not a linear relationship existed in any of the following four areas: between availability rates and time, between repair rates and time, between the dollar value of DLRs requisitioned and time, and finally, between equipment availability rates and repair rates.

Development of Conclusions and Recommendations

In this final step of the research process, the results of the analysis phase were used to answer the subordinate and primary research questions. Additionally, several general conclusions were developed concerning the impact that the stock funding of DLRs has had on equipment availability within the CONUS based divisions during the nine months since its full implementation. It is important to remember at this point in time, that the validity of these conclusions is based, to a great degree, on the four assumptions that were discussed previously in Chapter One. The research process concludes with the review of four related issues that were identified during the research process and deserve further study. These issues, and a brief discussion of their significance, are consolidated for easy reference as the final section of Chapter Five.

Data Sources

The US Army Materiel Command's Materiel Readiness Support Activity (MRSA) is the Army's central collection point for maintenance related logistics information and receives regular input from troop units in the field. Both direct and general support maintenance units from within the active as well as the reserve component of the US Army provide MRSA with maintenance data. This data is in the form of completed Maintenance Requests on Department of the Army (DA) Form 5504 that have been prepared by the Standard Army Maintenance System (SAMS). This weekly input is made via computer disks and is used to update the Work Order Logistics File (WOLF). The WOLF data base compiles data on total and mean man-hours needed to complete a repair, total and mean days that an item remains in shop, the reason for the work order and the type, quantity and cost of the parts used to return the item of equipment to an operational condition.

MRSA also maintains the Readiness Integrated Data Base (RIDB) which compiles data on equipment availability rates based on field unit submissions of three equipment status reports: DA Form 2406, Ground Equipment Materiel Condition Status Report; DA Form 1352, Aircraft Materiel Condition Status, Inventory and Flying Time; and DA Form 3266-1, Missile Materiel Readiness Report. These reports, which address the availability of Army ground equipment, missiles and aircraft, are submitted to MRSA on a monthly basis in accordance with AR 700-138, Army Logistics Readiness and Sustainability.

The US Army Materiel Command's Logistics Control Agency (LCA) is the Army's centralized data bank for supply and transportation information. LCA performs this mission by maintaining the logistics intelligence file (LIF), which "provides visibility of individual requisitions as they are processed through the logistics pipeline."[23] The LIF data base contains a record of all requisitions that have been submitted to the wholesale level of the Army supply system. This information enables LCA to generate a wide range of standard reports on supply performance, as well as conduct detailed data base searches based on practically any of the parameters that are contained in the Military Standard Requisitioning and Issue Procedures (MILSTRIP) document format.

Strengths and Weaknesses of the WOLF as a Data Source

The WOLF data base was chosen as the source for equipment repair rates versus requesting the data directly from the nine CONUS divisions for several reasons. In operation since 1985, the WOLF maintains approximately two years worth of data on-line, with older data available on request as well. This immediate accessability, combined with the fact that all of the required information on all nine divisions could be obtained at the same time, enabled MRSA to respond to requests for data very quickly. The same information would have been available from each of the divisions directly, but the response time would have been much longer and the risk of incomplete data due to "lost files" at the unit level would have been much greater. In light of the need to extend the data collection phase of this study for as long as possible due to the very limited number of months that have passed since the SFDLR program was implemented, the rapid response capability of the WOLF was a distinct advantage.

Another strength associated with using data from the WOLF is that it should be identical to the data that would have been available on the original DA Form 5504s at the divisional maintenance units. Since the unit input to the WOLF is provided via floppy disk, the risk of data entry errors is practically non-existent. Finally, since the WOLF is a data base, versus just a collection of source documents, as would have been the case for the various maintenance units' records, it was a very simple matter to change the search parameters and conduct a wide variety of different queries based on the relative importance of specific data elements.

Ironically, these strengths are, to some degree, also weaknesses. The use of a historical data base limited the amount of detailed analysis that could be done to isolate data points that fell well outside the anticipated range. Had the purpose of this study been more heavily oriented on answering why or how SFDLR was affecting units, versus simply has it, this weakness would have been a major disadvantage.

Although the floppy disk format for providing data to the WOLF greatly reduces the risk of data entry errors, MRSA acknowledges that they only receive about 90 percent of the required weekly submissions.[24] This is clearly a significant weakness associated with using the WOLF as a data source, but it is very likely that similar gaps in the availability of the actual source documents would have been experienced had the data been requested directly from the nine CONUS divisions.

Strengths and Weaknesses of the RIDB as a Data Source

The RIDB was chosen as the source for equipment availability rates for essentially the same reasons as mentioned in the preceding discussion about the WOLF -- immediate accessability to data on all nine of the CONUS divisions at one time and the abi ty to structure searches in a variety of different ways. Unfortunately, the RIDB does not share the WOLF's strength of low data entry error risk as the data is extracted from the monthly equipment readiness reports which are submitted by the units in the field as discussed earlier. The RIDB does, however, enjoy a better reporting rate than the WOLF, and due to the high degree of command emphasis that is placed on the accuracy of the monthly source documents, it is generally accepted that the data in the RIDB is fairly accurate. Since the RIDB is another central data base, however, it has all of the same weaknesses as the WOLF. But once again, using the RIDB was preferred to the alternative of requesting equipment availability data directly from each of the nine

CONUS divisions due to the need to collect data for as long as possible before starting the analysis phase.

Strengths and Weaknesses of the LIF as a Data Source

The primary reason for using the LIF as the source for DLR requisition data was, as with both the WOLF and RIDB, rapid accessability to data on all nine of the CONUS divisions at the same time. Although all units should now be tracking their DLR expenditures very closely, there was no reason or requirement for them to monitor this type of information prior to the full implementation of the Army's SFDLR program. Additionally, extracting this data from the source documents at the division level would have been an extremely complex and labor intensive task. Using the LIF facilitated the 100 percent sampling of all nine CONUS divisions, thereby improving the sample data's validity.

The one significant weakness with this approach is that it limited this analysis to only those requisitions that were submitted to the wholesale level of the supply system. Any DLR demands that were filled from stocks at the installation or by repair at the general support level maintenance activity would not be reflected in the LIF. But as previously mentioned, since the objective of this study was the identification of trends rather than the analysis of what had caused those trends, it was determined that this level of data was adequate. Additionally, by using the LIF, a standard baseline was established which made comparing the different divisions to each other possible.

Strengths and Weaknesses of the Analytical Process

Based on the Navy's experience with their program to stock fund DLRs, it appears that there is more than just a casual relationship between equipment availability rates and the adoption of an SFDLR methodology. An analysis of the objectives and impacts of the Army program extends this relationship to equipment repair rates and the dollar value of DLRs requisitioned as well. Given these relationships, the most logical approach to determine the degree to which the factors are related is regression analysis.

The major problem with this analytical approach is that the number of data points on which the calculations could be based was very limited due to the short amount of time since the Army's SFDLR program was implemented. The fact that many of the regression calculations used only three data points contributed to rather low coefficients of determination. Additionally, if the intent had been to use the resulting linear equations to forecast future rates, the range of values needed to have a reasonable degree of confidence in the estimate would have been extremely high. Although these weaknesses limit the value of this phase of the analysis in regards to projecting the future impacts of the Army's SFDLR program, several of the specific weapon system trends appear to be statistically viable enough to indicate that the general trends that were noted deserve further investigation.

Summary

This chapter has provided a discussion of the research methodology that was used to address the thesis topic. It described the four step process: the literature review, data collection, data analysis and the development of conclusions based on that analysis, that was used to answer the primary and supporting research questions. It provided a discussion of the strengths and weaknesses of the research methodology with emphasis on the analytical method selected and the choice of data sources.

CHAPTER 4

ANALYSIS

> We usually see only the things we are looking for - so much so that we sometimes see them where they are not.
>
> Eric Hoffer, The Passionate State of Mind

Introduction

This chapter presents an analysis of three related categories of data: equipment availability rates, the mean number of manhours required to repair non-operational items of equipment and the dollar value of requisitions for DLRs. In all three instances, the data used in the analysis spans five calendar year quarters, from 1 September 1991 through 31 December 1992. Additionally, it was based on reports from the following nine CONUS units: 1st Cavalry Division, 1st Infantry Division, 4th Infantry Division, 5th Infantry Division, 7th Infantry Division, 10th Mountain Division, 24th Infantry Division, 82d Airborne Division and the 101st Airborne Division. The first two categories of data form the basis for evaluating the impact that the SFDLR program has had on equipment availability rates. The latter one is indicative of how well the program is meeting its primary objective of reducing defense related costs.

The analysis process was conducted in four phases. The first one consisted of reviewing all three categories of data to identify any immediately obvious trends when division level totals were considered. The second phase involved a more detailed investigation of availability rates and repair times for twenty-seven items of equipment that were relatively common to all nine of the CONUS units. For this phase, the items were grouped into one of three general categories, rotary wing aircraft, combat systems and combat support systems. These three groups were then compared to determine whether or not the SFDLR program was having a more pronounced impact on a particular type of equipment. The third phase evaluated the same twenty-seven items, but on an individual weapon system basis. During each of these phases, bar graphs were used to simplify the visual identification of trends, and the observed trends were compared with the expected trends to determine if the SFDLR program was having the anticipated impact on the data elements being studied. The final step of this study was to analyze the data via regression analysis. The objective of this phase was to determine if a linear relationship existed in any of the following areas: between equipment availability rates and time, between repair rates and time, between the dollar value of DLRs requisitioned and time, and finally, between equipment availability rates and repair rates.

Division-Level Analysis

This initial step of the analysis evaluated the dollar value of DLR requisitions submitted to the wholesale level of the Army supply system, equipment availability rates, and the mean number of manhours required per repair action at the direct support maintenance unit level.

Dollar Value of DLR Requisitions

The most obvious trend observed during this portion of the analysis was that all of the divisions requisitioned far fewer DLRs during the calendar year quarter immediately following the full implementation of the SFDLR program.

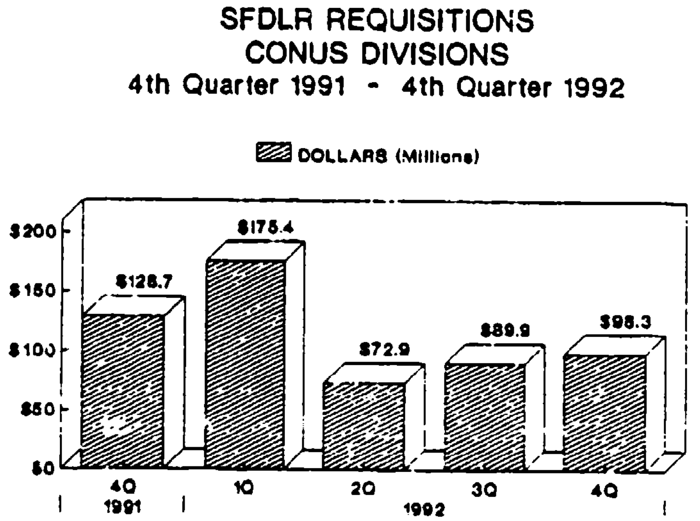

Figure 1

As Figure 1 shows, the total aggregate dollar value of these requisitions for all nine of the active duty CONUS divisions dropped from over $175 million during the first quarter of 1992 to slightly less than $73 million during the following three months. Although this drop in demands is well above the 10 percent decline that had been expected by the advocates of the SFDLR program, the rising trend that follows in the remaining quarters of 1992 was probably not expected. Of perhaps even greater significance is that while six of the nine divisions had an upward trend in the dollar value of DLR demands prior to 1 April 1992, seven are showing an upward trend after that date. Additionally, four of the seven divisions, the 4th, 7th and 24th Infantry as well as the 101st Airborne, are very close to, or have already exceeded, their first quarter 1992 dollar threshold after only nine months of operations under the Army's SFDLR program (see Figures 10 through 18). As with the aggregate figure, this is not the long-term, downward trend in demand that was anticipated given the US Navy's experience.

Equipment Availability

While not nearly as dramatic as the changes in the dollar value of DLRs requisitioned, a subtle change in equipment availability rates was also detected during this initial stage of the data analysis process. Figure 2 shows that, as a group, the nine divisions were in a period of rising equipment availability prior to 1 April 1992. This trend does continue as expected for six months following the implementation of the SFDLR program, but appears to end

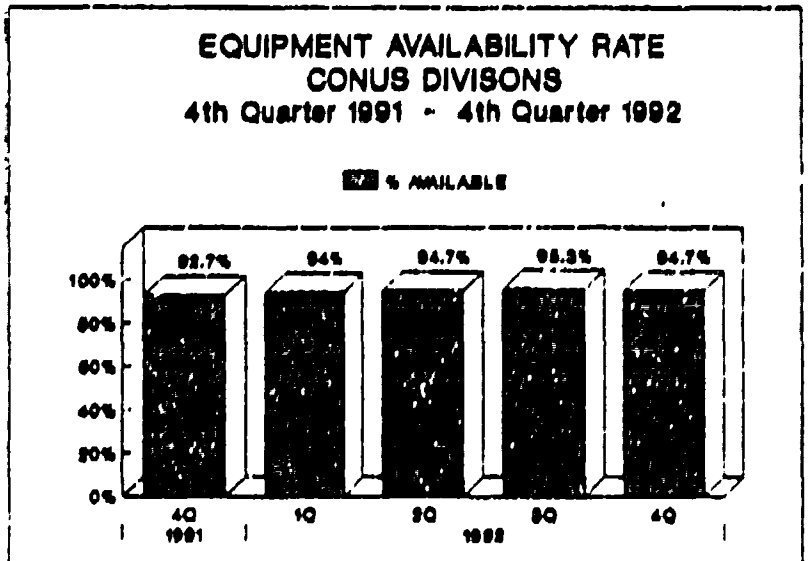

Figure 2

in the fourth quarter of 1992 with a return to the second quarter's level of availability, 94.7 percent. Given the Navy's experience regarding the impact of SFDLR, however, the rising trend should not have stopped. Admittedly, some more time will be needed to see if this reversal develops into a true downward trend.

When the divisions are evaluated individually, this reversal is even more readily apparent. During the six month period prior to 1 April 1992, all but two of the nine divisions were experiencing stable or rising equipment availability rates. In fact, three of the divisions, the 1st Cavalry, 1st Infantry and 101st Airborne had gains of two percentage points or more. From the second quarter of

1992 onward, however, only three divisions have continued this favorable trend and three, the 4th and 5th Infantry as well as the 10th Mountain, now appear to be on a downward path (see Table 1 and Figures 19 to 27). Admittedly, this drop of only a few percentage points in readiness rates is not a basis for immediate alarm. But, when this change is compared to the Navy's experience of a 10 percent rise in availability it is certainly not a good early trend.

EQUIPMENT AVAILABILITY
CONUS DIVISIONS
4th Quarter 1991 - 4th Quarter 1992

UNIT	4Q91	1Q92	2Q92	3Q92	4Q92
1st CAV	.87	.92	.93	.94	.94
1st INF	.87	.92	.93	.93	.94
4th IN	.93	.93	.94	.95	.93
5th INF	.93	.94	.95	.94	.94
7th INF	.97	.96	.96	.96	.98
10th MTN	.97	.96	.96	.97	.96
24th INF	.94	.94	.95	.96	.95
82d ABN	.94	.94	.96	.97	.96
101st ABN	.93	.95	.95	.96	.96
AVERAGE	.93	.94	.95	.95	.95

Table 1

Equipment Repair Rates

Viewed individually, from the division-level of resolution, equipment repair rates have also not responded to the full implementation of the Army's SFDLR program as expected. Prior to 1 April 1992, the 7th Infantry was the only division experiencing a rise in the mean number of direct support level manhours spent per maintenance work request. All other divisions were recording declining or stable mean time to repair rates (see Figures 28 to 36). In fact, three of the units, the 1st Cavalry, 1st Infantry, and 101st Airborne, actually reduced the average number of manhours spent per repair by over thirty minutes per job between the last quarter of 1991 and the first quarter of 1992. After 1 April 1992, equipment repair rates in three units, the 10th Mountain, 82d Airborne and 101st Airborne, show a slight increase, although the aggregate mean time to repair for all nine divisions continued to fall as shown in Figure 3.

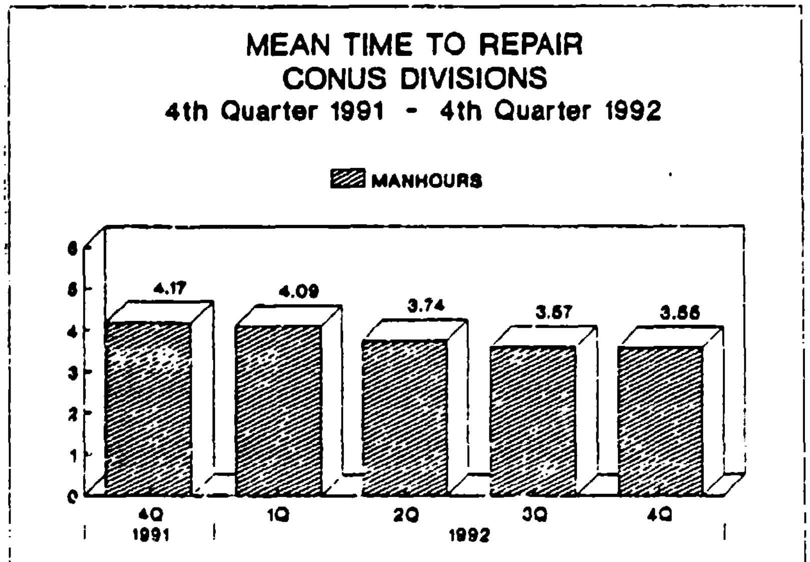

Figure 3

Admittedly, this downward trend in repair times is not one that most commanders would lose any sleep over. It does not, however, reflect the expected increase in mean time to repair rates that seems unavoidable under the SFDLR methodology. This rise was anticipated as mechanics should be spending more time performing malfunction diagnosis and DLR repair versus replacement given the monetary incentives that are inherent in the program.

Composite System Grouping-Level Analysis

During this phase of the data analysis process, equipment availability rates and repair times for each of three general categories, rotary wing aircraft, ground combat weapon systems and combat support systems, were considered. Nine different models of five Army aircraft: the UH-60, Blackhawk; the AH-64, Apache; the AH-1E, AH-1F and AH-1S, Cobra, the UH-1H, Huey and the OH-58A, OH-58C and OH-58D, Kiowa helicopters were consolidated into the general category of Army aircraft. Ground combat weapon systems, including the M1 and M1A1, Abrams Main Battle Tank, the M2 and M3 family of Bradley Fighting Vehicles, the M113 series of armored personnel carriers, the M109 series of self-propelled howitzers as well as the M101, M102, M119, and M198 series of towed howitzers, make up the second category. The M998, High Mobility Multi-purpose Wheeled Vehicle (HMMWV); the M923, M925, and M813 family of 5-ton cargo trucks; the M936 and M816 series of 5-ton wreckers; the M4K, 2-ton rough terrain forklift; and the MEP-16A and MEP-26A series 3 kilowatt generators compose the final category, combat support systems.

Army Aircraft

Of the three composite system groupings, the Army's rotary wing aircraft fleet demonstrated the most definitive early trends. Figure 4 shows that availability rates for aircraft were rising sharply prior to the second quarter of 1992, reaching their peak at just over 80 percent, but have fallen by four percentage points during the following six months. As was noted in the division-level phase of this analysis, this reversal of a rising trend is not what was expected.

