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**DEFENSE LOGISTICS AGENCY
LABORATORY TESTING RETURN ON
INVESTMENT MODEL**

NOVEMBER 1993

BURNHAM S. GOULD, JR.

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**DEPARTMENT OF DEFENSE
DEFENSE LOGISTICS AGENCY
Operations Research Office**

c/o Defense General Supply Center
8000 Jefferson Davis Highway
Richmond, VA 23297-5082

O'Hare International Airport
P.O. Box 66422
Chicago, IL 60666-0422



DEFENSE LOGISTICS AGENCY
HEADQUARTERS
CAMERON STATION
ALEXANDRIA, VIRGINIA 22304-6100



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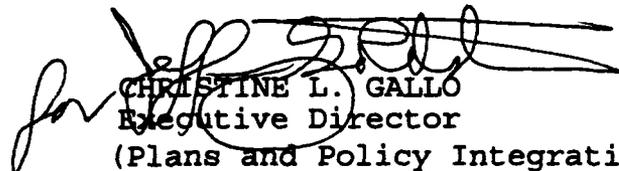
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FOREWORD

In September 1990, the Department of Defense Inspector General (DoDIG) released its final report entitled Audit of Nonconforming Products Procured by the Defense Industrial Supply Center. In the report, the DoDIG found an excessive number of items which did not conform to design specifications. The DoDIG claimed such high rates were attributed to an inadequate Department of Defense (DoD) Quality Assurance Program which "...lacked the support of a DoD policy that would use laboratory testing as a principal quality assurance tool."

Defense Logistics Agency's (DLA) Logistics Management Division, Directorate of Quality Assurance (DLA-QL) immediately initiated actions to improve DLA's Quality Assurance Program by establishing a program of laboratory testing. It included increased emphasis on inspecting items as they are received at depots, monitoring the quality of depot stocks, and verifying conformance of items before they leave vendor plants. Substantial investments were made in new in-house laboratory testing facilities at several supply centers and depots.

DLA's Quality Assurance Directorate desired development of a sound approach for measuring the returns from its investment in the laboratory testing program. It requested support in this effort from DLA's Operations Research Office (DORO). This report represents the initial study to provide that support. It was prepared under the guidance of Col Levi D. Lowman, Jr., USAF, Chief of the Laboratory Testing Team, and currently Chief of Product Conformance Product Definition.


CHRISTINE L. GALLO
Executive Director
(Plans and Policy Integration)

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EXECUTIVE SUMMARY

This report represents an initial effort to develop a sound approach for measuring DLA's return on its investment in its laboratory testing program. It provides a way of measuring both investment (costs incurred) and quantitative indicators of return (savings and costs avoided) broken down by supply center and in-house laboratory. It also provides initial measures of investment and return. They are based upon data on DLA laboratory testing activities (i.e., workloads, costs, etc.) obtained from supply centers and DLA in-house laboratories for FY 92.

Investment in the laboratory testing program consists largely of DLA labor and other operating costs, equipment depreciation, and payments for testing performed by non-DLA laboratories. Return is more complex. It includes motivating vendors to provide quality parts which result in fewer equipment breakdowns for DLA customers, thereby avoiding costly equipment repairs, and improving the success of military missions (with less loss of material, equipment, and life). Return also includes lower investments in inventory and reimbursements from vendors who provide nonconforming products. Use of DLA in-house laboratories collocated with supply centers reduces test cycle times. Use of such laboratories collocated with depots avoids shipping and handling costs. This study helps to show whether the various returns exceed the investments in laboratory testing.

The terminology used and availability of data on workloads and costs of the laboratory testing program vary greatly between different supply centers and DLA laboratories. Nevertheless, reasonably good estimates of investment can be made. Estimates of return are not as good. Much of the return cannot be expressed in quantitative terms. Moreover, data problems prevent the quantitative measures of return from being estimated in a consistent way for all supply centers and DLA laboratories.