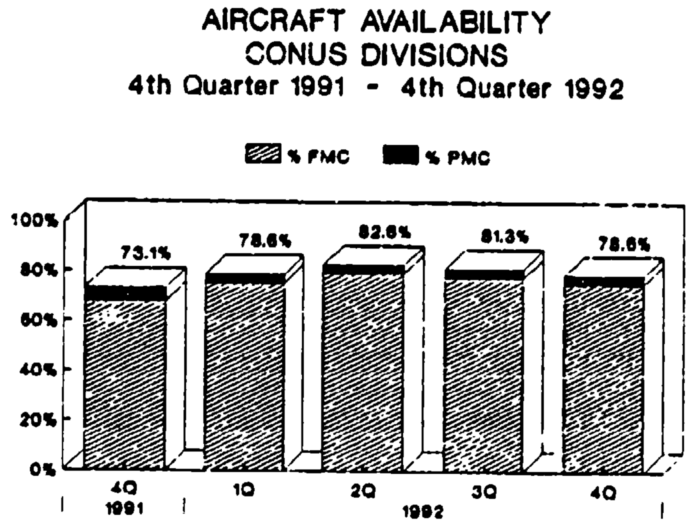

Figure 4

The trend in aircraft mean time to repair, unlike the one observed during the division-level phase, was clearly downward, but appears to have reversed itself in the quarter following the noted drop in availability rates. After falling by 25 percent, from a high of slightly less than 20 hours during the first three months of 1992, the fourth quarter mean time to repair rose to almost 17 hours per maintenance work order (see Figure 5). Given the very complex nature of these weapon systems and the high dollar value of aviation DLRs, this change was anticipated.

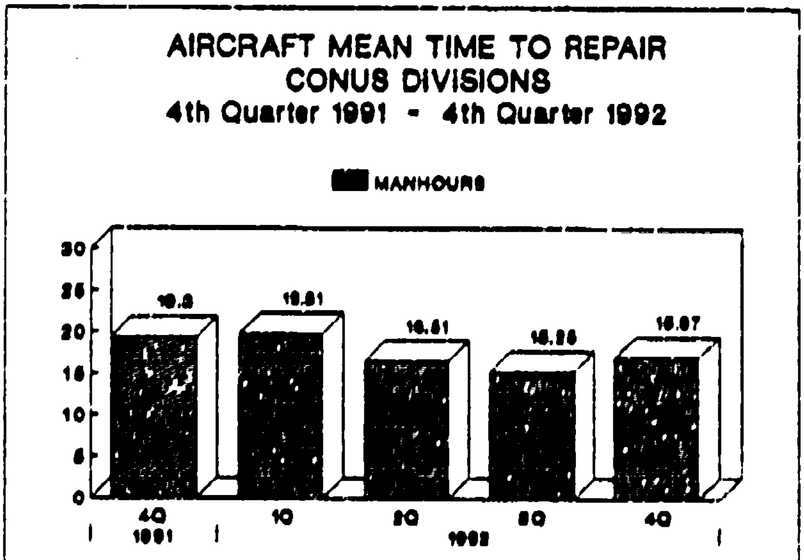

Figure 5

Ground Combat Systems

Trends in equipment availability for this category, although not as dramatic, parallel those observed in Army aircraft. The second quarter of 1992 marks the upper limit of a rising trend in equipment availability rates, which then decline during the following six months by just under two percentage points, to 91 percent (see Figure 6). As with the aircraft composite group, this group's reversal of a rising availability trend was not anticipated.

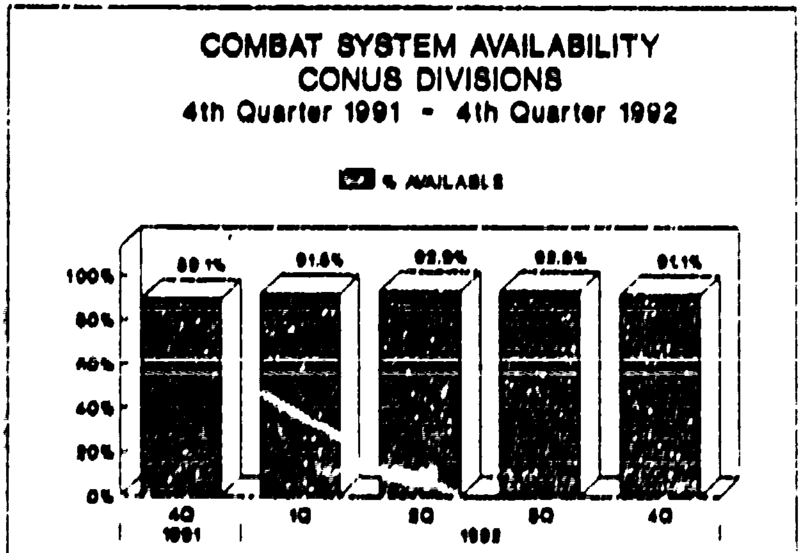

Figure 6

Repair rates for this composite grouping fluctuate too widely to establish a clear trend over the course of the evaluation period. Figure 7 does, however, show that the lowest mean time to repair rate was recorded in the second quarter of 1992 with slightly higher repair times observed in both the preceding and succeeding six month periods. Though it is extremely difficult to determine

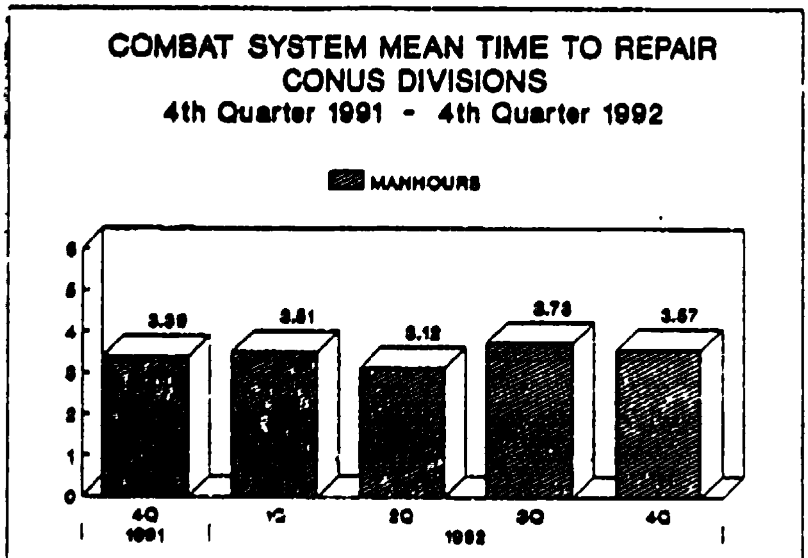

Figure 7

with any degree of certainty, it would appear that, as expected, this group of equipment has reversed a declining trend in mean time to repair rates.

Combat Support Systems

The implementation of the SFDLR methodology does seem to have had the anticipated effect on this composite equipment grouping. Figure 8 shows that an upward trend in equipment availability rates has continued throughout the fifteen months under study, rising two percentage points.

Although the availability rate trend for this final group has developed as expected, the mean time to repair trend has not. After a one-hour rise in the first quarter of 1992, to just under five and one-half hours, mean time to repair has declined throughout the year to a low of just over four hours in the final quarter (see Figure 9).

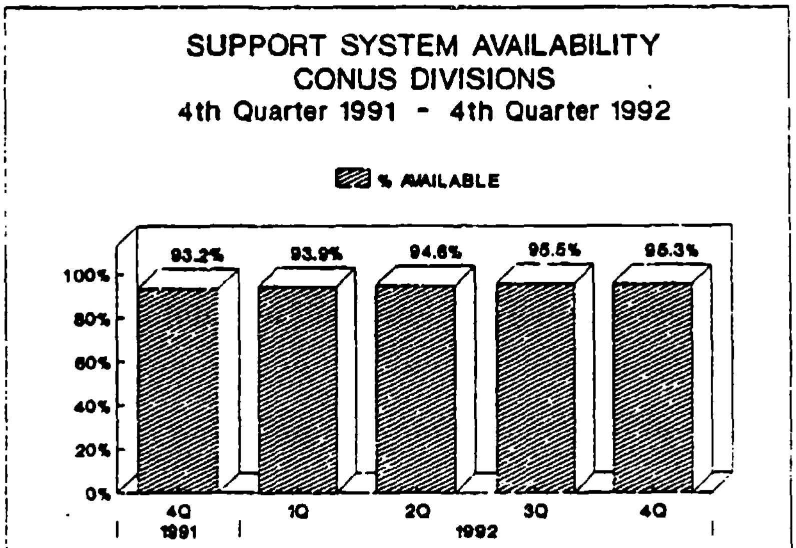

Figure 8

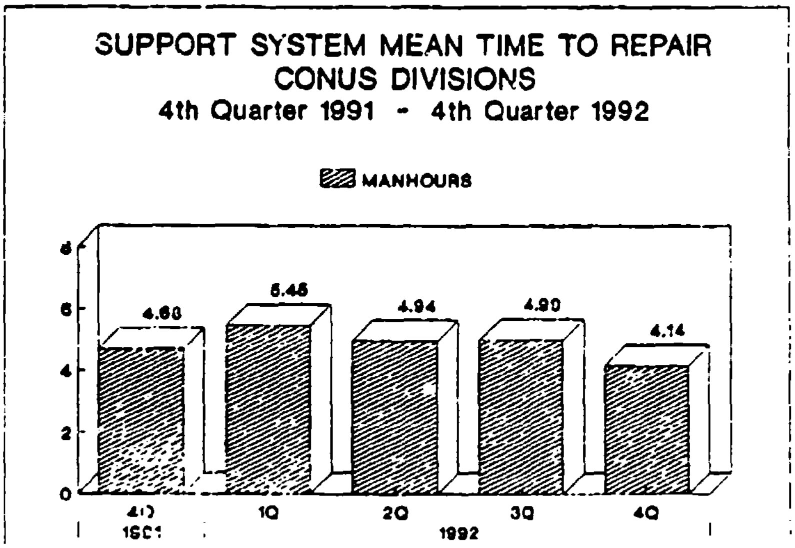

Figure 9

Weapon System Level Analysis

During this phase of the data analysis process, a more detailed investigation of equipment availability and repair rates was conducted for the same twenty-seven items of equipment that were considered in the first two phases. The aircraft studied included: the UH-60, Blackhawk; the AH-64, Apache; the AH-1E, F and S models of the Cobra; the UH-1H, Huey; and the OH-58A, C and D models of the Kiowa helicopter. Additionally, the ground combat weapon systems considered were: the M1 and M1A1, Abrams Main Battle Tank; the M2 and M3 family of Bradley Fighting Vehicles; the M113 series of armored personnel carriers; the M109 series of self-propelled howitzers; and the M101, M102, M119 and M198 series of towed howitzers. The service support systems studied included: the M998, High Mobility Multi-purpose Wheeled Vehicle (HMMWV); the M923, M925, and M813 series of 5-ton cargo trucks; the M936 and M816 series of 5-ton wreckers; the M4K, 2-ton rough terrain forklift; and the MEP-16A and MEP-26A series 3 kilowatt generator. Due to space limitations, the thirty bar graphs developed during this phase of the analysis have been consolidated for quick reference following the endnotes at pages 93 through 107.

AH-64, Apache

Seven of the nine CONUS divisions reported having the Apache as an authorized piece of equipment. Viewed in the aggregate, equipment availability was improving prior to April 1992, but has declined slightly since that date (see Figure 37). Five of the seven divisions report lower availability rates after the implementation of SFDLR, with the worst decline occurring in the 1st Cavalry where the fully mission capable rate has fallen from 80 percent in the second quarter of 1992 to 63 percent only two quarters later. A reversal of a declining trend line in the mean number of manhours spent per direct support maintenance workorder also occurs one quarter after the change in the availability rate trend as shown in Figure 38.

OH-58, Kiowa

All nine CONUS divisions reported that they were authorized one or more models of the OH-58. An upward trend in equipment availability rates for the weapon system within all nine of the divisions existed prior to the start of the SFDLR program. However, like the AH-64, the Kiowa's availability has also begun to decline slightly, although the reversal does not occur until the fourth quarter of 1992 as shown in Figure 39. In fact, the 101st Airborne is the only unit that has reported higher availability rates under SFDLR, and a major decline in readiness has occurred in the 1st Infantry. The fully mission capable rate there fell by over ten percentage points, from 85 to 71 percent, between the third and fourth quarters of 1992. Mean time to repair figures for the OH-58 have varied widely, falling from over 14 hours in the second quarter of 1992 to less than 10 hours in the third, only to rebound to more than 16 hours in the fourth quarter (see Figure 40).

UH-60, Blackhawk

Eight of nine CONUS divisions have reported the Blackhawk as an authorized piece of equipment. Equipment availability for this aircraft was improving sharply prior to April 1992, rising almost 15 percent in the two quarters analyzed. But like both of the previous Army aircraft, the UH-60's availability rates also begin to decline following the second quarter of 1992 (see Figure 41). All eight divisions are reporting lower availability under SFDLR, with the worst decline occurring in the 1st Infantry where the fully mission capable rate has fallen by more than twenty points, to below 60 percent, in the fourth quarter of 1992. Ironically, Figure 42 shows a steady downward trend in mean time to repair that has continued without interruption since the fourth quarter of 1991, declining by ten hours during the fifteen month period covered by this research effort.

AH-1, Cobra

All nine CONUS divisions reported having some version of the Cobra as a authorized item of equipment. Viewed from a weapon system perspective, these rates are changing very similarly to those of the Kiowa -- rising through the third quarter of 1992 and then declining in the fourth -- as shown in Figure 43. At the division-level of analysis, the changes were mixed with three divisions reporting higher and three reporting lower availability rates under SFDLR. The worst decline takes place in the 101st Airborne where the fully mission capable rate fell to 71 percent in the fourth quarter of 1992. Mean time to repair for the AH-1 declined through the third quarter of 1992, but rose slightly in the fourth (see Figure 44).

UH-1, Huey

Eight of the nine CONUS divisions report having the UH-1 as an authorized piece of equipment. Weapon system availability for the Huey was improving prior to the second quarter of 1992, and has fallen less than 5 percent since that date (see Figure 45). All divisions, except for the 7th Infantry, report lower availability rates under SFDLR. The relatively minor declines in the 10th Mountain and the 101st Airborne have mitigated more severe declines in other divisions as these two units account for 60 percent of the total fleet under evaluation. By far, the worst decline occurs in the 1st Cavalry where the fully mission capable rate has fallen from 81 percent in the second quarter of 1992 to 38 percent in the fourth. A slightly declining trend line is noted in the mean number of manhours spent per direct support maintenance workorder, but quarterly fluctuations of several hours, as shown in Figure 46, makes the identification of any real trend difficult.

M1, Abrams Main Battle Tank

Five of the nine CONUS divisions report having the M1 as an authorized piece of equipment. When viewed in the aggregate, SFDLR seems to have had a positive impact on the availability of this combat weapon system (see Figure 47). Equipment availability rates were improving slightly prior to April 1992, and the drop of five percent since that date is due, at least in part, to the 75 tanks the 4th Infantry reported at 0 percent availability for the entire fourth quarter of 1992. If this anomaly, which is attributed to the division replacing their M1s with M1A1s, is removed from the sample data base, the overall availability trend, even after SFDLR implementation, is positive. In fact, the only unit besides the 4th Infantry that is reporting lower availability rates under SFDLR is the 5th Infantry, which has experienced a one percent drop since the second quarter of 1992. A slightly declining trend line in the mean time required for repairs prior to SFDLR, however, has clearly been reversed, with the aggregate rate rising from just over two and one half hours in the second quarter of 1992 to almost four hours in the fourth quarter (see Figure 48).

M2/M3, Bradley Fighting Vehicles

Five of the nine CONUS divisions report having the M2/3 as an authorized piece of equipment. In comparison to the M1, SFDLR seems to have had a more pronounced impact on this weapon system. Equipment availability was improving prior to April 1992, rising almost 10 percent between the 4th quarter of 1991 and the 2d quarter of 1992, but has fallen almost two percent since then (see Figure 49). The most significant declines occur in the 5th Infantry, a five percent drop in the M2 rate; in the 24th Infantry, a five percent drop in the M3A1 rate; and in the 1st Cavalry, an eleven percent drop in the M3A2 rate. Figure 50 depicts a slowly rising trend line in mean time to repair that was present prior to SFDLR and continued after 1 April 1992, except for a brief drop of almost one hour in the third quarter.

M113, Armored Personnel Carrier

Availability rates for M113s were reported by six of the nine CONUS divisions. Considered in the aggregate, SFDLR seems to have had very little impact on this combat weapon system. Equipment availability has continued to improve during the entire 15 months covered by this study effort as shown in Figure 51. The only reported decline, a drop of less than two percent, occurs in the 5th Infantry. A slowly falling trend line in mean time to repair prior to SFDLR also continues after 1 April 1992, although the rate of decline does appear to be decreasing (see Figure 52).

M109, Self-Propelled Howitzer

Five of the nine CONUS divisions have reported the M109 as an authorized piece of equipment. Availability rates for this weapon system were on the rise prior to April 1992, but are now declining slightly (see Figure 53). Only one division, the 1st Infantry, has reported higher availability rates under SFDLR, while the worst decline occurred in the 5th Infantry where M109 availability rates have fallen by eight percentage points, from 98 percent in the second quarter to 90 percent in the fourth quarter of 1992. Mean time to repair for the M109 has varied each quarter, reaching a high of over three and one-half hours in the third quarter of 1992 and a low of just over two and one-half hours the previous quarter. Despite these wide fluctuations, the general trend for mean time to repair rates does appear to be slightly upward (see Figure 54).

Towed Howitzers

The M119, M101, M102, or M198 howitzers have been reported as authorized equipment by four of nine CONUS divisions. Viewed in the aggregate, SFDLR seems to have had the expected impact on equipment availability for this weapon system (see Figure 55). Only two of the divisions, the 10th Mountain and the 82d Airborne, reported lower availability rates under SFDLR, with the sharpest decline occurring in the 10th Mountain where availability rates for the M198 are down four percent since full implementation on 1 April 1992. Mean time to repair for the towed howitzers has fluctuated from quarter to quarter. The high was over five hours in the third quarter of 1992, and the low was under three and one-half hours during both the previous and subsequent three-month periods. Despite these variances the general trend appears to be slightly downward as shown in Figure 56.

M998, High Mobility Multi-Purpose Wheeled Vehicle

All nine CONUS divisions report having the M998 as an authorized piece of equipment. When considered in the aggregate, SFDLR seems to have had a minor impact on this combat support system. Figure 57 reflects that equipment availability rates for this system were improving slightly prior to April 1992, but have flattened out since the third quarter of 1992. No significant declines occur in any of the units studied, although the 1st Infantry has reported a minor decrease of one percent in the last three quarters. A slowly falling trend line in mean time to repair prior to the full implementation of SFDLR has continued throughout the five quarters under investigation (see Figure 58).

M923, M925, and M813, 5-Ton Cargo Trucks

Repair and availability rates for the M923, M925, and M813 series of drop side cargo trucks were reported by all nine CONUS divisions. When viewed in the aggregate, equipment availability rates for this support system were also improving slightly prior to 1 April 1992. Like the Kiowa helicopter, availability is now declining slightly -- less than one percent -- although the reversal did not take place until the fourth quarter of 1992 (see Figure 59). Two divisions, the 4th and 24th Infantry report the most significant declines, losing five points in their M923 and M925 cargo truck fleets respectively. Slightly rising or steady rates in other units which have more trucks have helped offset these declines for the most part. Mean time to repair for these 5-ton trucks rose through the third quarter of 1992, but dropped sharply from over five hours to less than three in the fourth quarter (see Figure 60).

M936 and M816, 5-Ton Wrecker

All nine CONUS divisions report having 5-ton wreckers as authorized items of equipment. SFDLR seems to have had a favorable impact on this combat support system. A slightly rising trend in equipment availability rates prior to April 1992 has continued through the final quarter of 1992 as reflected in Figure 61. No declines of more than three percent were noted in any of the reporting units, and three divisions, 1st Cavalry, 7th Infantry, and 101st Airborne, all reported increases of over five percent since 1 April 1992. A nine-month-long declining trend in mean time to repair rates has, however, stopped and turned upward during the fourth quarter of 1992. (see Figure 62).

M4K, 2-Ton Rough Terrain Forklift

Availability and repair rates on the M4K forklift have been reported by all nine CONUS divisions during the entire period covered by this study effort. Availability rates for this system were clearly on an upward trend before 1 April 1992, but are now declining. As was the case with the OH-58, the downturn in the readiness of this support system did not occur until the final quarter of 1992 (see Figure 63). Four divisions, the 1st Cavalry, as well as the 5th and 7th Infantry and the 101st Airborne all report significant declines, losing over five percentage points in their forklift fleets. The mean time to repair rate for the M4K followed a track very similar to that of the M936 wrecker, three quarters of declining rates are followed by a rise during in the final quarter of 1992 as shown in Figure 64.

MEP16A and MEP-26A Generator Set

All nine of the CONUS divisions reported having all four models of this 3 kilowatt generator as an authorized piece of equipment. And, it would appear that SFDLR has had a very minor impact on this system's availability. A slight upward trend in equipment availability rates prior to April 1992 stopped during the fourth quarter and has declined by approximately 1 percent (see Figure 65). The 4th Infantry reported a sharp decline in availability, over three percent since 1 April 1992, but most CONUS divisions have simply retreated one or two points to their second quarter level of readiness. Figure 66 shows that there has been a year-long rising trend line in mean time to repair rates. This trend begins in the first quarter of 1992 and continues steadily throughout all four quarters.

Regression Analysis

This final step in the analysis process involved the use of regression analysis to evaluate the statistical validity of the trends identified in the preceding phases. Using a linear regression software application, linear equations as well as the coefficients of determination were calculated for all three categories of data at the three levels of resolution previously discussed. The purpose of these computations were to determine the slope of the observed trend lines as well as whether or not the trends that have developed since 1 April 1992 could be used to predict future events. For all three sets of calculations, time was used as the independent variable with the dollar value of DLRs requisitioned, percent of equipment available or mean manhours to repair used as the respective dependent variable. Additionally, a second regression calculation was done for each of the fifteen weapon systems using mean time to repair as the independent variable and availability as the dependent variable to determine if the intuitively linear relationship between these two factors was supported by the sample data.

The first set of regression calculations, with some exceptions, resulted in some extremely low coefficients of determination as shown in Tables 2 and 3. These low values

Table 2. Results of Linear Regression Calculations at the Division and Composite Group Level of Analysis

Factor Computed	Slope Expected	Slope Computed	Coefficient of Determination
Division Level Analysis			
SFDLR Requisitions	-	+	.620
Availability Rates	+	N/A	.000
Mean Time to Repair	+	-	.828
Composite Group Analysis			
Aircraft Availability	+	-	.961
Aircraft MTR	+	+	.067
Combat System Availability	+	+	.792
Combat System MTR	+	+	.506
Support System Availability	+	+	.550
Support System MTR	+	-	.703

indicate that, for the most part, the changes in dollars, equipment availability and mean time to repair could not be attributed to the SFDLR program only.

A number of notable exceptions to the generally low coefficients of determination were found at each level of resolution. At the division-level of analysis, 62 percent of the upward trend in dollars spent on DLRs and 82 percent of the downward trend in mean time to repair appears to be tied to the implementation of the Army SFDLR program. For the composite system-level data, the aircraft and combat system groups' declining availability over time resulted in a 96 and 79 percent correlation respectively. The weapon system-level of analysis had a total of three aircraft, the AH-64, UH-60 and UH-1, and two combat systems, the M2/3 and M109, with correlations of between 40 and 87 percent for

Table 3. Results of Linear Regression Calculations at the Weapon System Level of Analysis

Factor Computed	Slope Expected	Slope Computed	Coefficient of Determination
AH-64 Availability	+	-	.874
AH-64 MTR	+	+	.691
OH-58 Availability	+	-	.002
OH-58 MTR	+	+	.074
UH-60 Availability	+	-	.480
UH-60 MTR	+	-	.915
AH-1 Availability	+	-	.041
AH-1 MTR	+	+	.034
UH-1 Availability	+	-	.504
UH-1 MTR	+	+	.224
M1 Availability	[illegible]	-	.074
M1 MTR	+	+	.500
M2/3 Availability	+	-	.407
M2/3 MTR	+	+	.141
M113 Availability	+	+	.001
M113 MTR	+	-	.882
M109 Availability	+	-	.453
M109 MTR	+	+	.007
Howitzer Availability	+	+	.068
Howitzer MTR	+	+	.001
M998 Availability	+	+	.002
M998 MTR	+	-	.592
5 Ton Availability	+	+	.049
5 Ton MTR	+	-	.755
Wrecker Availability	+	+	.091
Wrecker MTR	+	-	.007
Forklift Availability	+	-	.005
Forklift MTR	+	-	.032
Generator Availability	+	-	.136
Generator MTR	+	+	.999

the drop in equipment availability rates over time. Other exceptions at this level included the rising mean time to repair trends for the AH-64, M1, and 3 kilowatt generator, and the downward trend in mean time to repair rates for the UH-60, M113, M998, and 5-Ton Cargo Truck.

The second set of regression calculations also resulted in fairly low coefficients of determination as shown in Table 4. These results indicate that, again with a few exceptions, the data used does not provide a high degree of correlation between changes in availability rates and changes in mean time to repair.

Table 4. Results of Linear Regression Calculations: Mean Time to Repair versus Availability Rates

Level\	Slope		Coefficient of
Weapon System	Expected	Computed	Determination
Division Level	-	-	.828
Aircraft Group	-	-	.506
Combat System Group	-	-	.001
Support System Group	-	-	.091
AH-64	-	-	.641
OH-58	-	-	.327
UH-60	-	-	.079
AH-1	-	-	.958
UH-1	-	-	.101
M1	-	-	.146
M2/3	-	-	.001
M113	-	-	.897
M109	-	-	.021
Towed Howitzer	-	-	.901
M998	-	-	.214
5-Ton Cargo	-	-	.077
5-Ton Wrecker	-	-	.011
2-Ton Forklift	-	-	.151
3 KW Generator	-	-	.143

Summary

This chapter has presented the analysis of three related categories of data: equipment availability rates, the mean manhours required to repair non-operational items of equipment and the dollar value of requisitions for DLRs submitted as they relate to nine active duty, CONUS based divisions. The first two categories of data form the basis for evaluating the impact of the Army's SFDLR program on equipment availability, and the latter is indicative of how well the SFDLR program is meeting its primary objective of reducing defense related costs. Based on the results of this analysis several conclusions and recommendations have been drawn. These will be presented in the final chapter.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

Disagreement is not disrespect.

General Gordon R. Sullivan

Introduction

This thesis has investigated the impact that the stock funding of DLRs has had on equipment availability within the nine CONUS based, active Army divisions since 1 April 1992. Answering this question has been achieved by answering the following subordinate research questions.

1. Have equipment availability rates changed since the Army fully implemented its program to stock fund DLRs?

2. Has the time it takes to repair non-operational pieces of military equipment changed since 1 April 1992?

3. Have demands for DLRs declined now that the using unit is required to pay for them?

This chapter will present the answers to these questions as well as several recommendations for further research.

Equipment Availability Rates

Equipment availability rates have changed slightly since the Army fully implemented its program to stock fund

DLRs. Although the sustainment of equipment availability rates was not among the three thrusts of the Army's SFDLR program, the Navy's experience indicated that a rise in materiel availability is possible when an SFDLR methodology is used. Furthermore, the mission of the Army demands that the stock funding of DLRs not have a significant adverse impact on equipment availability rates.

Based on the data used in this study, equipment availability rates have not significantly declined as a result of the Army's SFDLR program. Unfortunately, the positive impact that the Navy enjoyed has not materialized yet either. Additionally, certain types of Army equipment, especially the more complex and expensive systems, such as Army aircraft, Abrams Tanks, and Bradley Fighting Vehicles, appear to have developed a definite downward trend in availability since the SFDLR methodology was adopted.

Although the analysis of the trends that were identified indicates that they are, for the most part, not statistically sound enough to say that the SFDLR program is directly responsible for degrading equipment readiness, the noticeable decrease in aircraft availability, and to a lesser degree in selected ground combat weapon systems, should be a matter of concern. The actual cause, or causes, of these developing trends must be identified, and corrective actions must be taken to reverse the decline in the readiness of these critical combat weapon systems.

Equipment Repair Rates

The time it takes to repair a piece of military equipment has changed since 1 April 1992. The SFDLR program encourages units Army-wide to repair unserviceable DLRs at the appropriate maintenance level and requisition a replacement only when the required repair is beyond the unit's authority, capability or capacity. Based on this aspect of the SFDLR program, an increase in the number of manhours required to perform many types of repairs at the direct support maintenance level was anticipated. This increase in repair times would be a direct result of the additional time required to accurately diagnose the cause of an equipment malfunction and then repair, rather than replace, the defective DLR component.

Based on the data collected, a generally upward trend in mean time to repair rates since 1 April 1992 has not developed. When viewed from the perspective of all nine CONUS divisions, there is a clearly downward trend in mean time to repair. This result runs contrary to the expected need for mechanics to spend more time diagnosing and troubleshooting the cause of a malfunction, and then repair versus replace a defective DLR. At the weapon system level of resolution, a rising trend for mean time to repair was noted for nine of the fifteen systems studied, although six declining trends appear to offset this point. Only six of the fifteen items studied had a linear trend line with a coefficient of determination of 70 percent or higher, but, five of these trends were downward. The lack of a statistically sound linear relationship between changes in mean time to repair and availability rates, based on the data collected, is one possible explanation for this unexpected discovery.

Requisitions of DLRs

The dollar value of demands for DLRs has dropped now that the using unit is required to pay for all costs related to the item. Since DLRs are no longer funded by a procurement appropriation and "free issued" to the requesting unit, this decline in the total dollar value of DLRs requisitioned was expected. This anticipated drop, like the projected rise in repair times, should have been a direct reflection of the increased efforts to repair items at the appropriate maintenance level and in so doing, avoid the financial impact of requisitioning a new DLR.

The results of this research clearly indicate a significant drop in the dollar value of DLRs requisitioned between the first and second quarters of 1992. Although this decrease -- over $100 million -- is noteworthy, the trend since 1 April 1992 is upward. The fact that several of the divisions under evaluation are already near, or have even exceeded, their pre-SFDLR dollar level of requisition level runs contrary to what was expected. And when you consider that the amount of savings that the SFDLR program was expected to achieve was deducted from the Army budget in advance, if units return to their earlier levels of DLR demands, it will not take long for the program to get into serious financial trouble.

Areas for Further Research

Although the Army adopted a stock fund methodology for DLRs primarily to take advantage of its potential to reduce the costs associated with maintaining combat weapon systems, the program has the potential to impact on a wide variety of other areas. In light of the rather rapid pace with which the implementation was undertaken, further study of a number of these seems justified. The following sections will briefly describe three of the key spin-offs that could reasonably be expected as a result of the SFDLR program and why they should be investigated.

The Impact of SFDLR on Direct Support Maintenance Doctrine

The SFDLR program uses financial constraints to encourage units Army-wide to repair unserviceable DLRs at the appropriate maintenance level, and only requisition a replacement when the required repair is beyond the unit's authority, capability, or capacity. While this makes great "business" sense, the overriding mission of the military is to be prepared to go to war in defense of our nation's vi l interests. In light of that mission, direct support level maintenance doctrine stresses quickly returning pieces of military equipment to an operational condition, with emphasis on the replacement of defective components. This doctrine is reflected in the Maintenance Allocation Charts (MAC), which is in the Technical Manual (TM) of almost every piece of Army equipment, and identifies what repairs are authorized at each level of maintenance.

These two objectives seem to be, at least slightly, at odds with each other. Should direct support maintenance doctrine be changed as a result of the implementation of the SFDLR program? Are the diagnostic tools, and more importantly, trained operators available in the current maintenance organization? What is the price of, and how difficult will it be to, transition from the peacetime, cost conscious mentality of SFDLR to a wartime footing? It would seem that all of these questions should have been answered, or at least asked, as part of the implementation process. It would appear that they were not.

The Impact of SFDLR on Depot Level Capacity

The conversion of the Army Industrial Fund and the Army Stock Fund into the Defense Business Operating Fund which occurred recently, along with a number of the DMRDs, will have far reaching effects on the Army's depot system. While making the customer pay all the costs of an item, as mandated by DMRD 901, and forcing the depots to operate more effectively are worthy objectives, we must ensure that appropriate steps been taken to ensure that this vital component of our national defense capability remains functional.

One of the results of the SFDLR program is that fewer items will be returned to the depot level for repair. Additionally, those items that are returned, will require more extensive work than they have in the past. Other cost reduction efforts that are ongoing within both the Army and DoD, such as the Base Re-alignment and Closure Commission, will result in the elimination of some of our nation's depot capacity. Has this reduction been adequately planned and programmed? Could the decrease in customer reimbursed funding that will result from fewer DLRs being sent to the depot for repair result in even deeper reductions in depot capacity? Ultimately, will the military depot system of the United States have the capacity to surge in order to meet the demands of the next Operation Desert Storm? If these types of questions have not been adequately and accurately addressed, the cost could be unbearable.

The Interaction of Sparing to Availability and SFDLR

The Sparing to Availability (STA) methodology that is currently undergoing evaluation at the National Training Center (NTC) at Fort Irwin, California, offers a dramatic change from the historical, demand-based procedures that the Army uses to compute stockage levels for spare parts at the retail level of the supply system. One aspect of the STA concept is that divisions stock more of the low-dollar parts that are needed to repair the intermediate level components of an end item, versus stocking the component itself. This focus seems to be extremely well suited for operations under an SFDLR methodology which promotes the repair of unserviceable DLRs at the lowest possible maintenance level, and avoids the requisitioning of a replacement item whenever the required repair is within the unit's authority, capability or capacity.

Was any effort made to study the potential impacts, and identify the possible advantages and disadvantages when the two systems are employ together? Now that the SFDLR program has been implemented, this "test" is actually being conducted at the NTC. Has this change in the original STA test conditions been recognized, and just as importantly, are any unanticipated benefits being realized?

It seems that the concept of the STA methodology for determining repair parts stockage levels is tailor made to support funding procedures that include the stock funding of DLRs. If the two systems complement each other as well in practice as they do in theory, there is a strong potential to improve the effectiveness of both programs.

Summary

It appears that the Army's SFDLR program is working, perhaps not nearly as well as its advocates had projected, but certainly better than many of its opponents had initially forebode. Several rather significant trends have been identified during the course of this study, but overall, it does not appear that the Army is underwriting the "costs" of its SFDLR program with a major decline in equipment readiness. This conclusion is quite tentative, however, as the statistical testing of the relationship between time and changes in availability rates since the second quarter of 1992 did not provide a high degree of correlation.

In light of the many ongoing and projected decreases in defense spending, the stock funding of DLRs seems to be one program that may actually be capable of attaining its worthy and necessary objectives. Since the program's focus is primarily on monetary issues, however, it is imperative that its effect on combat readiness be closely monitored and evaluated on a recurring basis in the event that any of the negative trends identified by this initial study develop more fully. This further study is especially important given the trends that seem to be developing with Army aircraft and complex ground combat weapon systems.

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SFDLR REQUISITIONS
1st CAVALRY DIVISION
4th Quarter 1991 - 4th Quarter 1992