The investment in the DLA laboratory testing program for FY 92 was about \$12 million. Quantitative estimates of return, within the limitations mentioned in the preceding paragraph, are \$36 million for FY 92. Qualitative indicators of return, in our view, are far larger and more important. Thus, the total return (quantitative plus qualitative) on investment in laboratory testing is highly favorable.

DLA should consider steps to standardize terminology and procedures for reporting workload and cost information so that activities at different supply centers and laboratories can be compared on a common basis. Measurements of investments in and returns from the laboratory testing program should be extended into FY 93 and beyond, using the procedures described in this report.

Because of the recent decision to fund DLA laboratories on a fee-for-service basis, the reader may be tempted to try to use this report to compare the economics of using commercial laboratories in lieu of in-house laboratories. Resist that temptation! The data in this report are not adequate for such a comparison. Moreover, the desirability of increasing in-house laboratory utilization to lower unit costs are not examined herein. A study of the economics of using in-house versus commercial laboratories will be instructive when; (a) more information on laboratory costs and returns is available, (b) there has been some experience with funding in-house laboratories on a fee for service basis, (c) relocation of the in-house laboratories at the Defense Electronics Supply Center and Defense Personnel Support Center (Clothing and Textile) becomes necessary because of Base Realignment and Closure 1993.

In conclusion, based on this study it appears that the overall DLA laboratory testing program is cost effective. Its optimality cannot be determined because of data limitations. As the program matures, further studies to improve the system will be feasible as the quality of data improves.

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ABBREVIATIONS

ABVM	Automated Best Value Model
CAPE	Contractor Assessment-Product Evaluation
C&T	Clothing and Textile
DCSC	Defense Construction Supply Center
DDRE	Defense Distribution Region East
DDRW	Defense Distribution Region West
DESC	Defense Electronics Supply Center
DGSC	Defense General Supply Center
DISC	Defense Industrial Supply Center
DLA	Defense Logistics Agency
DLA-Q	DLA Directorate of Quality Assurance
DoD	Department of Defense
DORO	DLA Operations Research Office
DPSC	Defense Personnel Support Center
FDA	Food and Drug Administration
FY	Fiscal Year
IMAS	Informal Material Accounting System
MRO	Material Release Order
PQDR	Product Quality Deficiency Report

SECTION 1 INTRODUCTION

1.1 BACKGROUND

DLA's Quality Assurance (QA) Directorate (superseded by the Supply Management Policy Group) has requested development of a sound approach for measuring the returns from its laboratory testing program. In response, the DLA Operations Research Office (DORO) prepared an Analytical Services Agreement which was approved on 29 January 1993 (Appendix F). This report was prepared in accordance with that agreement.

Several problems with measuring returns were apparent from the outset. One set of problems concerns defining what should be counted as return. For example, some testing is mandated by law or regulation. Requirements for some testing are so obvious that, although not legally mandated, failure to test would constitute gross mismanagement. Some testing seems truly discretionary. Clearly the requirements for, and returns from, the various types of testing are quite different. Complete elimination of laboratory testing is simply not a viable option.

Another set of problems concerns obtaining data needed to measure returns. Because the laboratory testing program was recently initiated at some supply centers and depot regions, the various DLA supply centers differ in the types of testing performed, in the data collected, in the use made of laboratory results, and even in the terminology used.

This report attempts to provide a reasonable approach to measuring these dissimilar activities. Admittedly, the approach is based on several key assumptions. Therefore, use of this report to make detailed comparisons (e.g. of the effectiveness of the laboratory testing program at different supply centers or at different in-house laboratories, or of commercial vs. in-house laboratories) would be unfair. For example, the report does not examine the desirability of increasing in-house laboratory utilization to lower unit costs of in-house testing. At most the report should be used to evaluate the strength of the overall program.

1.2 SCOPE

The study encompasses the laboratory testing program at Headquarters DLA, 5 supply centers (DCSC, DESC, DGSC, DISC, and DPSC(C&T)) and 5 DLA laboratories (DCSC, DESC, DPSC(C&T), DDRE, and DDRW). DPSC (Subsistence) and DPSC (Medical) testing were not included since they are not discretionary and do not incur out-of-pocket costs to DLA. Subsistence testing is controlled by the Departments of Agriculture and Commerce. Medical testing is controlled by the Food and Drug Administration. The photographic

laboratory at DGSC was not included because it was not opened until October 1992, after the close of FY 92.