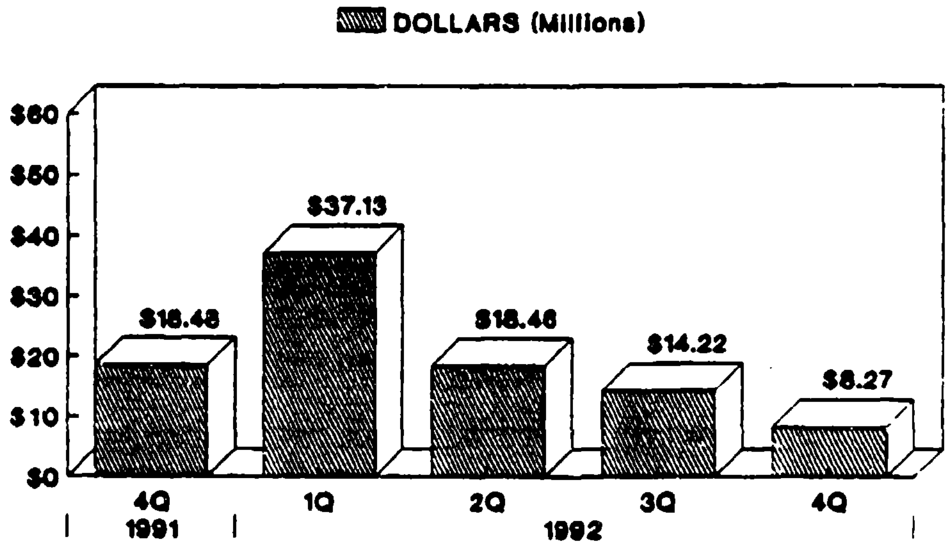


Figure 10

SFDLR REQUISITIONS
1st INFANTRY DIVISION
4th Quarter 1991 - 4th Quarter 1992

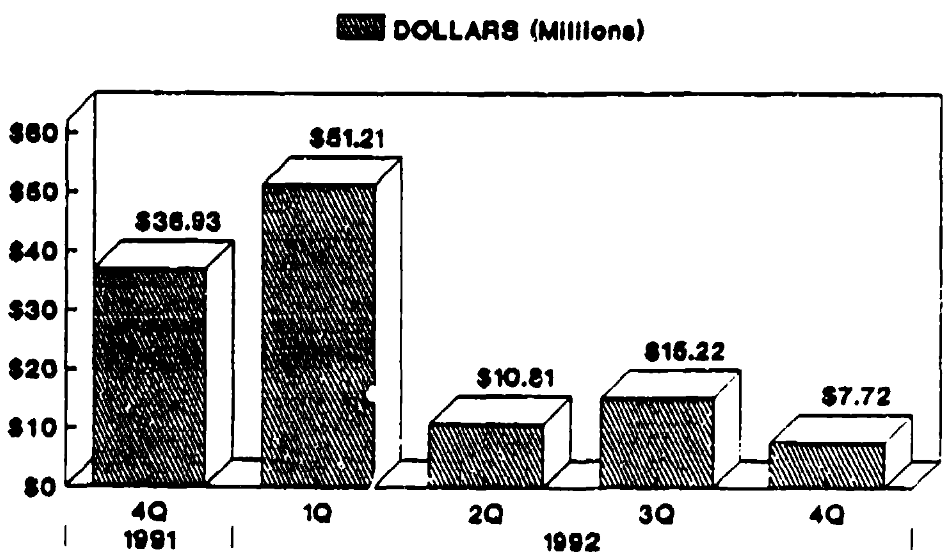


Figure 11

SFDLR REQUISITIONS
4th INFANTRY DIVISION
4th Quarter 1991 - 4th Quarter 1992

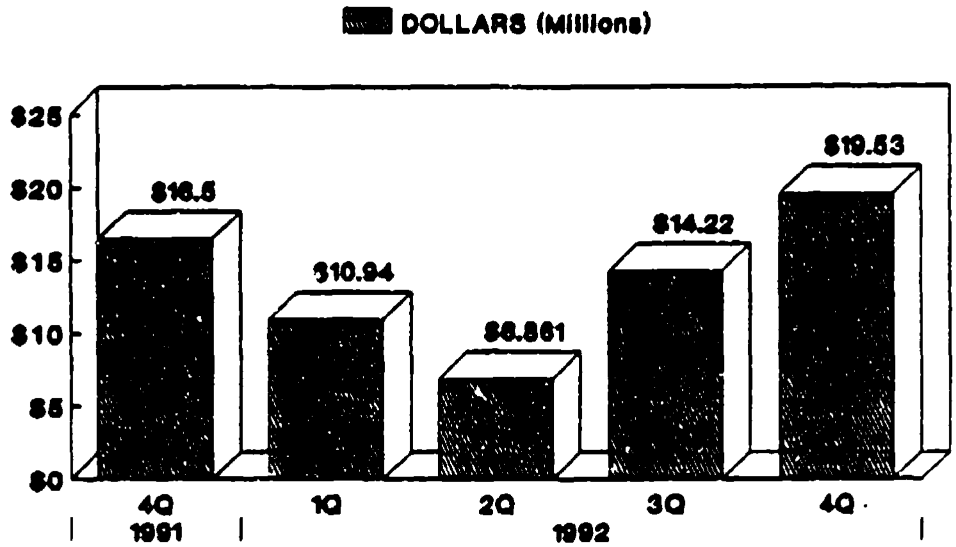


Figure 12

SFDLR REQUISITIONS
5th INFANTRY DIVISION
4th Quarter 1991 - 4th Quarter 1992

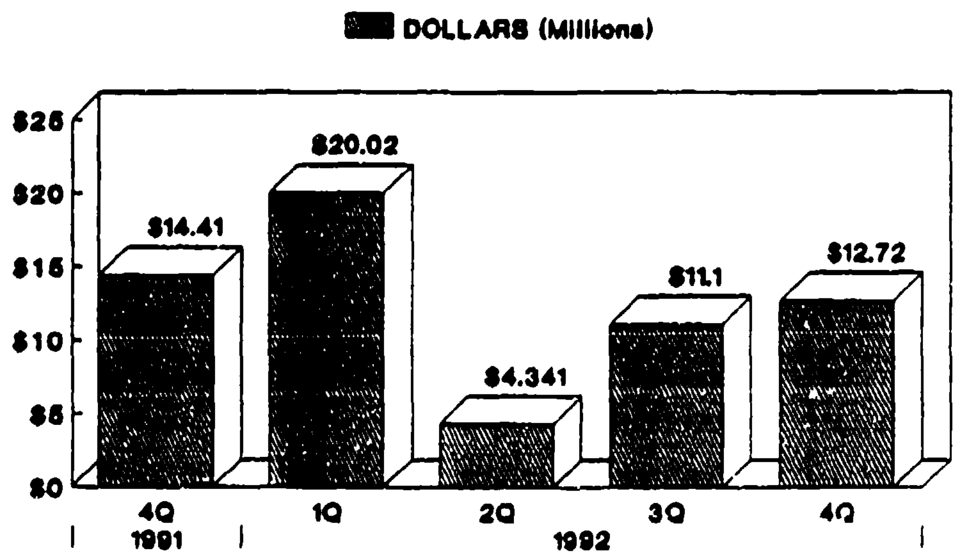


Figure 13

SFDLR REQUISITIONS
7th INFANTRY DIVISION
4th Quarter 1991 - 4th Quarter 1992

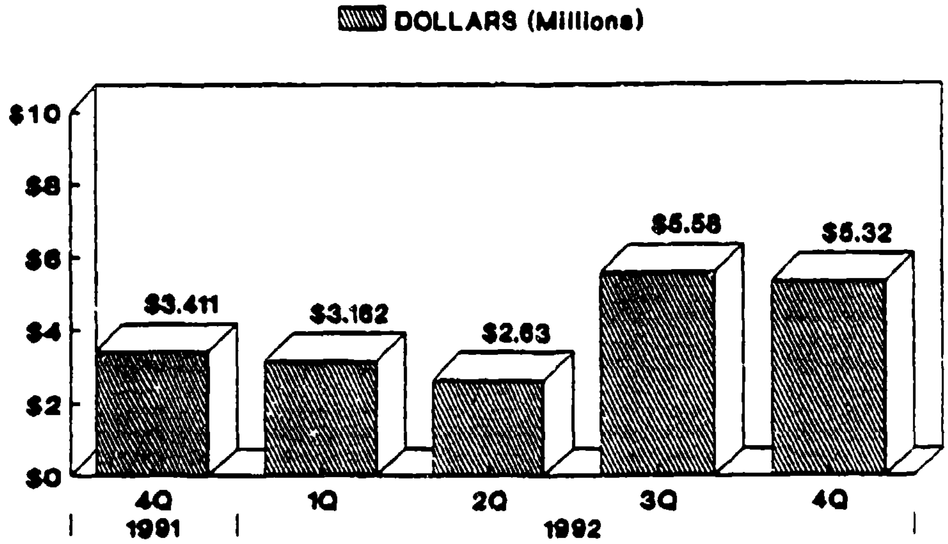


Figure 14

SFDLR REQUISITIONS
10th MOUNTAIN DIVISION
4th Quarter 1991 - 4th Quarter 1992

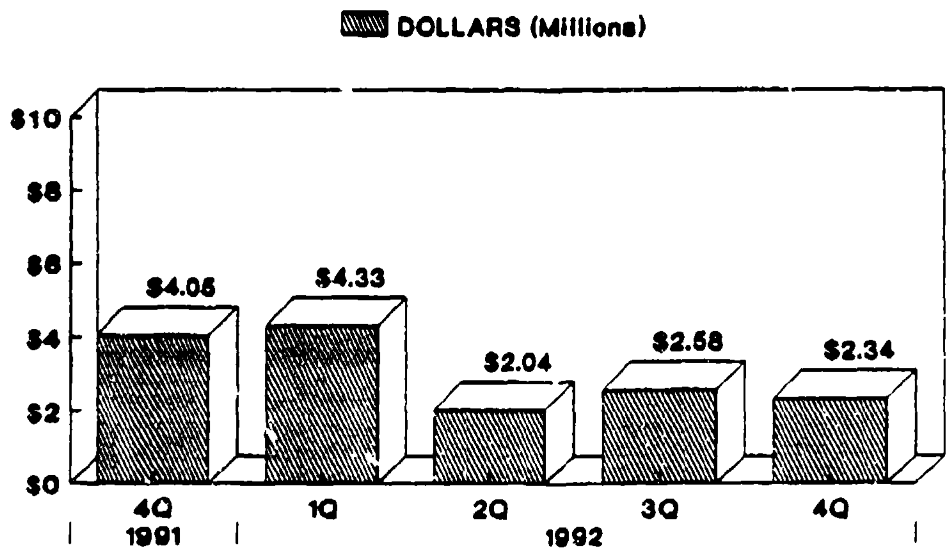


Figure 15

SFDLR REQUISITIONS
24th INFANTRY DIVISION
4th Quarter 1991 - 4th Quarter 1992

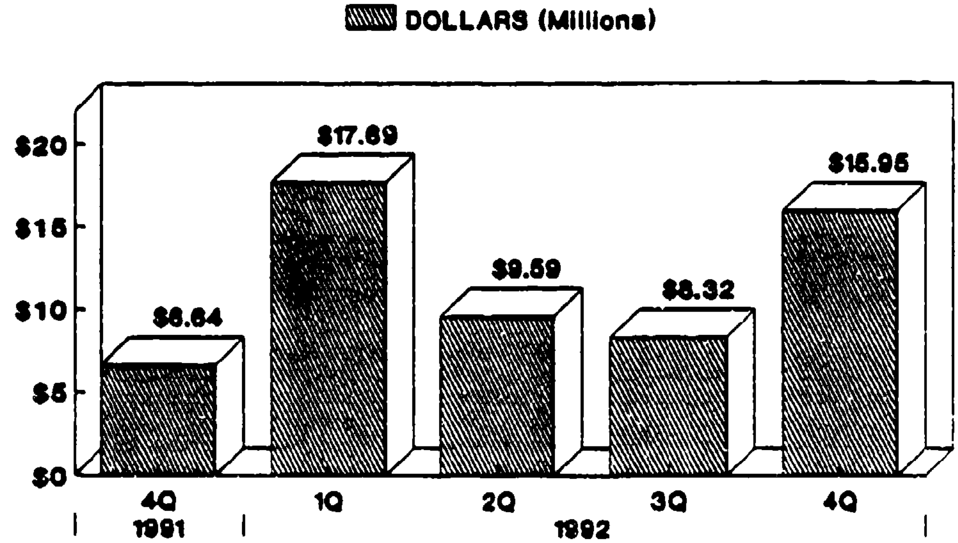


Figure 16

SFDLR REQUISITIONS
82d AIRBORNE DIVISION
4th Quarter 1991 - 4th Quarter 1992

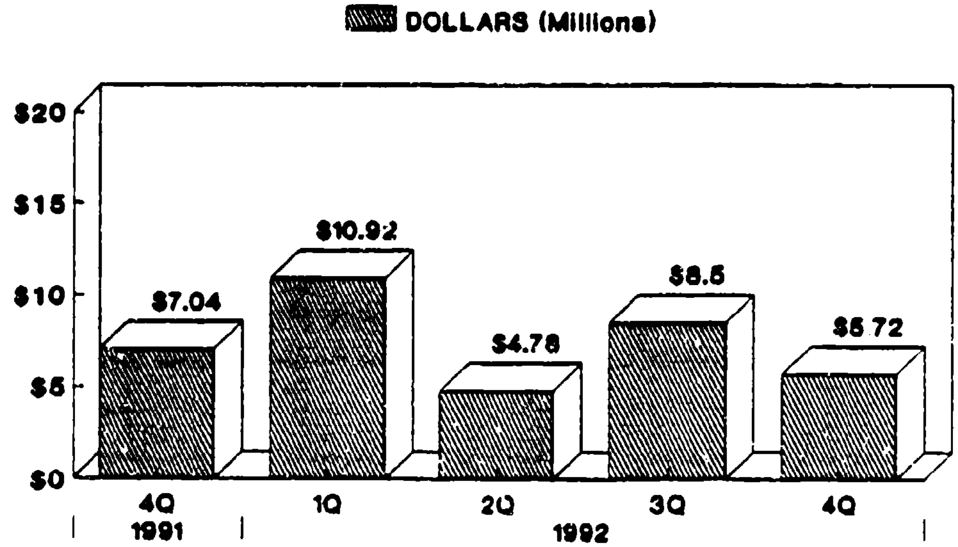


Figure 17

SFDLR REQUISITIONS
101st AIRBORNE DIVISION
4th Quarter 1991 - 4th Quarter 1992

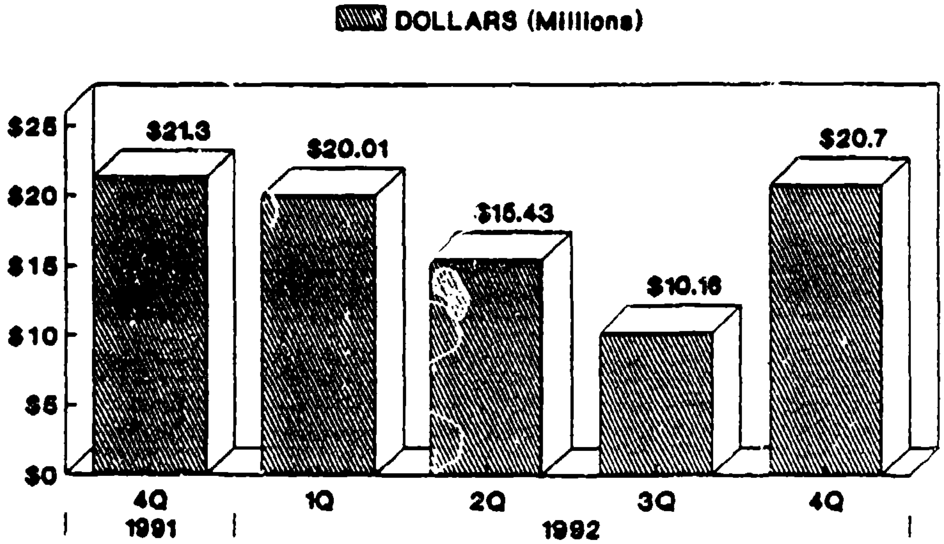


Figure 18

EQUIPMENT AVAILABILITY RATE
1st CAVALRY DIVISION
4th Quarter 1991 - 4th Quarter 1992

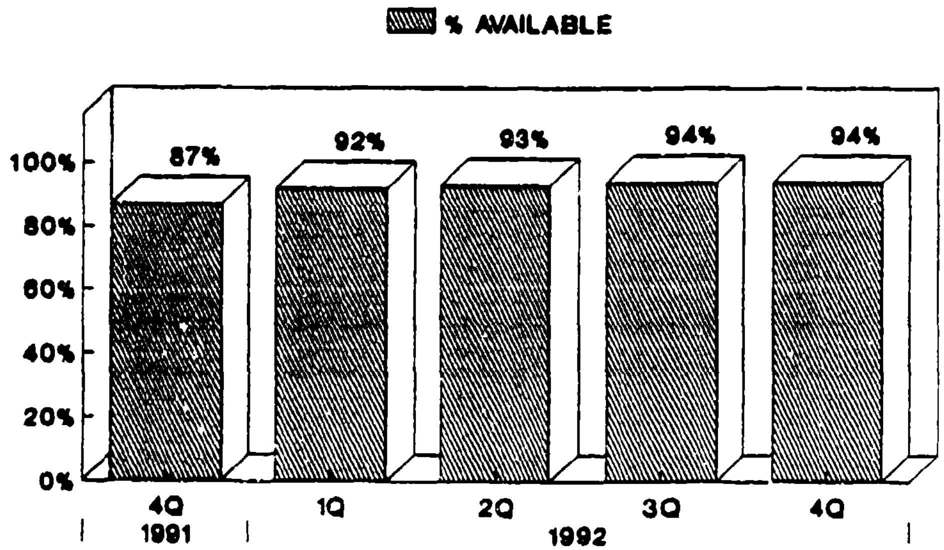


Figure 19

EQUIPMENT AVAILABILITY RATE
1st INFANTRY DIVISION
4th Quarter 1991 - 4th Quarter 1992

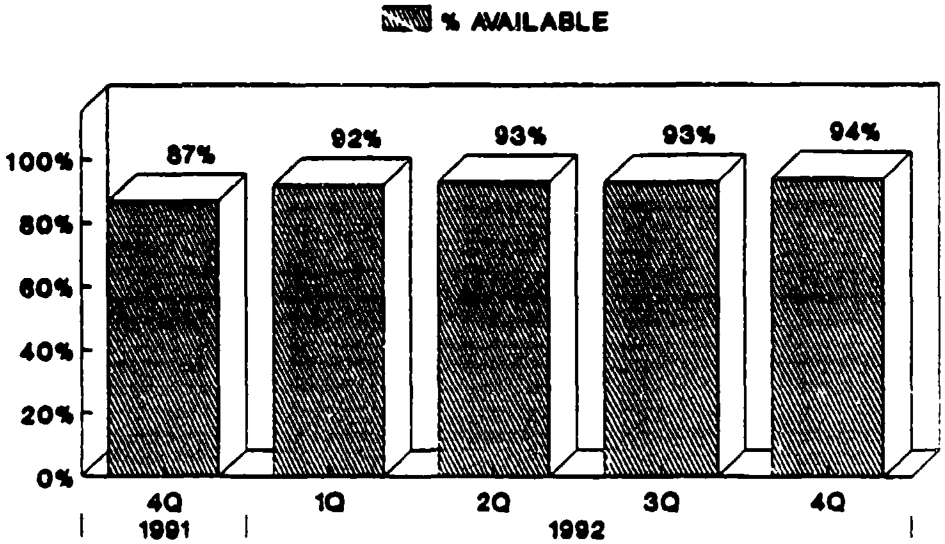


Figure 20

EQUIPMENT AVAILABILITY RATE
4th INFANTRY DIVISION
4th Quarter 1991 - 4th Quarter 1992

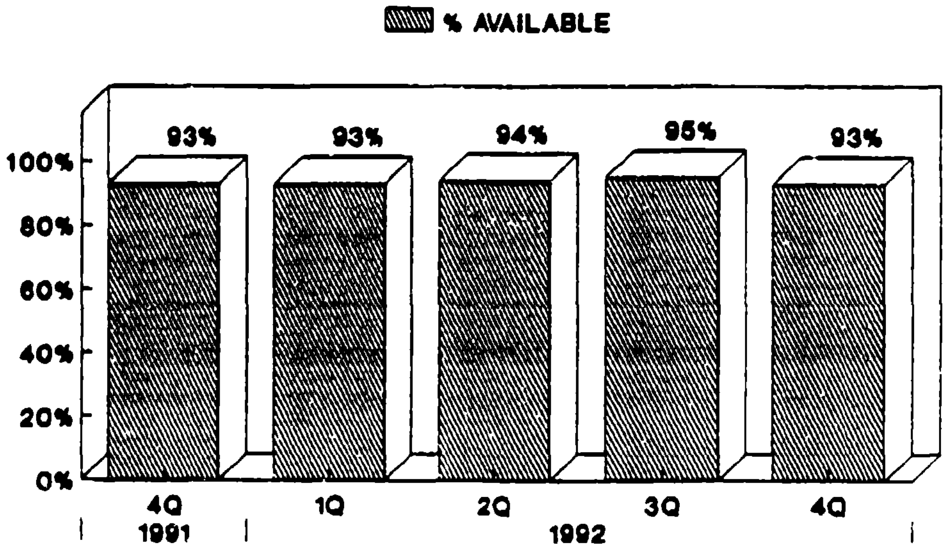


Figure 21

EQUIPMENT AVAILABILITY RATE
5th INFANTRY DIVISION
4th Quarter 1991 - 4th Quarter 1992

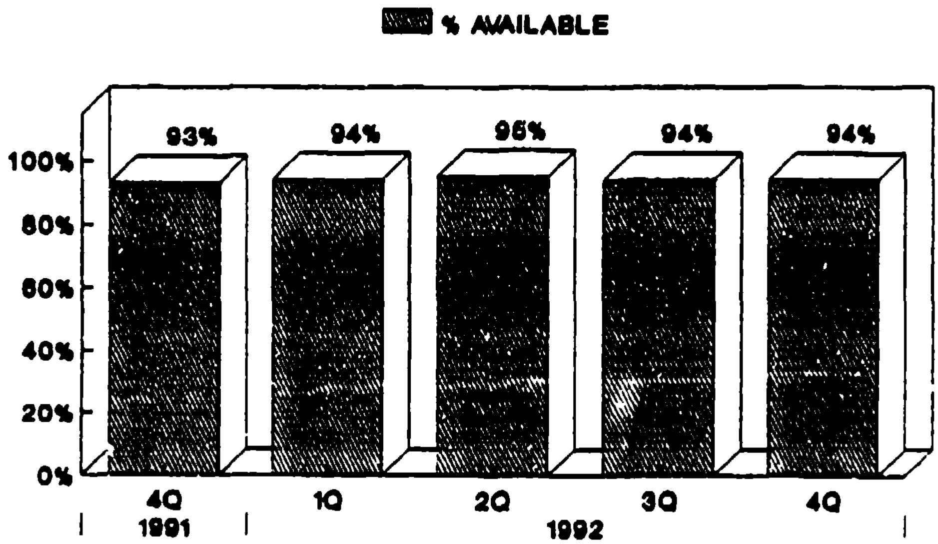


Figure 22

EQUIPMENT AVAILABILITY RATE
7th INFANTRY DIVISION
4th Quarter 1991 - 4th Quarter 1992

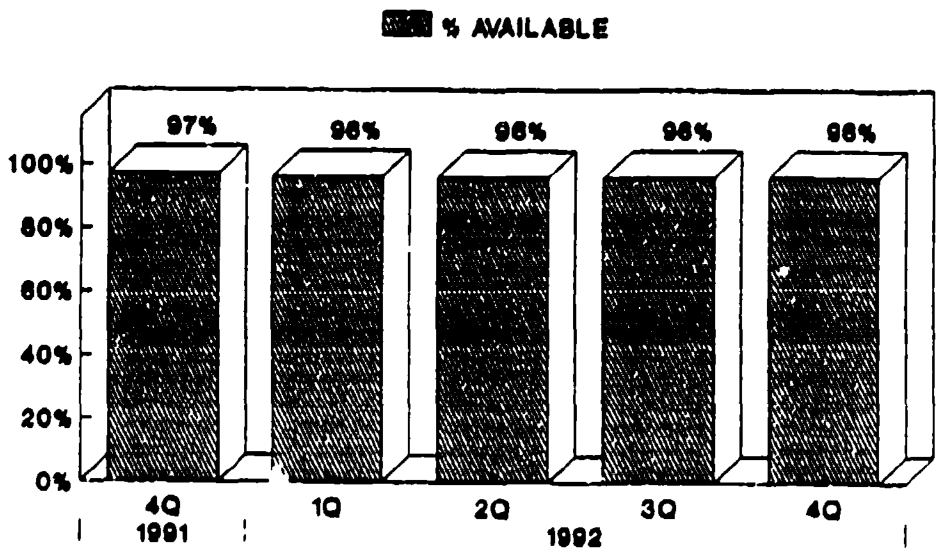


Figure 23

EQUIPMENT AVAILABILITY RATE
10th MOUNTAIN DIVISION
4th Quarter 1991 - 4th Quarter 1992