1.3 OBJECTIVES

The study has three objectives:

Develop a methodology for measuring DLA investments in and returns from its laboratory testing program.

Develop initial measures of DLA investments in and returns from its laboratory testing program.

Provide DLA management with the capability to run "what if" simulations on the financial impacts of changes in workload levels, use of in-house versus outside laboratories, new investments in laboratories, expanded or curtailed lab testing programs, etc.

SECTION 2 METHODOLOGY

This study was carried out in accordance with the study approach described in the Analytical Services Agreement between the Directorate of Quality Assurance (DLA-Q) and the Directorate of Policy and Plans (DLA-L). The analysis was further specified in flow charts of operational processes for DLA laboratory testing. The charts were submitted to, and approved by, DLA-Q on 3 February 1993. They are shown at Appendix D.

Results of the study are based upon data obtained from supply centers and DLA in-house laboratories. Most of the data pertains to DLA laboratory testing activities (i.e., workloads, costs, etc.) during FY 92. However, some data for earlier years were obtained and used.

DORO initially submitted the data requirements for the study to DLA-Q on 3 February 1993. DLA-Q sent letters requesting the needed data to supply centers and defense distribution regions on 12 March 1993. Responses were submitted to DLA-Q for review, then forwarded to DORO for analysis. On 4 May 1993, an In-Process Review was held during which some gaps in the data, certain data anomalies, and some misinterpretations of questions were identified. As a consequence on 7 May 1993, the DLA Supply Management Group (having taken over sponsorship of the project from DLA-Q) sent follow-up data requests to the Quality Assurance directorates of supply centers and defense distribution regions. The responses were submitted directly to DORO. Any necessary clarifications generally were handled telephonically. This report utilizes the responses to the data requests of both 12 March and 7 May.

Appendix E shows the major points of contact who furnished data used in this report.

**SECTION 3
INVESTMENT (COSTS INCURRED)**

3.1 OVERVIEW

This section describes the investment in DLA's laboratory testing program. Investment is taken as equivalent to costs incurred. The subsections which follow describe the categories of investment included in this report. The summary shows estimated investment for FY 92 by supply center and DLA laboratory. Appendix A shows detail on how these investment estimates were developed by category of investment.

3.2 LABOR

This category represents salaries and benefits for personnel engaged in the laboratory testing program. It includes personnel who design test plans and monitor laboratory testing at each supply center as well as laboratory personnel who perform the tests.

3.3 TESTING, NON-DLA

This category represents the cost to DLA supply centers of tests performed by commercial and non-DLA governmental laboratories.

3.4 TESTING, OTHER DLA LABS

This category represents the cost to DLA supply centers of tests performed by DLA in-house laboratories that are not part of the supply centers ordering the tests.

3.5 OTHER OPERATING COSTS

This category represents operating costs other than labor. It includes travel, tuition, supplies, equipment operation and maintenance, other maintenance, etc. It does not include non-DLA testing, shipping and handling costs, or material destroyed, which are included elsewhere. No allowance is made for administrative and support burden.

3.6 EQUIPMENT DEPRECIATION

This category represents capital investment in equipment usually depreciated on a straight line basis using a 10 year service life.

3.7 SHIPPING AND HANDLING

This category includes the cost of depot handling and commercial shipping of items shipped from depots to test laboratories and back to depots.

3.8 MATERIAL DESTROYED

This category represents the cost of material destroyed as part of destructive testing.

3.9 REIMBURSEMENTS, NON-DLA

This category represents reimbursements provided to DLA laboratories for tests they performed for non-DLA requesters (i.e., directly for the Military Services or other Government Agencies).

3.10 REIMBURSEMENTS, DLA

This category represents reimbursements provided to DLA laboratories for tests performed for DLA supply centers of which they are not a part. This is a deduction from the cost of operating those laboratories. For DLA as a whole, the amounts are exactly offset by the charges shown under Testing, Other DLA Labs in Section 3.4, above.

3.11 SUMMARY

Table 3-1 provides a summary of the measures of investment for FY 92. Details are in Appendix A.

TABLE 3-1. SUMMARY OF MEASURES OF INVESTMENT, FY 92

<u>Activity</u>	<u>Investment (\$000)</u>
DCSC	\$ 1,377
DESC	2,846
DGSC	384
DISC	2,849
DPSC (C&T)	3,059
DDRE	439
DDRW	183
HQ DLA	<u>437</u>
TOTAL	\$11,574

The investment measures for FY 93 and beyond are expected to be significantly different. FY 92 was the first year of implementation of a formal laboratory test program at DCSC and DGSC. As such, they were building up during FY 92 and should have higher costs in the future. Investment at DGSC should be much higher because of the opening of the photographic laboratory in October 1992. The laboratories at DDRE and DDRW also were new in FY 92. As they develop a track record more of their costs should be offset by reimbursements. The DLA reorganization has resulted in smaller investments in the laboratory testing program at HQ DLA. Further changes are expected in FY 94 when the DLA in-house laboratories become independent of supply centers and their funding under a fee-for-service arrangement is initiated.

SECTION 4
RETURN (COSTS AVOIDED)

4.1 **OVERVIEW**

This section describes the methodology used to calculate the return from the laboratory testing program. Return is taken as being equivalent to benefits. It consists primarily of avoidance of costs that would be incurred if there were no laboratory testing program. Some types of cost avoidance can be measured. These are discussed in Section 4.2. The measurement procedures are illustrated using data for FY 92. However, the measurements should not be taken too seriously as good measures of several key variables were not available. Several simplifying assumptions were made. They are documented in the footnotes to Appendix B. Types of cost avoidance which cannot be measured are discussed in Section 4.3.

4.2 **QUANTITATIVE INDICATORS**

Measured, or quantitative, indicators of return are divided into three categories. The first two are programmatic. These are associated with the laboratory testing program independent of whether the tests are performed by DLA in-house laboratories or non-DLA governmental or commercial laboratories. They measure costs avoided as a result of testing ordered by supply centers. They are differentiated according to whether the testing is performed before or after the product is accepted into inventory. The former (i.e., programmatic pre-acceptance testing) is discussed in Section 4.2.1, below. The latter (i.e., programmatic post acceptance testing) is discussed in Section 4.2.2.

The third category consists of handling and shipping costs that are avoided when testing is performed by a DLA laboratory collocated with a depot that supplies the tested items. This is discussed in Section 4.2.3.

Costs avoided because tests performed by DLA in-house laboratories are not performed by non-DLA governmental or commercial laboratories are not included. From the standpoint of an individual laboratory this is an element of return. However, from the standpoint of the entire DLA laboratory testing program, it is a cost avoidance attributable to having in-house laboratories rather than a return. Appendix C shows the magnitude of this cost avoidance.

4.2.1 **FROM PROGRAMMATIC PRE-ACCEPTANCE TESTING**

This category refers to cost avoidance as a result of testing of items before they are received into inventory. It includes tests of samples of items taken at vendor plants (e.g. at DESC the

program known as TRISTAR) and at depots (i.e. receiving inspections for destination accepted material). The potential for cost avoidance is quite large. This is because detection and rejection of unsatisfactory lots at this stage prevent all of the non-conforming parts from reaching DLA customers.

The parameters used to estimate this type of cost avoidance are as follows:

- A= Number of lots rejected.
- B= Average number of items per lot.
- C= Number of items tested in lots rejected.
- D= Number of items failed in lots rejected.
- E= Number of items failed in lots accepted.
- F= Average cost to the Government (i.e., DLA customers) of repairing equipment damaged because of non-conforming items supplied by DLA.
- G= Total cost of non-conforming items in lots rejected and items rejected in lots accepted.

Given estimates of the parameters listed above, cost avoidance is estimated to be $\frac{D \times A \times B + E}{C} F + G$

Three supply centers, DESC, DISC, and DPSC (C&T), did a substantial amount of pre-acceptance testing in FY 92. Estimates of the costs avoided are provided in Table 4-1. Appendix B.1 shows the derivation of the estimates.