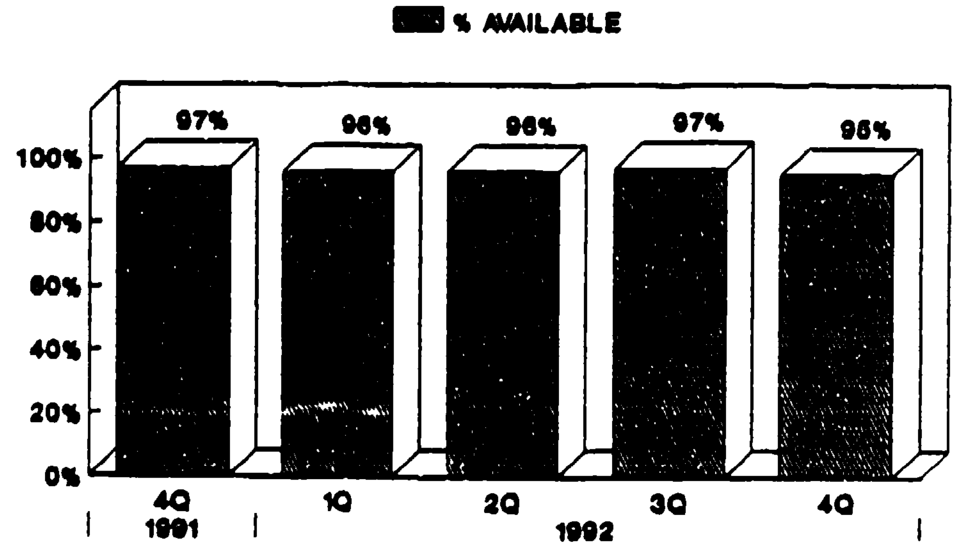


Figure 24

EQUIPMENT AVAILABILITY RATE
24th INFANTRY DIVISION
4th Quarter 1991 - 4th Quarter 1992

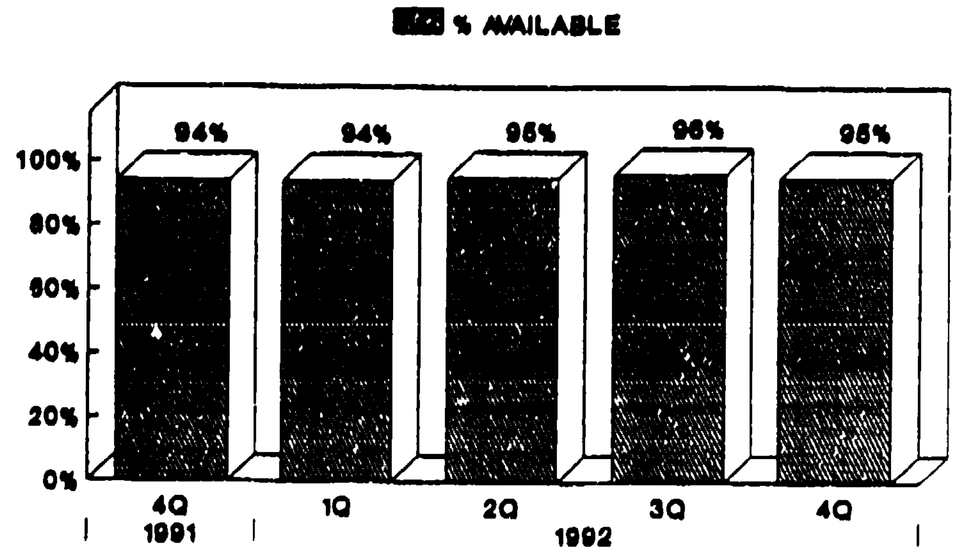


Figure 25

EQUIPMENT AVAILABILITY RATE
82d AIRBORNE DIVISION
4th Quarter 1991 - 4th Quarter 1992

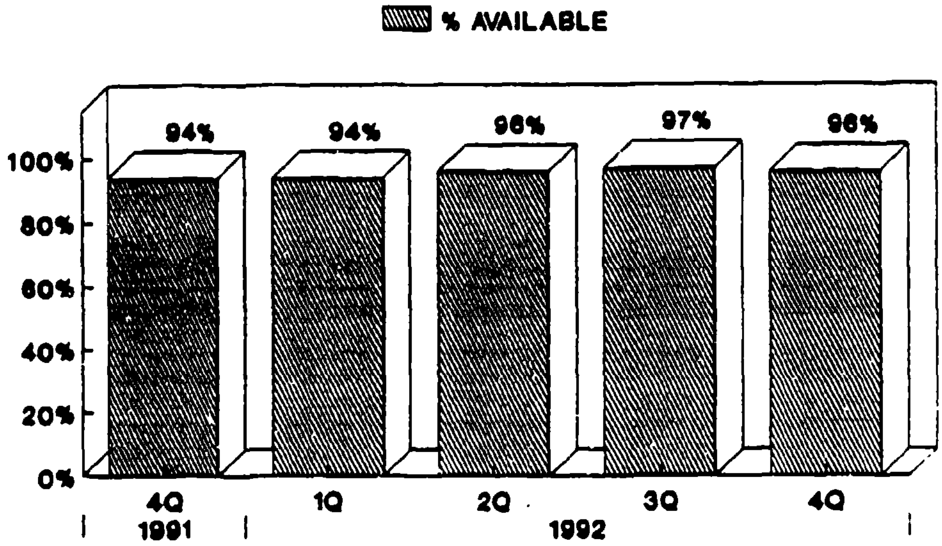


Figure 26

EQUIPMENT AVAILABILITY RATE
101st AIRBORNE DIVISION
4th Quarter 1991 - 4th Quarter 1992