Table 4-1. ESTIMATED COST AVOIDANCE FROM PROGRAMMATIC PRE-ACCEPTANCE TESTING, FY 92

<u>Supply Center</u>	<u>Costs Avoidance(\$000)</u>
DESC	\$ 21,040
DISC	46
DPSC (C&T)	<u>11,823</u>
TOTAL	\$ 32,909

Two major qualifications about the above estimates must be clearly understood. Firstly, they are proportional to parameter F, the average cost to the Government of repairing equipment damaged because of non-conforming items supplied by DLA. Yet there is no hard data on this parameter. DESC provided some estimates that were little more than plausible guesses. The other supply centers had no data on this, so estimates provided by DESC were used.

Secondly, supply centers varied in their ability to provide data on the other parameters. DESC provided all of the parameters for electronic testing but did not provide parameters C, D, and E for other testing. DISC did not provide parameters B and G. DPSC(C&T) provided no data on parameters D, E, and G. DCSC and DGSC did not report any pre-acceptance testing. (Their data on post-acceptance testing was difficult to interpret because of

uncertainty about whether items in failed lots were withdrawn from stock (DCSC) and the meanings of the data furnished (DGSC).)

In the absence of needed data, alternative procedures were used to estimate cost avoidance from pre-acceptance testing (see Appendix B.1). The underlying assumptions are listed and should be noted.

4.2.2 FROM PROGRAMMATIC POST ACCEPTANCE TESTING

This category refers to cost avoidance as a result of testing of items after they are received into inventory. Cost avoidance may be estimated in a manner similar to that used for pre-acceptance testing with two exceptions. Firstly, since stock in accepted lots may be difficult to trace at depots and some may have been shipped to customers, part of the non-conforming lots will never be recovered. To compensate for this it is assumed that 50 percent of the items in non-conforming lots will not be recovered. Secondly, the cost of non-conforming items in lots rejected and items rejected in lots accepted is not counted. In some cases DLA can recover costs through voluntary refunds, replacement, or warranties, but this cost avoidance is expected to be minimal.

The parameters used to estimate this type of cost avoidance are as follows:

- A= Number of lots rejected.
- B= Average number of items per lot.
- C= Number of items tested in lots rejected.
- D= Number of items failed in lots rejected.
- E= Number of items failed in lots accepted.
- F= Average cost to the Government (i.e., DLA customers) of repairing equipment damaged because of non-conforming items supplied by DLA.

Given estimates of the parameters listed above, cost avoidance is estimated to be $\frac{D}{C} \times A \times B + E)F \times 0.5$.

Four supply centers, DCSC, DESC, DGSC, and DISC, did a substantial amount of post acceptance testing in FY 92. Estimates of the costs avoided are provided in Table 4-2. Appendix B.2 shows the derivation of the estimates.

Table 4-2. ESTIMATED COST AVOIDANCE FROM PROGRAMMATIC POST-ACCEPTANCE TESTING, FY 92

<u>Supply Center</u>	<u>Costs Avoidance(\$000)</u>
DCSC	\$ 495
DESC	1,221
DGSC	171
DISC	<u>912</u>
TOTAL	\$ 2,799

It must be emphasized that the foregoing estimates leave much to be desired. Firstly, the estimates are proportional to parameter F. As explained in Section 4.2.1 (above), the evidence supporting the data is very soft. Secondly, DESC was the only supply center for which the desired method of estimating returns could be used with some confidence. It was necessary to use other methods for the other supply centers (see Appendix B.2, footnote 3). This resulted in conservative estimates of cost avoidances.

4.2.3 HANDLING AND SHIPPING

This category refers to handling and shipping costs that are avoided when testing is performed by a DLA laboratory collocated with a depot that supplies the tested items. The handling costs that are avoided are the costs of depot Material Release Orders (MROs) for shipping products to and receiving products from outside test facilities less the costs of depot Informal Material Accounting System (IMAS) documents for issuing products to and receiving products from the collocated test facilities. The shipping costs that are avoided are the costs of shipping products to outside test facilities and return via commercial carriers.