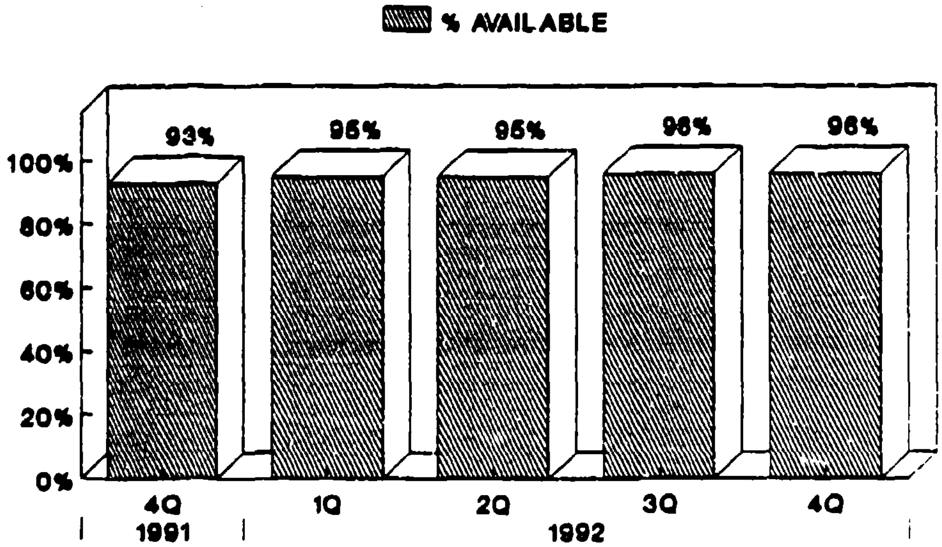


Figure 27

MEAN TIME TO REPAIR
1st CAVALRY DIVISION
4th Quarter 1991 - 4th Quarter 1992

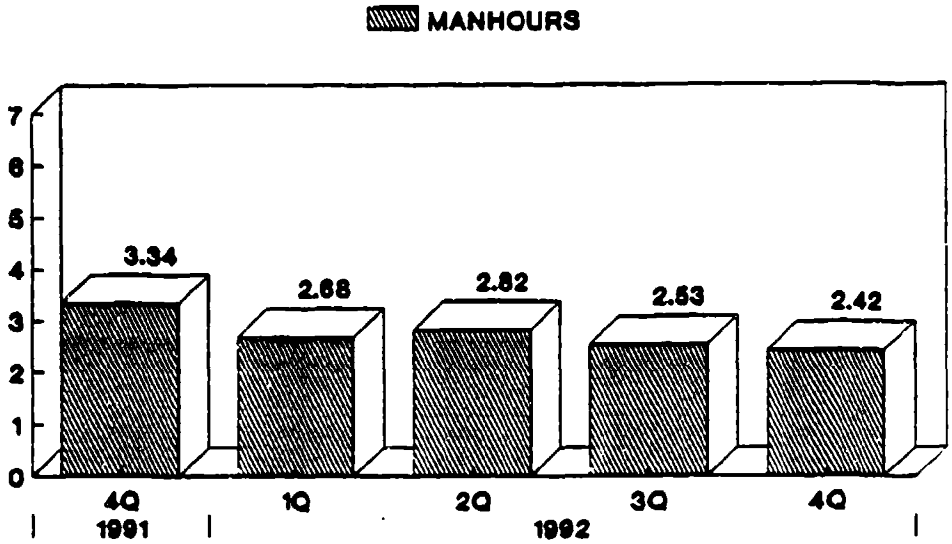


Figure 28

MEAN TIME TO REPAIR
1st INFANTRY DIVISION
4th Quarter 1991 - 4th Quarter 1992

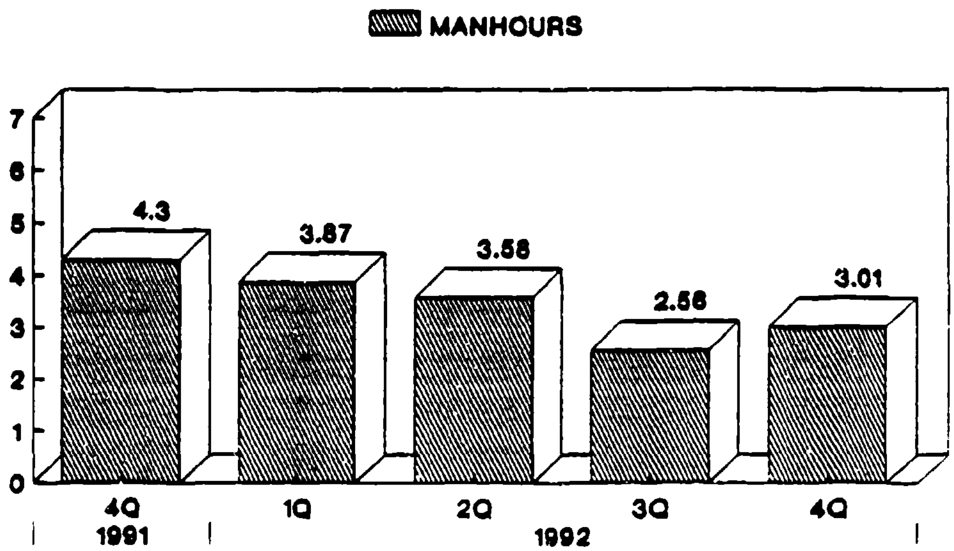


Figure 29

MEAN TIME TO REPAIR
4th INFANTRY DIVISION
4th Quarter 1991 - 4th Quarter 1992

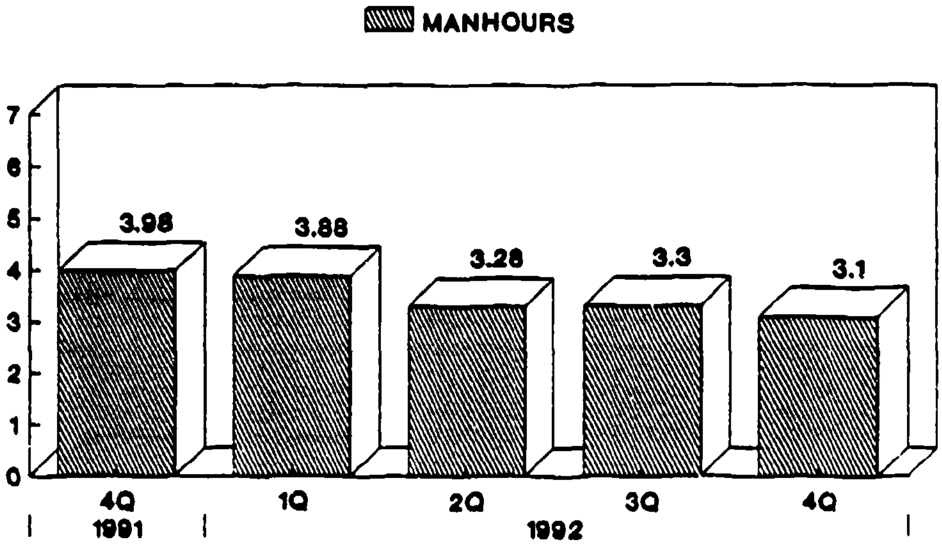


Figure 30

MEAN TIME TO REPAIR
5th INFANTRY DIVISION
4th Quarter 1991 - 4th Quarter 1992

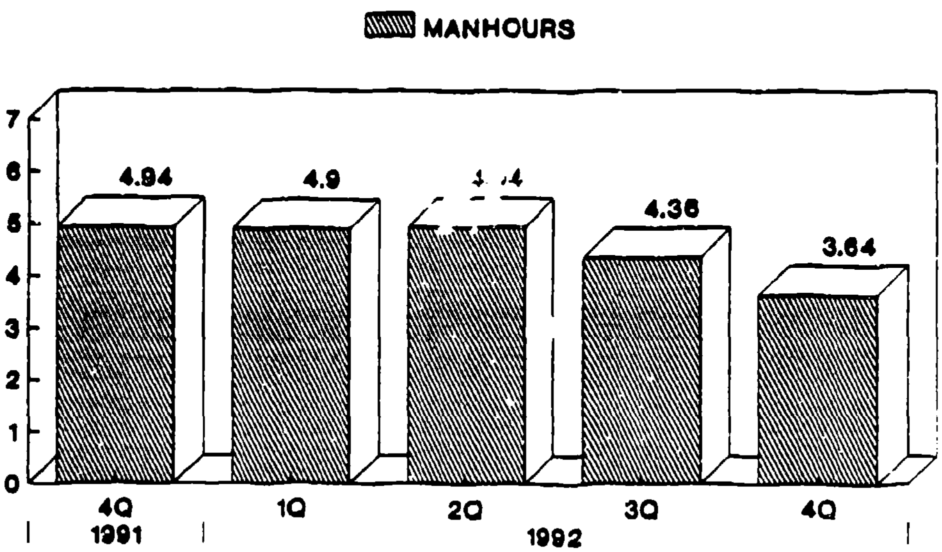


Figure 31

MEAN TIME TO REPAIR
7th INFANTRY DIVISION
4th Quarter 1991 - 4th Quarter 1992

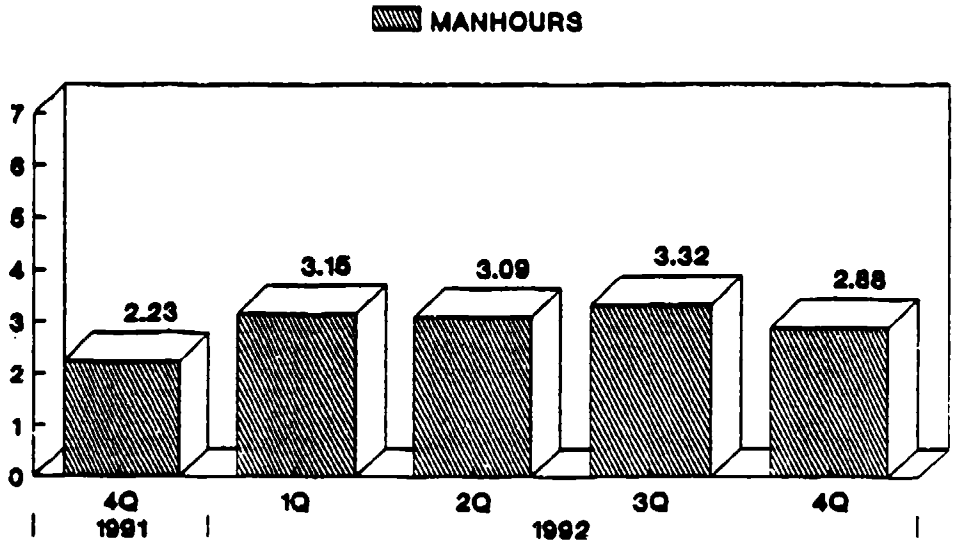


Figure 32

MEAN TIME TO REPAIR
10th MOUNTAIN DIVISION
4th Quarter 1991 - 4th Quarter 1992

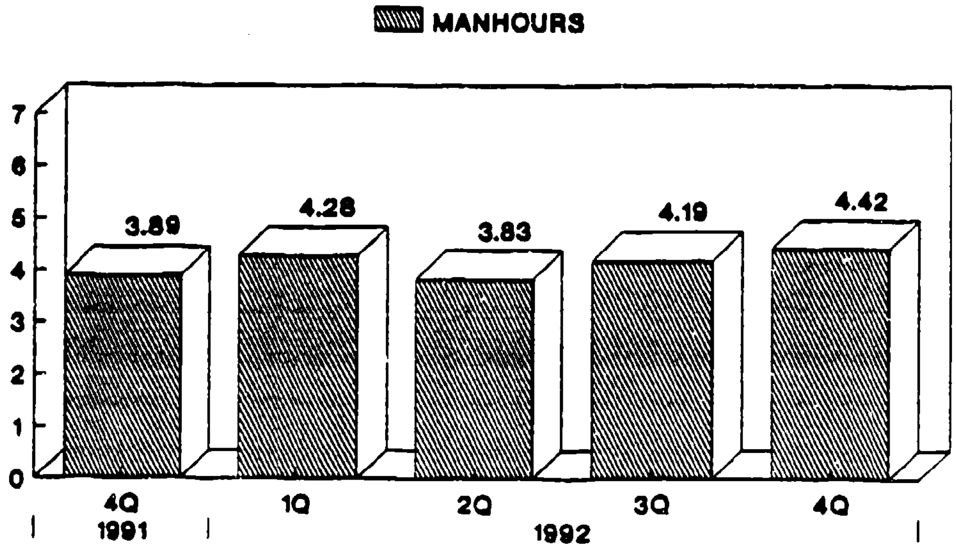


Figure 33

MEAN TIME TO REPAIR
24th INFANTRY DIVISION
4th Quarter 1991 - 4th Quarter 1992

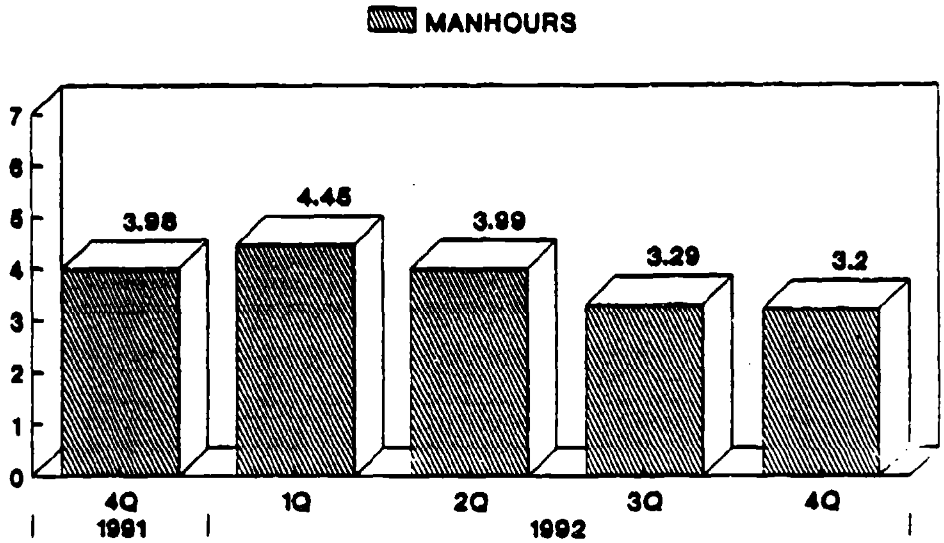


Figure 34

MEAN TIME TO REPAIR
82d AIRBORNE DIVISION
4th Quarter 1991 - 4th Quarter 1992

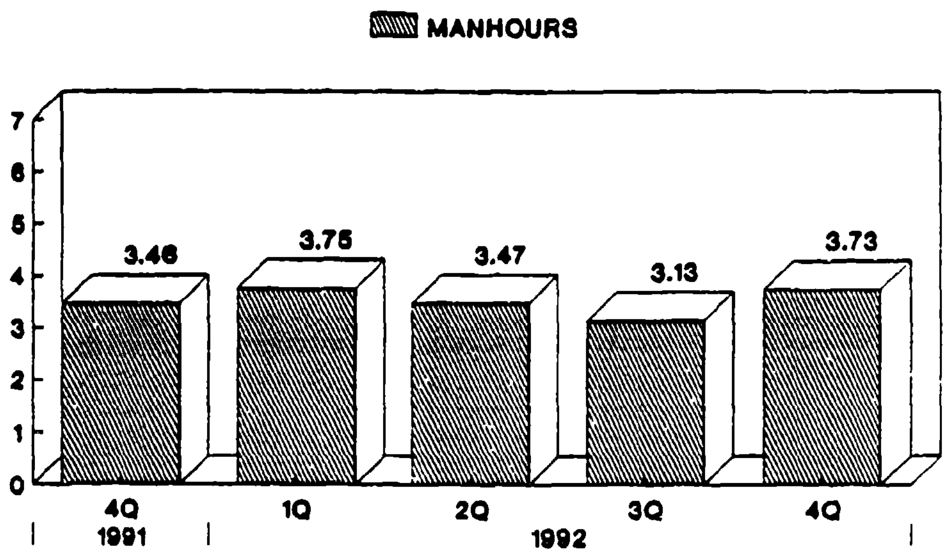


Figure 35

MEAN TIME TO REPAIR
101st AIRBORNE DIVISION
4th Quarter 1991 - 4th Quarter 1992

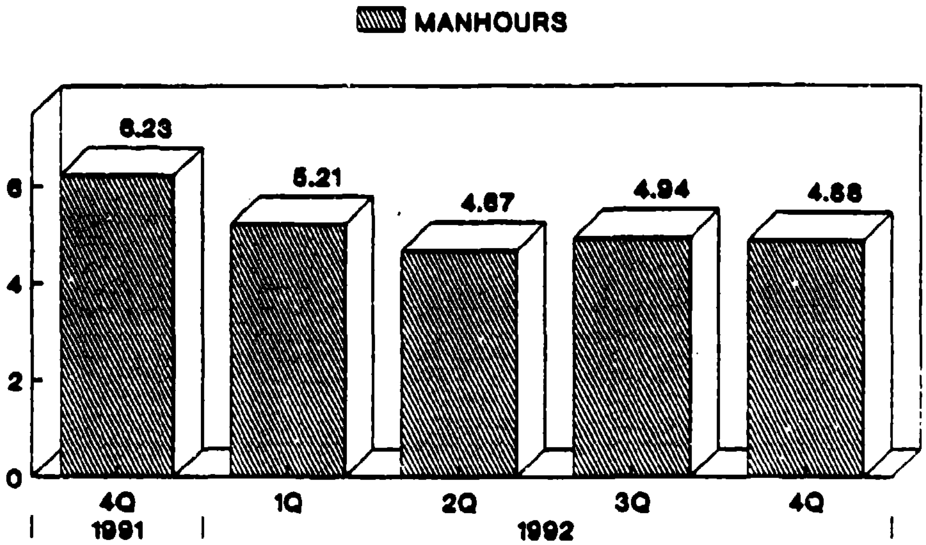


Figure 36

AH-64 AVAILABILITY
4th Quarter 1991 - 4th Quarter 1992

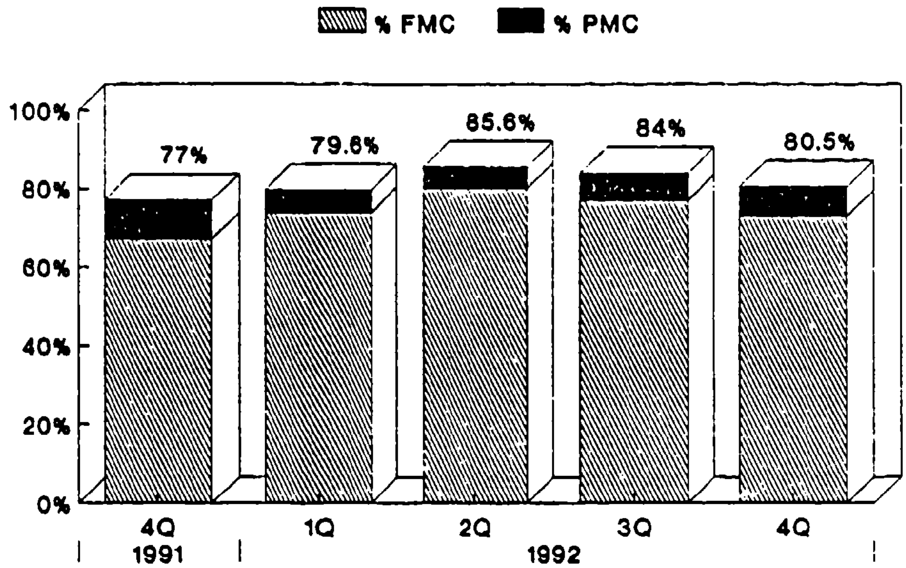


Figure 37

AH-64 MEAN TIME TO REPAIR
4th Quarter 1991 - 4th Quarter 1992

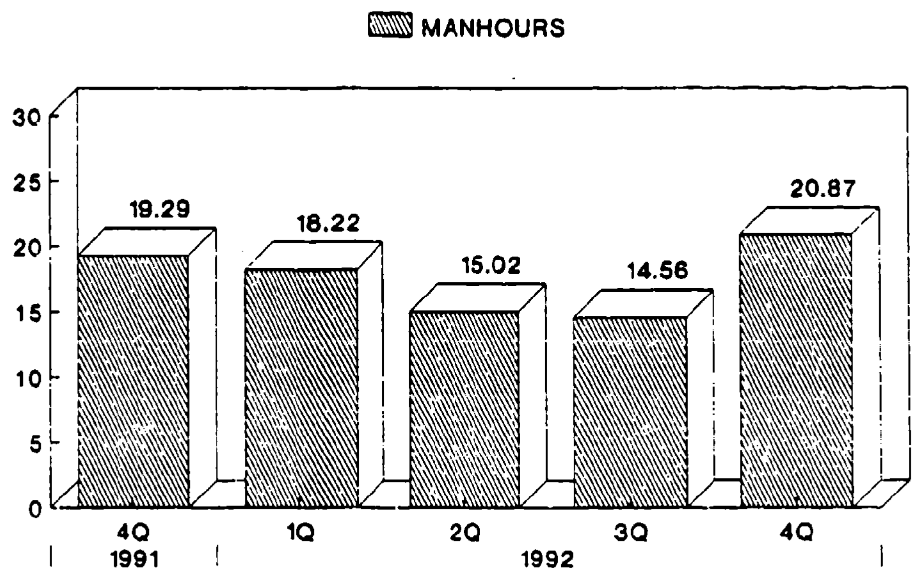


Figure 38

OH-58 AVAILABILITY
4th Quarter 1991 - 4th Quarter 1992

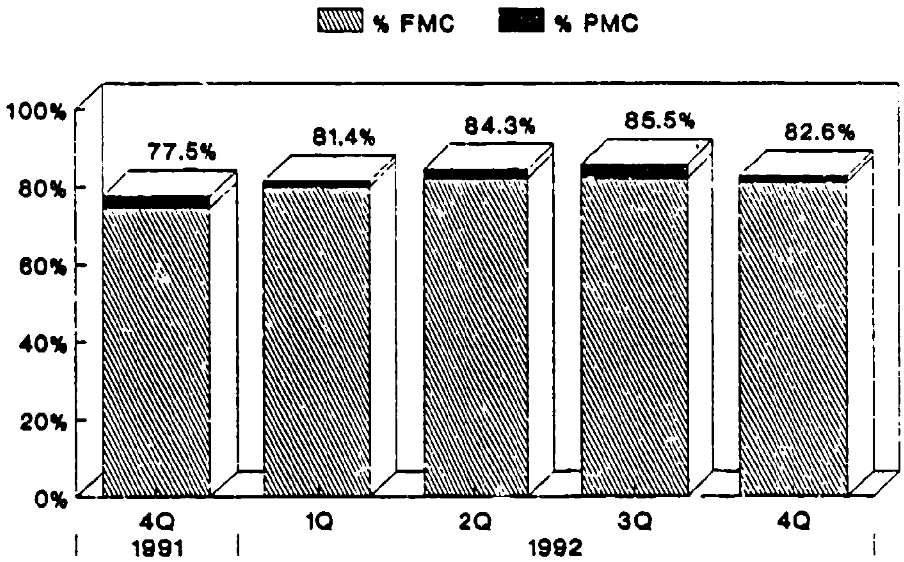


Figure 39

OH-58 MEAN TIME TO REPAIR
4th Quarter 1991 - 4th Quarter 1992

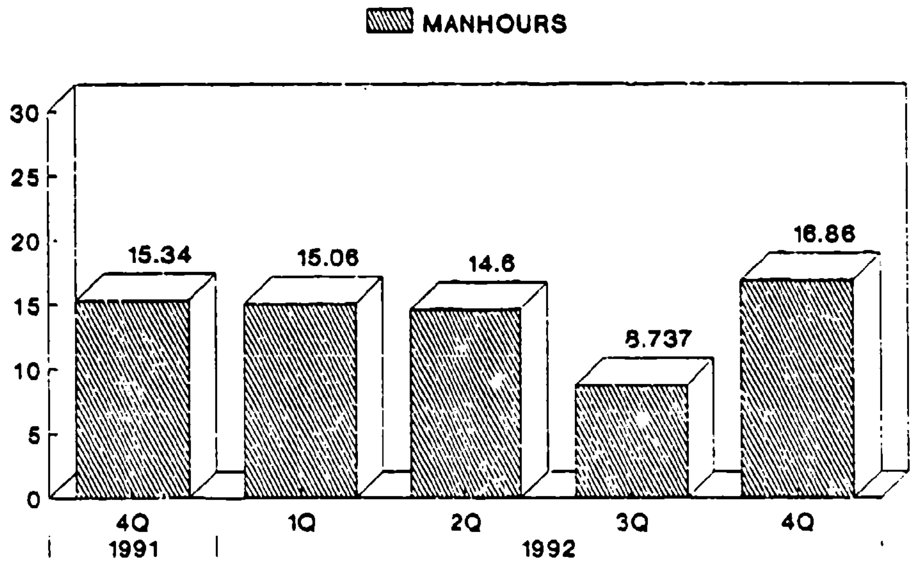


Figure 40

UH-60 AVAILABILITY
4th Quarter 1991 - 4th Quarter 1992

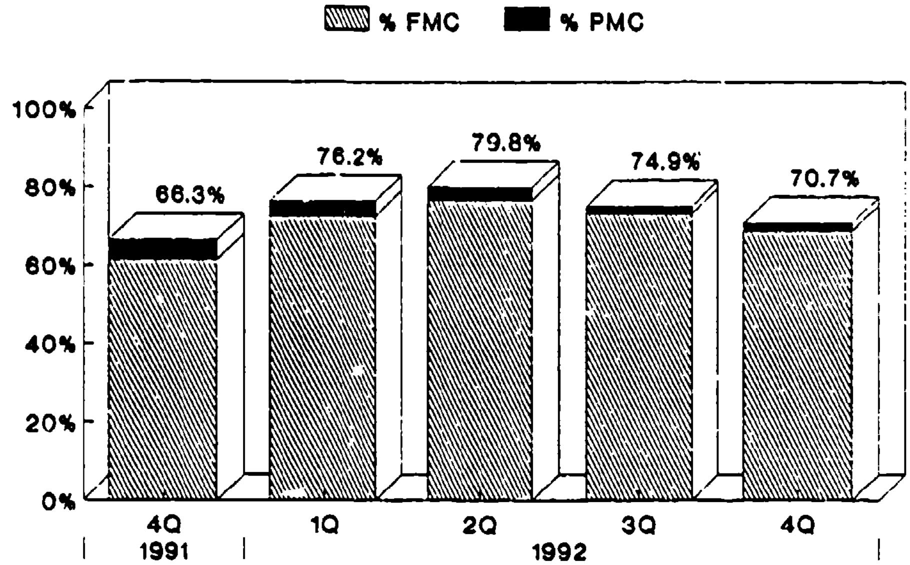


Figure 41

UH-60 MEAN TIME TO REPAIR
4th Quarter 1991 - 4th Quarter 1992

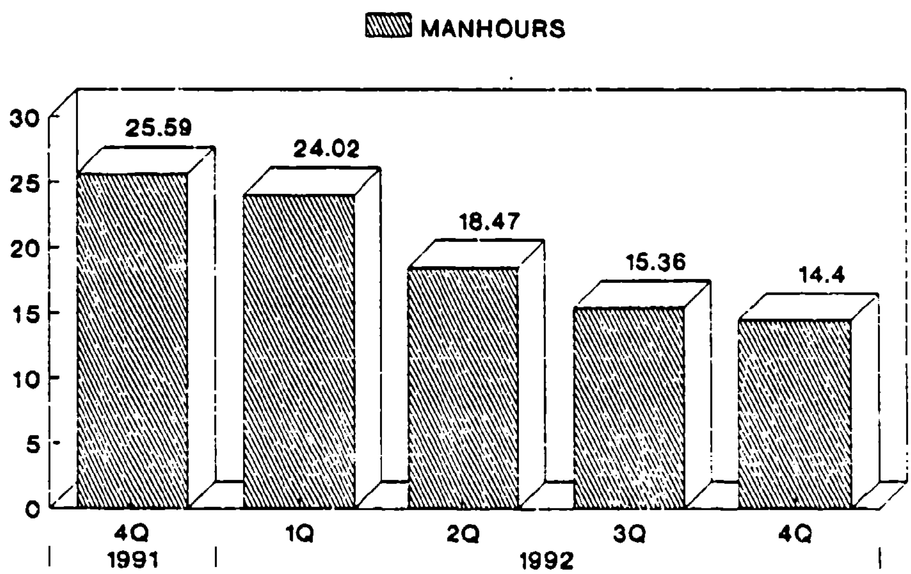


Figure 42

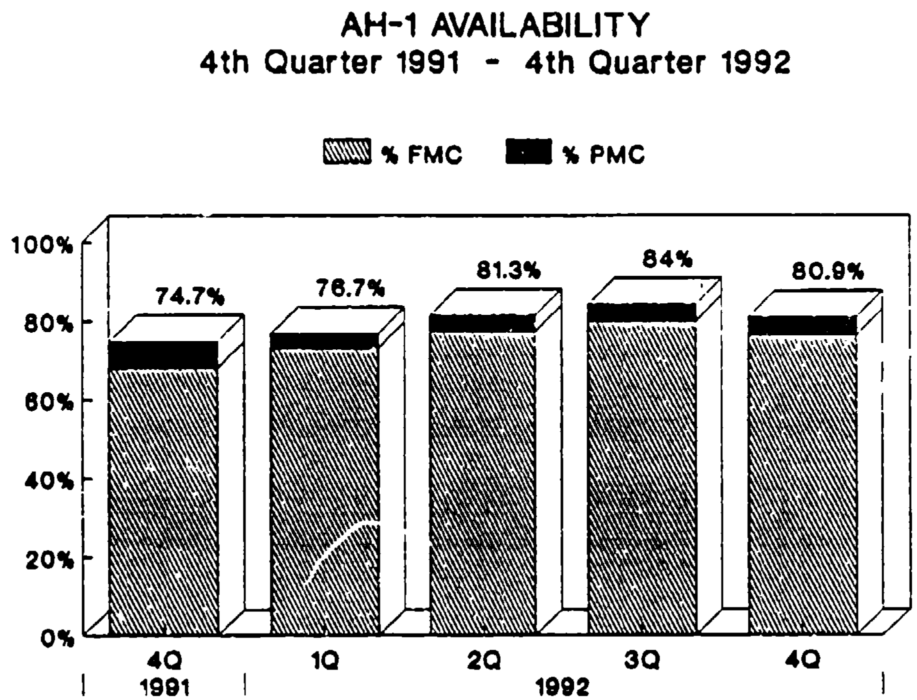
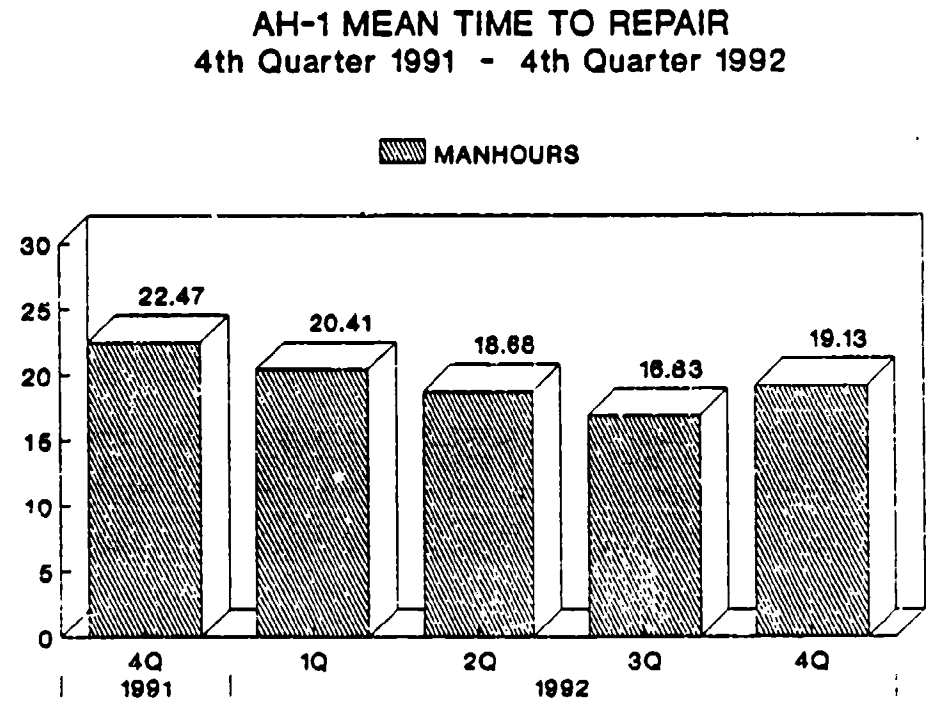