Estimates of both types of costs were documented in the report entitled "Analysis of DLA's Quality Assurance Testing Laboratories," DLA-92-P10146, prepared by the DLA Operations Research and Economic Analysis Office, October 1991. For this report the estimates contained in the earlier report were updated. Specifically, handling costs (i.e., MROs and IMASs) were increased by 8.32 percent to reflect increases in federal pay schedules between FY 90 and FY 92. Shipping costs were updated to reflect average overnight shipping costs for the second and third quarters of FY 92 and ground transportation rates on file as of February 1993.

Estimates of the costs avoided for each DLA in-house laboratory collocated with a depot are provided in Table 4-3. Appendix B.3 shows the derivation of the estimates.

TABLE 4-3. ESTIMATED HANDLING AND SHIPPING COST AVOIDANCE, FY 92

<u>DLA Laboratory</u>	<u>Costs Avoidance(\$000)</u>
DCSC	\$ 24
DDRE	1
DDRW	<u>35</u>
TOTAL	\$ 60

4.2.4

SUMMARY

Table 4-4 provides a summary of the quantitative measures of return for FY 92, as described above.

TABLE 4-4. SUMMARY OF QUANTITATIVE MEASURES OF RETURN, FY 92 (000)

Activity	Programmatic		Handling and Shipping	Total
	Pre-Acceptance Testing	Post-Acceptance Testing		
DCSC	\$ -	\$ 495	\$ 24	\$ 519
DESC	21,040	1,221	-	22,261
DGSC	-	171	-	171
DISC	46	912	-	958
DPSC:C&T	11,823	-	-	11,823
DDRE	-	-	1	1
DDRW	-	-	35	35
TOTAL	\$32,909	\$2,799	\$ 60	\$35,768

4.3

QUALITATIVE INDICATORS

Laboratory testing is an essential part of the acquisition process. The benefits probably are best understood in qualitative terms. Some of them are described below.

4.3.1

VENDOR MOTIVATION

The knowledge that products may be tested motivates vendors to provide an acceptable product. In part, this is because failure of a product to pass tests will result in non-payment of invoices. Even worse, it may result in legal expenses, fines, penalties, and fraud convictions. DISC reported 56 contractor debarments and 22 contractor convictions as a result of laboratory testing for the period FY 87-92. DCSC reported 20 contractor debarments/separations supported by laboratory testing during the last 3 years. Moreover, the results of laboratory testing affect the ability of vendors to obtain new contracts. For example, an Automated Best Value Model (ABVM) and the Contractor Assessment-Product Evaluation (CAPE) program are designed to insure that vendors which consistently provide acceptable products receive favorable consideration in contract awards. Results of laboratory tests are essential inputs to ABVM and CAPE.

4.3.2

CUSTOMER SERVICE

The improved quality resulting from laboratory testing results in much better customer service. Since DLA ships fewer non-conforming parts, its customers have fewer equipment breakdowns due to faulty parts. Consequently, customers need to make fewer potentially expensive equipment repairs. More importantly, military readiness is improved. Missions can be

carried out more successfully, with less loss of material, equipment, and life.

4.3.3 IMAGE

Improved customer service enhances DLA's image with its customers. This provides many intangible benefits (e.g., pride in work, employee morale). One tangible benefit is that the number of Product Quality Deficiency Reports (PQDRs) probably goes down. The savings is addressed in a report entitled, "Administrative and Holding Costs Resulting from Processing Reports of Nonconforming Supplies," DLA-89-P81012, prepared by the DLA Operations Research and Economic Analysis Office, July 1989. It showed that the cost to DLA of a typical PQDR includes, as a minimum, administrative costs of \$501 and holding costs of 3.55 percent of the contract value.

4.3.4 INVENTORY COSTS

The improved quality resulting from laboratory testing means that customers return less product, stockouts due to faulty product are reduced, lead times for receipt of acceptable products are more dependable, and inventory can be controlled more effectively. This reduces the investment in inventory required to produce a given level of customer service.

4.3.5 SHELF LIFE EXTENSIONS

Laboratory testing sometimes is used to determine whether shelf lives may be extended. This can produce large savings by avoiding the purchase of new stock. For example, DPSC (Medical) reported that for FY 92, as a participant in the DoD/FDA Shelf Life Extension Program, it avoided purchases of over \$13 million at a cost for testing of \$285,000. (DoD wide purchases of over \$76 million were avoided for a testing cost of \$1,233,000.)

4.3.6 REIMBURSEMENTS

Laboratory testing frequently enables DLA to obtain large reimbursements from vendors who supply non-conforming products. For example, DCSC reported receiving over \$11 million as a result of legal actions over the period, FY 90-92. DISC reported receiving \$3 million as a result of legal actions over the period, FY 87-92. In addition, it received \$17 million in voluntary reimbursement from one company last year.

4.3.7 CYCLE TIME

The availability of in-house laboratories keeps test cycle times (i.e., elapsed time between initiation of test plans and evaluation of test results) low. DCSC and DPSC (C&T) reported that their in-house laboratories had much lower cycle times than non-DLA laboratories. This benefit, although difficult to quantify, is important to supply management effectiveness.

4.3.8**SUMMARY**

The preceding quantitative summary identified returns from the laboratory testing program in FY 92 of about \$36 million. The qualitative indicators of return from laboratory testing are far more important than the quantitative indicators. Laboratory testing motivates vendors to provide better products. This means that DLA customers have fewer equipment breakdowns. Hence, military missions can be carried out more successfully with less loss of material, equipment, and life. Moreover, DLA customers need make fewer costly equipment repairs. DLA can better control its investment in inventory. Also DLA receives substantial reimbursements from vendors, both voluntarily and from legal actions, as a result of laboratory testing.

SECTION 5 CONCLUSIONS

This report provides a methodology for measuring the investment in the DLA laboratory testing program. The data needed to support the measurements of investment for FY 92 were readily available only from DESC and DDRW. Various estimation procedures had to be used for the other supply centers and DLA laboratories. Nevertheless, the estimates are believed to be reasonably good. They indicate that the investment in the DLA laboratory testing program in FY 92 was about \$12 million.

This report provides a methodology for measuring some types of returns from the DLA laboratory testing program. Much of the data needed to support the measurements of return for FY 92 was either obtainable only with great difficulty or not available at all. Data meanings and availabilities differed greatly between supply centers and DLA laboratories. Data problems were least severe at DESC and the two distribution region laboratories. Data problems at the other supply centers led to assumptions which make detailed use of the estimates highly undesirable. The quantitative measures of return developed in this report indicate that the return from the laboratory testing program in FY 92 was about \$36 million. Most of the return is a cost avoidance associated with prevention of costs to customers for installing and replacing defective parts.

Use of the quantitative indicators of return shown in this report to compare different supply centers would be unfair and misleading. There are several reasons for this. Firstly, the measures shown are biased on the conservative side. Secondly, the types of testing performed and the use of the results vary greatly between supply centers and laboratories. Thirdly, there are important differences in the meaning of the data furnished by the different supply centers. For these reasons the biases in the measures shown are not consistent between supply centers.

The qualitative indicators of return are far larger and more important than the quantitative indicators. The total return (quantitative plus qualitative) from the DLA laboratory testing program is a large multiple of the annual investment in it. Thus, the annual return on investment was highly favorable in FY 92. Since FY 92 was the first year of the program at some locations, resulting in some high nonrecurring investment costs, future return on investment should be more favorable.

The principal returns from the laboratory testing program are associated with supply center functions (e.g., ordering tests, using test results) rather than laboratory functions (i.e., conducting tests). These benefits accrue regardless of where the tests are performed. The returns on investment from in-house

laboratories, particularly those not located at supply centers, are much lower. The return from DDRE in FY 92 was especially low, reflecting the fact that it was being developed during the year, was opened near the close of the year, and was seriously under utilized.