Figure 43



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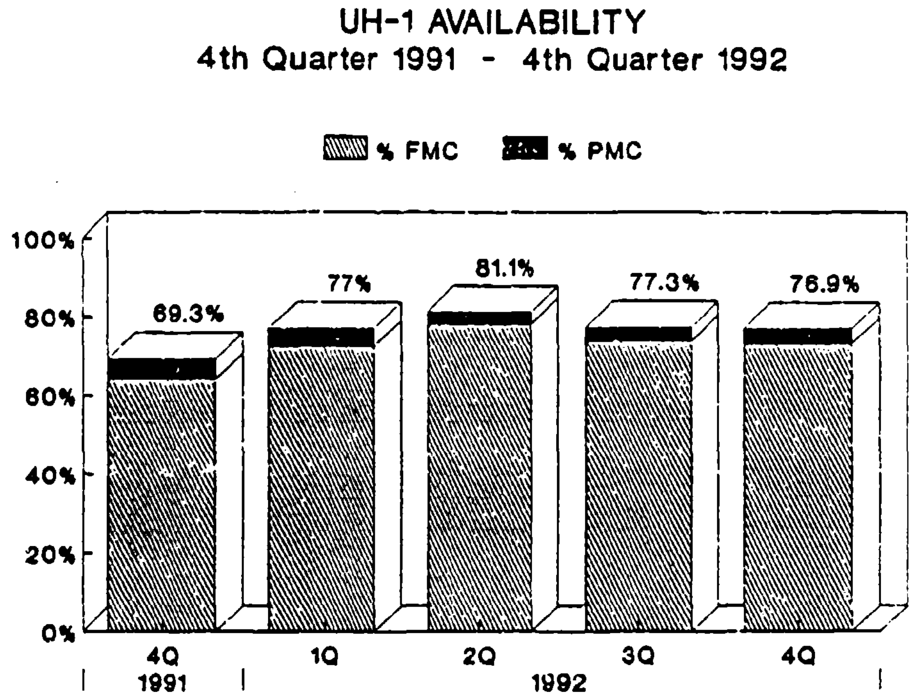

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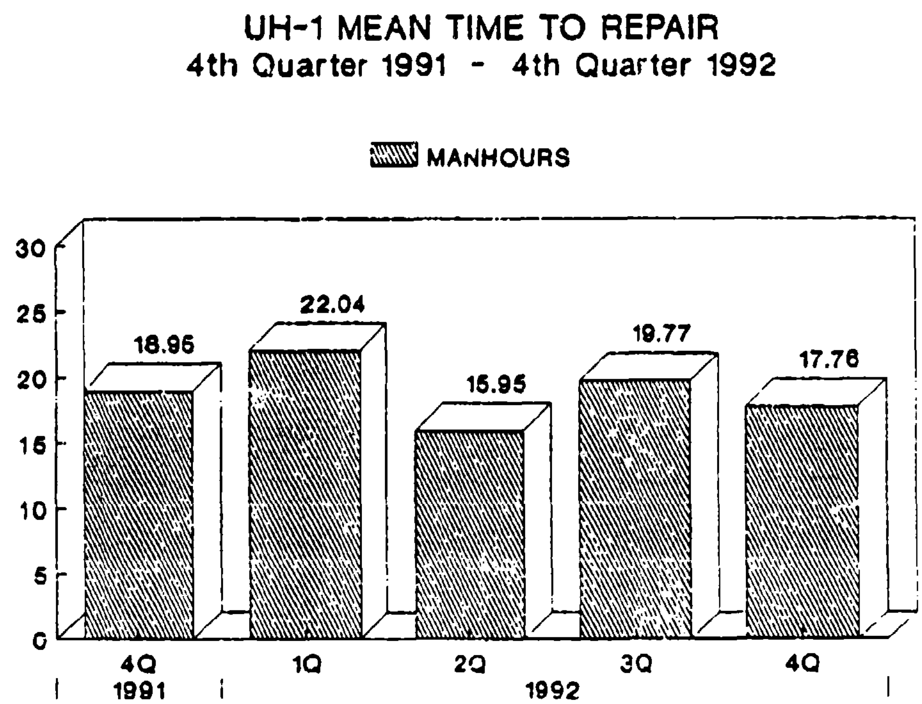

Figure 46

M1 AVAILABILITY
4th Quarter 1991 - 4th Quarter 1992

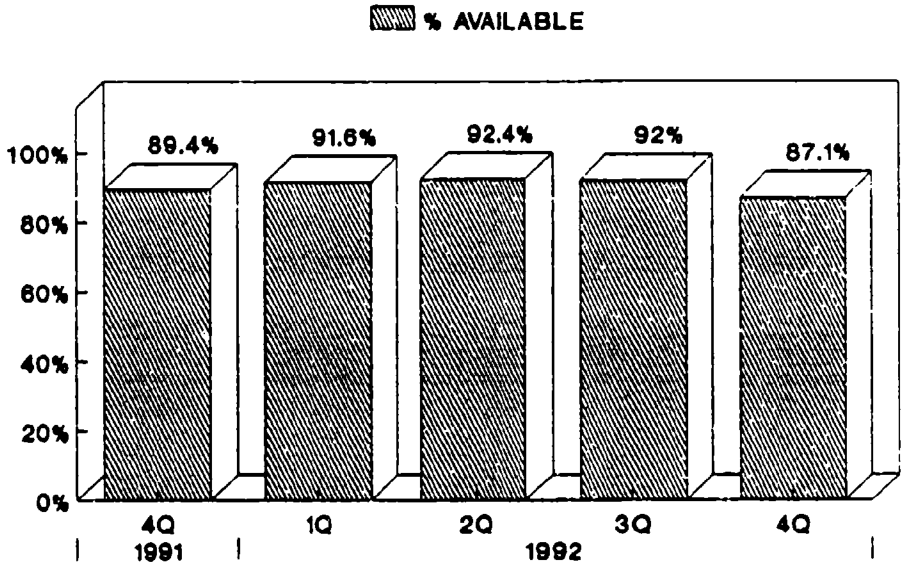

Figure 47

M1 MEAN TIME TO REPAIR
4th Quarter 1991 - 4th Quarter 1992

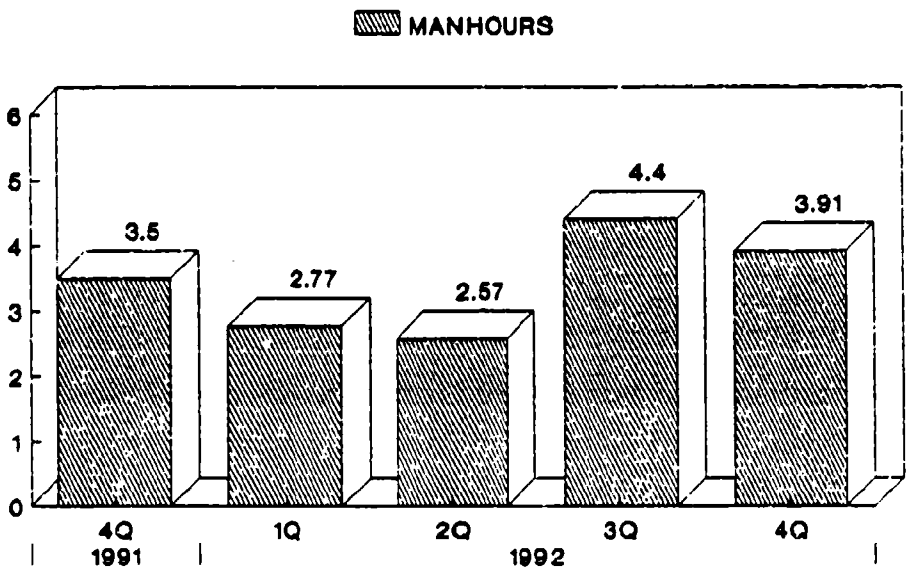

Figure 48

M2/3 AVAILABILITY
4th Quarter 1991 - 4th Quarter 1992

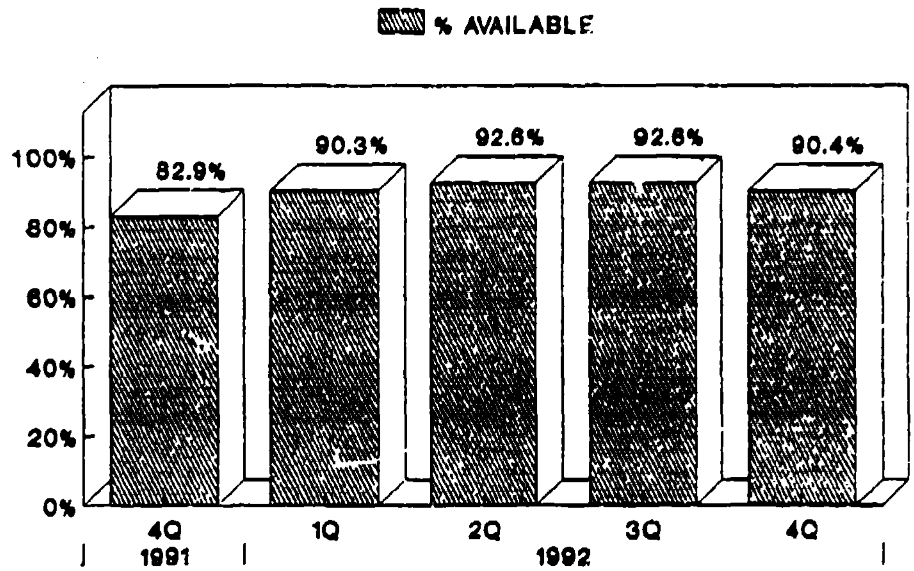

Figure 49

M2/3 MEAN TIME TO REPAIR
4th Quarter 1991 - 4th Quarter 1992

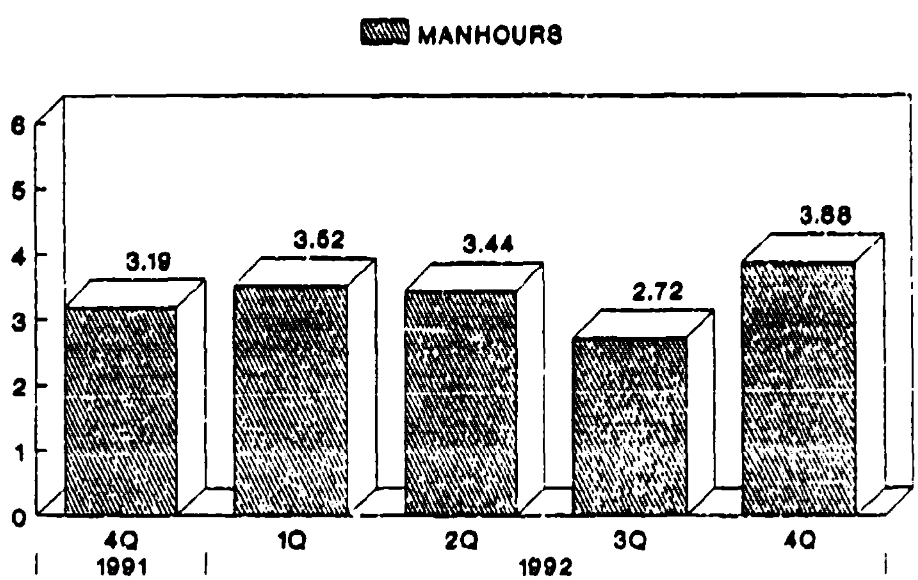

Figure 50

M113 AVAILABILITY
4th Quarter 1991 - 4th Quarter 1992

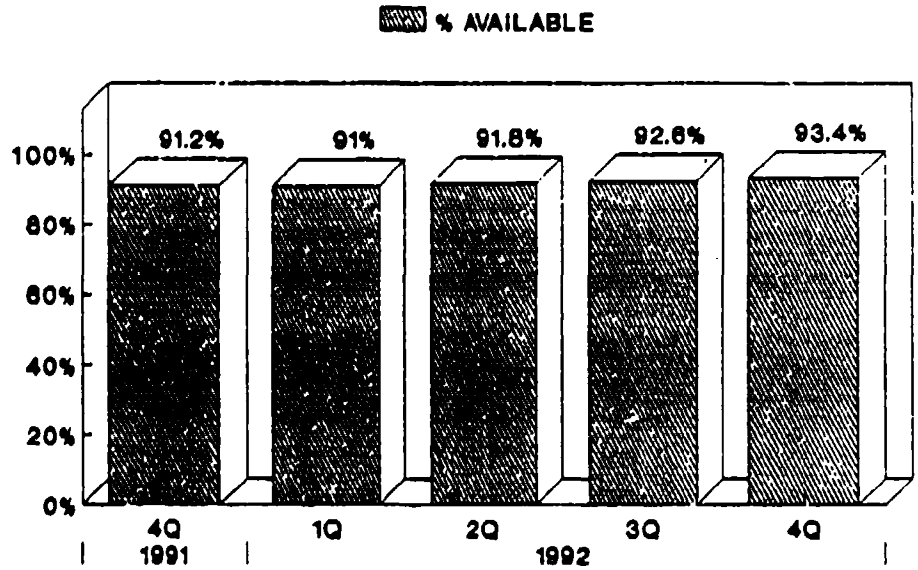

Figure 51

M113 MEAN TIME TO REPAIR
4th Quarter 1991 - 4th Quarter 1992

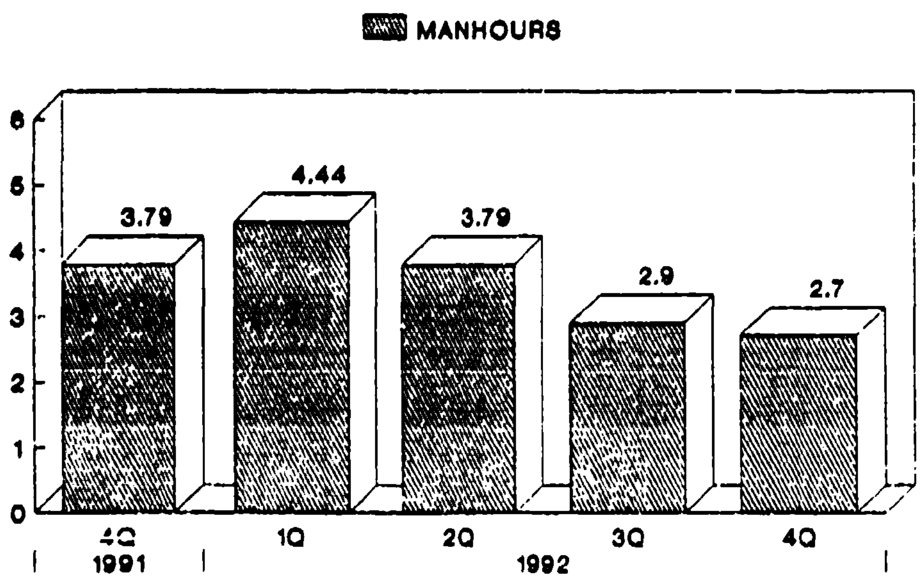

Figure 52

M109 AVAILABILITY
4th Quarter 1991 - 4th Quarter 1992

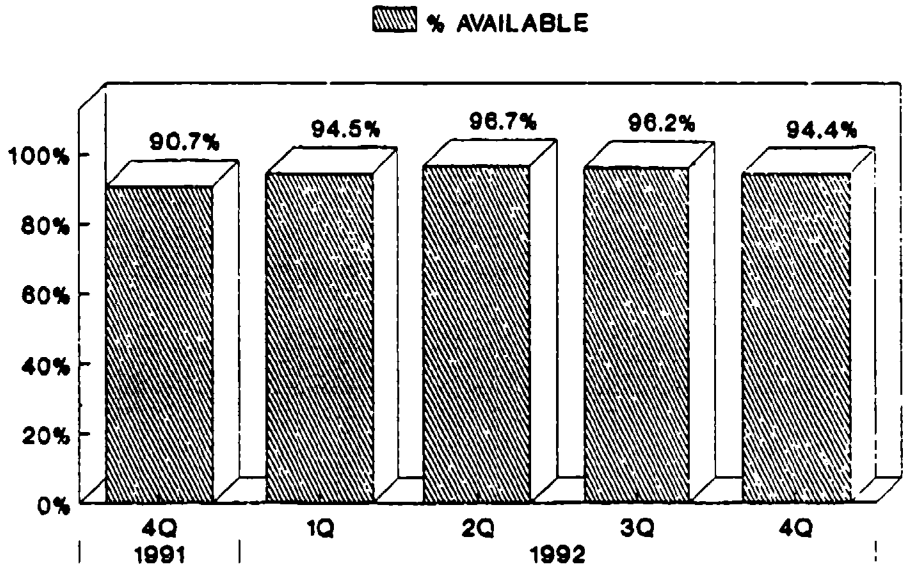

Figure 53

M109 MEAN TIME TO REPAIR
4th Quarter 1991 - 4th Quarter 1992

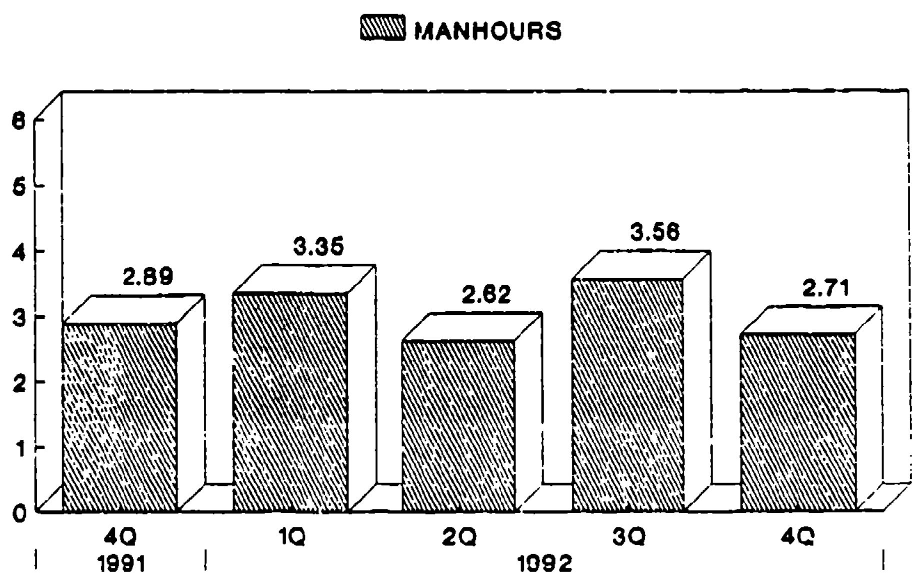

Figure 54

TOWED HOWITZER AVAILABILITY
4th Quarter 1991 - 4th Quarter 1992

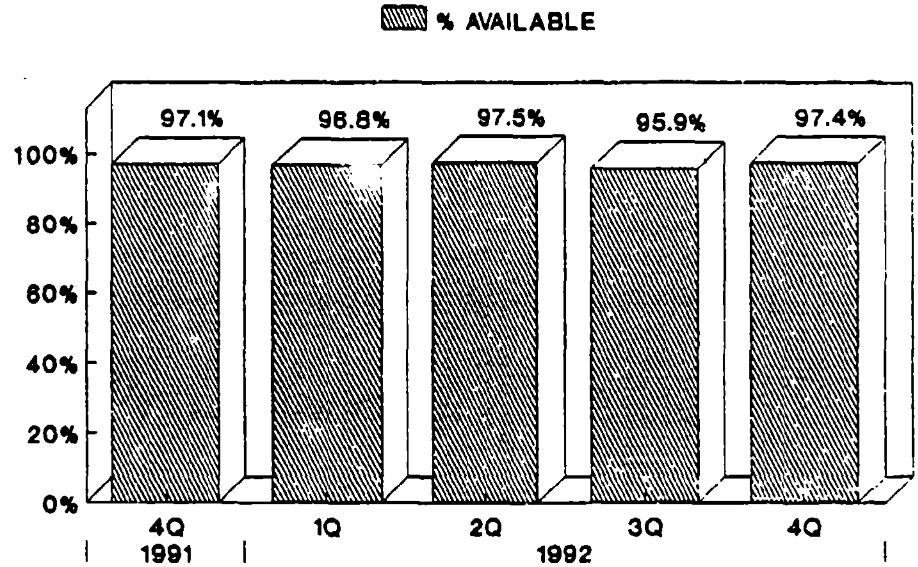

Figure 55

TOWED HOWITZER MEAN TIME TO REPAIR
4th Quarter 1991 - 4th Quarter 1992

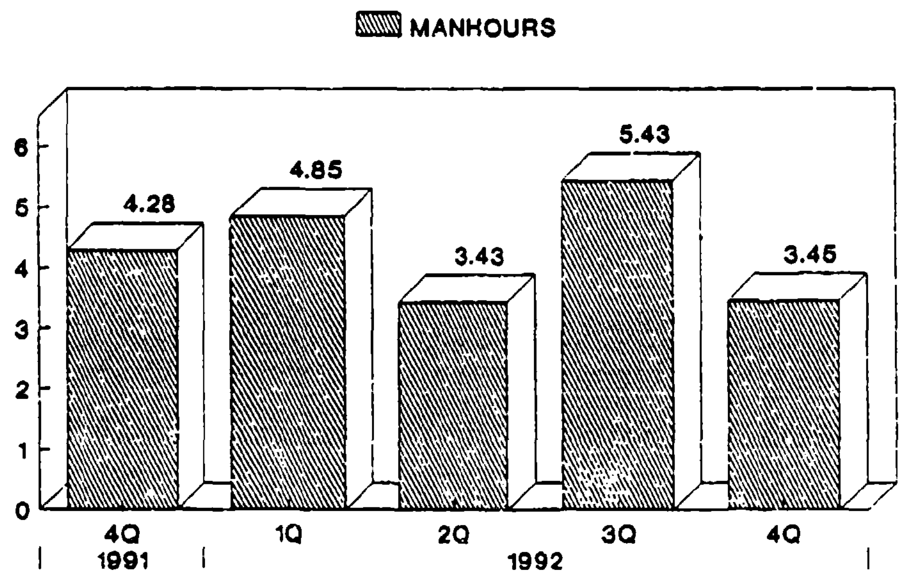

Figure 56

M998 AVAILABILITY
4th Quarter 1991 - 4th Quarter 1992

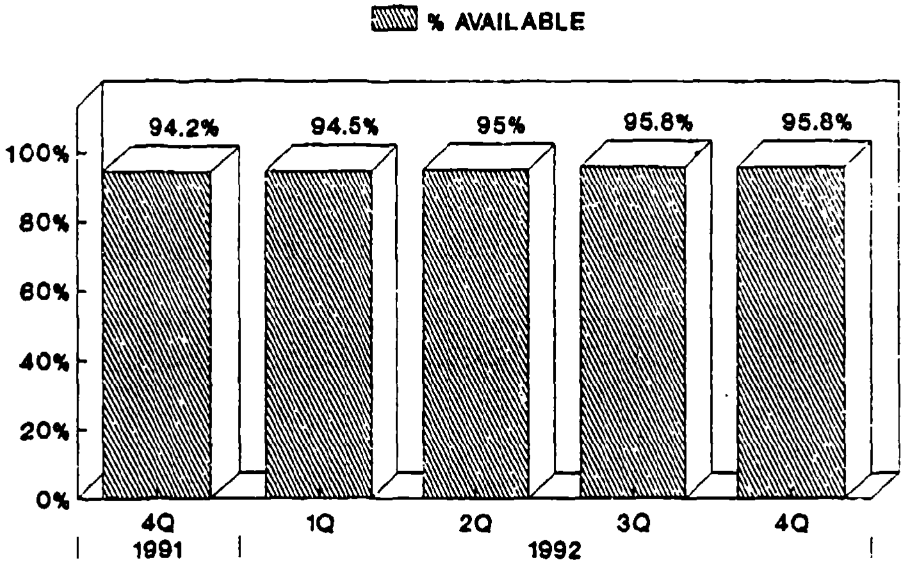

Figure 57

M998 MEAN TIME TO REPAIR
4th Quarter 1991 - 4th Quarter 1992

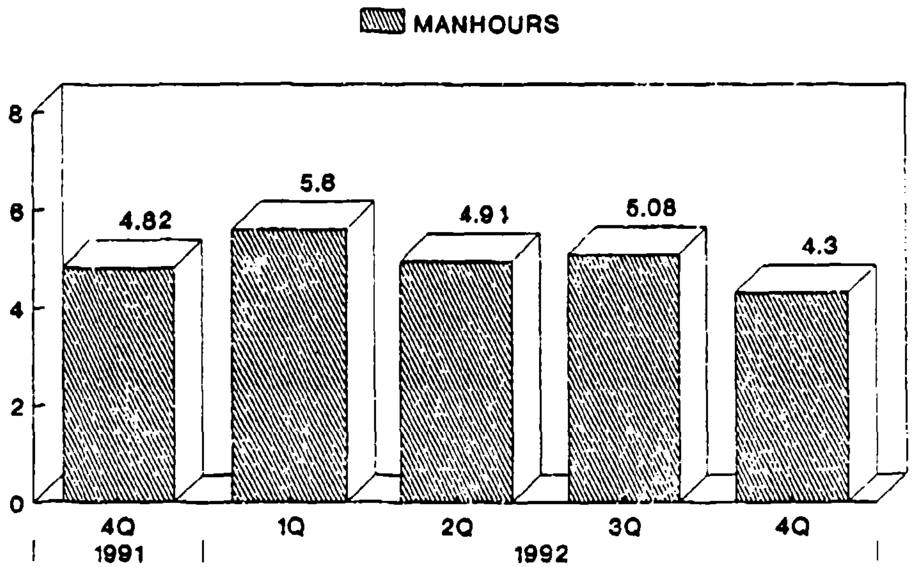

Figure 58

5 TON CARGO AVAILABILITY
4th Quarter 1991 - 4th Quarter 1992

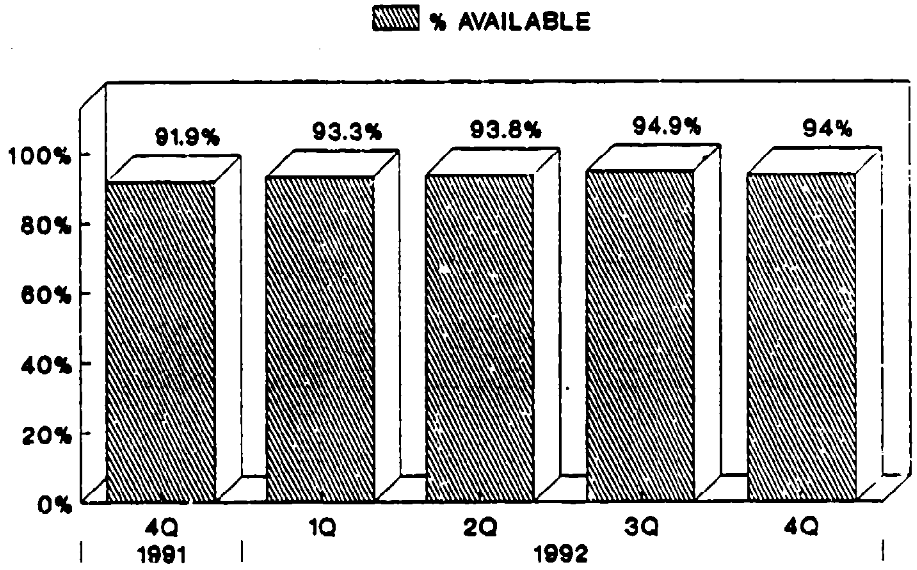

Figure 59

5 TON CARGO MEAN TIME TO REPAIR
4th Quarter 1991 - 4th Quarter 1992

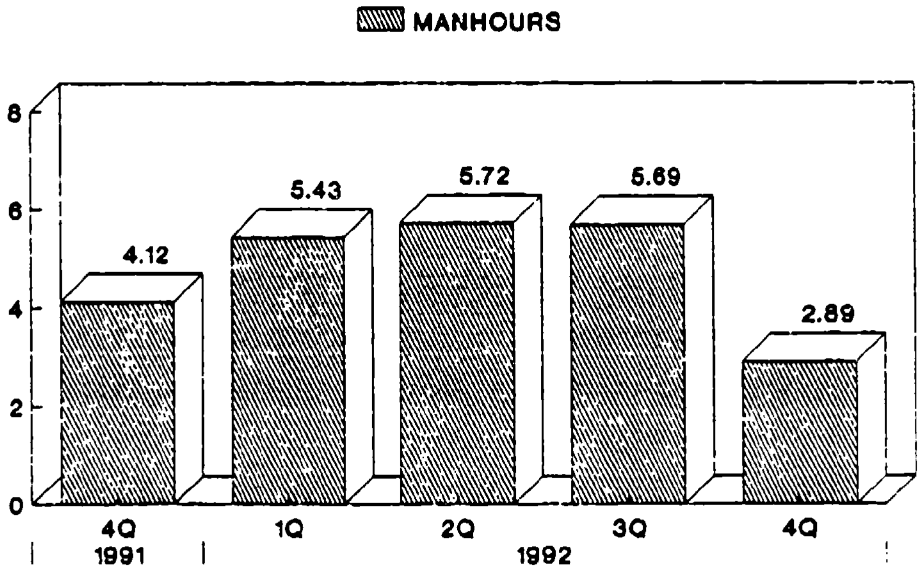

Figure 60

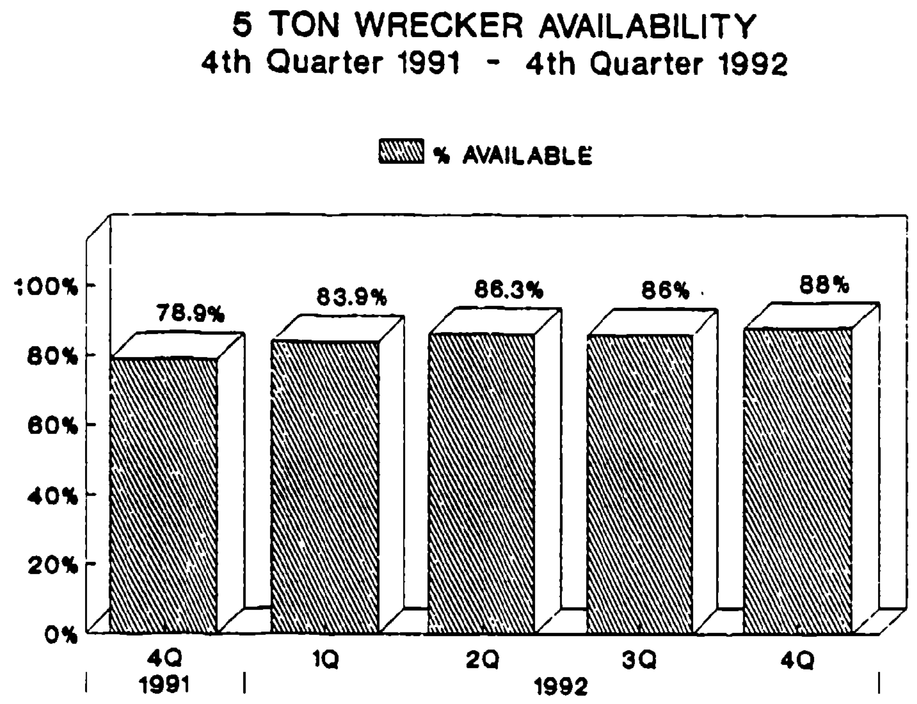

Figure 61

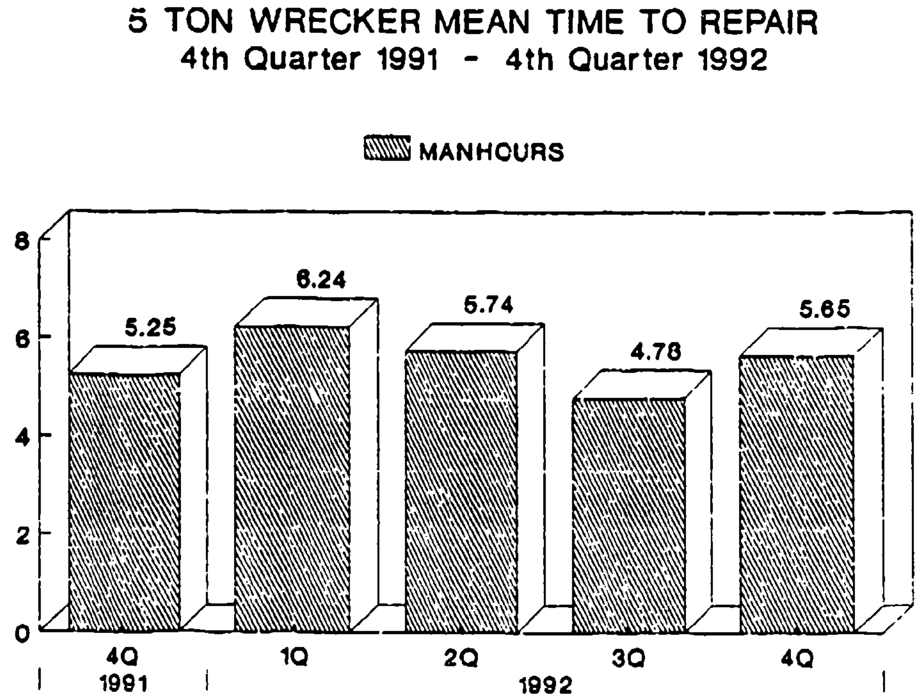

Figure 62

2 TON FORKLIFT AVAILABILITY
4th Quarter 1991 - 4th Quarter 1992

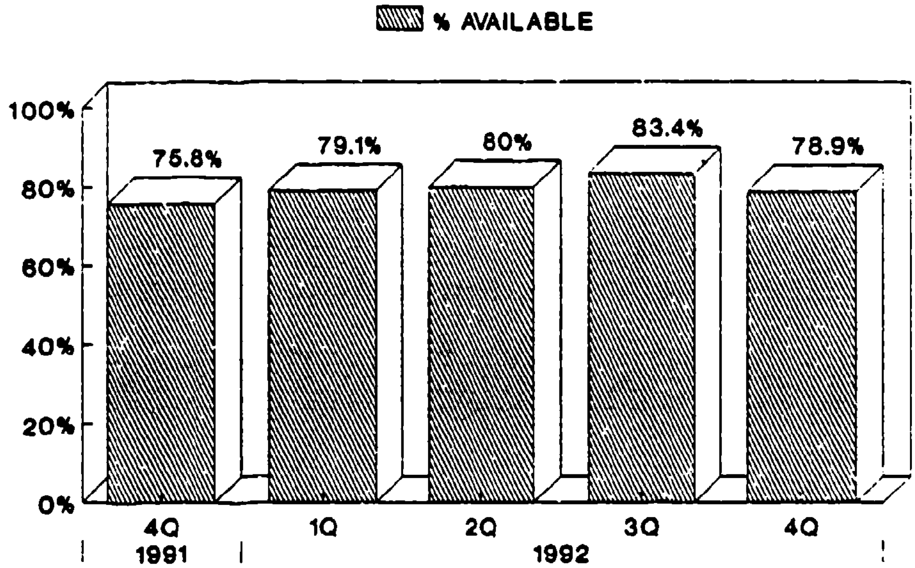

Figure 63

2 TON FORKLIFT MEAN TIME TO REPAIR
4th Quarter 1991 - 4th Quarter 1992

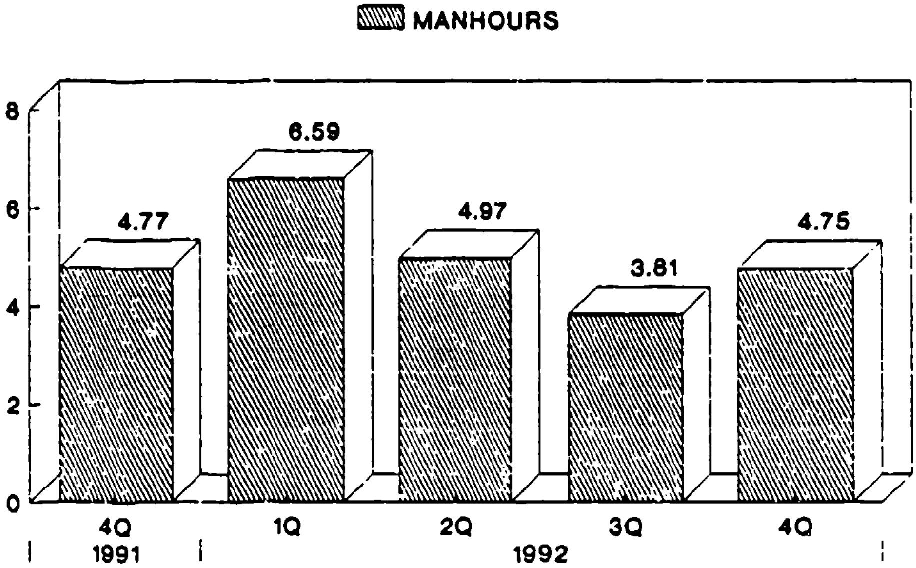

Figure 64

3 KW GENERATOR AVAILABILITY
4th Quarter 1991 - 4th Quarter 1992

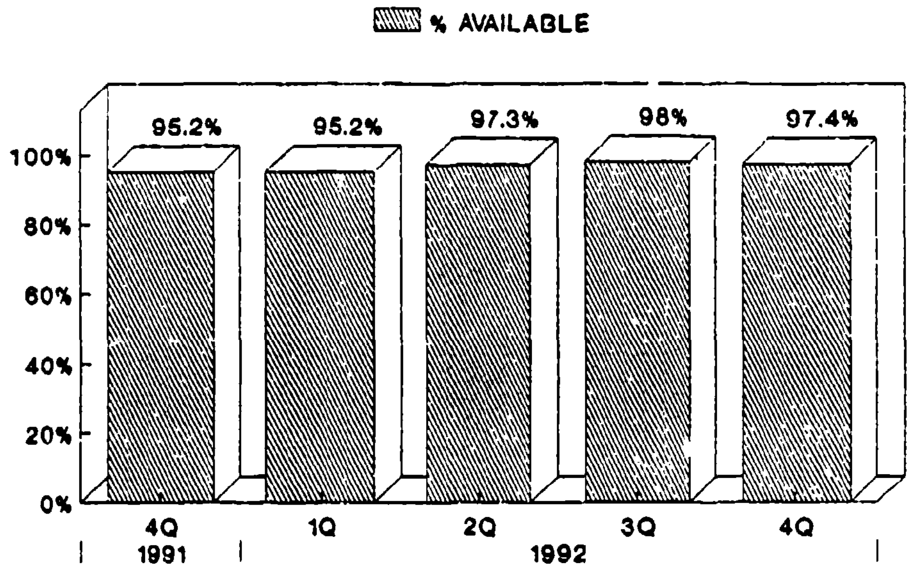

Figure 65

3 KW GENERATOR MEAN TIME TO REPAIR
4th Quarter 1991 - 4th Quarter 1992

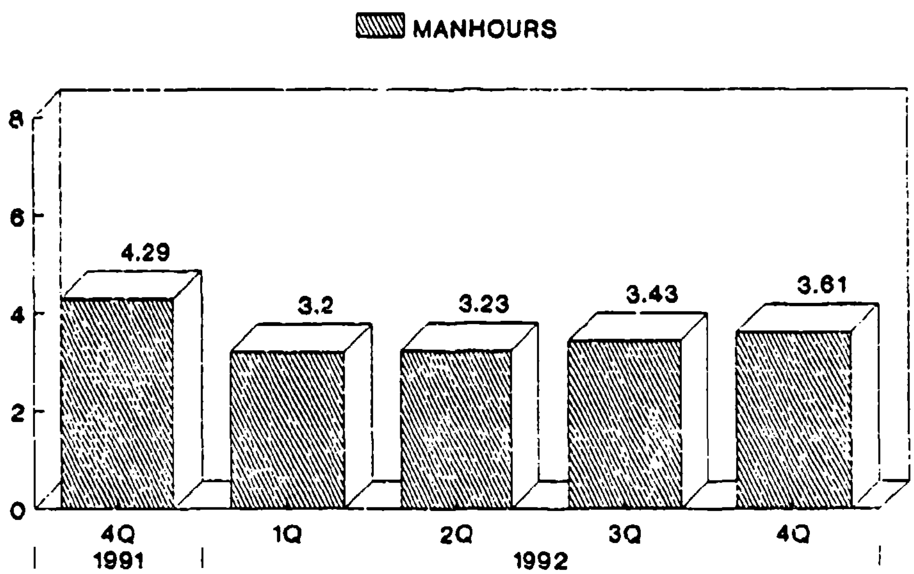

Figure 66

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