At some locations (e.g., DCSC, DESC, DPSC (C&T)) the DLA in-house laboratories are an integral part of the laboratory testing program of the supply centers. There is no simple way of separating their costs. This makes it impossible to develop return on investment models for DLA in-house laboratories separate from the laboratory testing program of the supply centers which they support. However, this will change with the administrative changes planned for FY 94 (i.e., in-house laboratories becoming independent of supply centers and funded on a fee for service basis). Development of return on investment models for DLA in-house laboratories separate and distinct from the laboratory testing program at supply centers should become feasible.

SECTION 6 RECOMMENDATIONS

DLA should consider steps to standardize terminology and procedures for reporting workload and cost data so that the costs of and results generated by the laboratory testing program at all supply centers and DLA laboratories can be examined on a common basis. The data elements used in this report provide a useful starting point.

DLA should consider undertaking further research to measure the cost to its customers of receiving items from DLA which do not meet specifications. For example, the probability of equipment failure and subsequent cost of repairing damaged equipment caused by non-conforming products supplied by DLA needs to be better understood.

DLA should consider measuring the return on investment from the laboratory testing program for FY 93 and subsequent years using the methodology described in this report. This will provide visibility on trends and a basis for identifying further research and opportunities for improvement. Beginning in FY 94, when the DLA in-house laboratories become independent of supply centers and their funding on a fee-for-service basis is initiated, separate measures of return on investment for DLA in-house laboratories and the laboratory testing program at supply centers would be desirable.

DLA should consider a follow-on study of the economics of using commercial laboratories in lieu of DLA in-house laboratories. Such a study would be appropriate when; (a) more information on laboratory testing costs and return is available, (b) there has been some experience with funding in-house laboratories on a fee for service basis, (c) relocation of the in-house laboratories at DESC and DPSC(C&T) becomes necessary because of Base Realignment and Closure 1993.

APPENDIX A
ESTIMATES OF INVESTMENT FOR FY 92

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**APPENDIX A
ESTIMATES OF INVESTMENT FOR FY 92**

<u>Cost Category</u>	<u>DCSC</u>	<u>DESC</u>	<u>DGSC</u>	<u>DISC</u>	<u>DPSC(C&T)</u>
Labor	\$ 855,916'	\$2,026,393'	\$160,246'	\$ 422,602'	\$1,911,653'
Testing, Non DLA	55,983'	18,800'	120,632'	2,240,245'	800,000'
Testing, Other DLA Labs	2,015' ⁰	-	76,346' ⁰	107,000' ⁰	-
Other Operating	163,032'	438,130'	1,096'	7,443'	259,276'
Equipment Depreciation	287,874'	278,962'	-	-	87,602'
Shipping and Handling	-	100,000'	26,000'	71,166'	-
Material Destroyed	12,408' ¹	-	-	-	-
TOTAL	\$1,377,228	\$2,862,285	\$384,320	\$2,848,456	\$3,058,531
Less: Reimbursements, Non DLA	-	16,100'	-	-	-
Reimbursements, DLA	-	-	-	-	-
Net	\$1,377,228	\$2,846,185	\$384,320	\$2,848,456	\$3,058,531

<u>Cost Category</u>	<u>DDRE</u>	<u>DDRW</u>	<u>HO DLA</u>	<u>TOTAL</u>
Labor	\$ 290,946'	\$ 228,740'	\$437,231'	\$ 6,333,277
Testing, Non DLA	-	23,524'	-	3,259,184
Testing, Other DLA Labs	-	-	-	185,361
Other Operating	55,333'	133,477'	-	1,057,787
Equipment Depreciation	97,704'	76,933'	-	829,075
Shipping and Handling	-	-	-	197,166
Material Destroyed	-	-	-	12,408
TOTAL	\$ 443,533	\$ 462,674	\$437,231	\$11,874,258
Less: Reimbursements, Non DLA	-	99,216'	-	115,316
Reimbursements, DLA	4,515' ¹	180,846'	-	185,361
Net	\$ 439,018	\$ 182,612	\$437,231	\$11,573,581

Footnotes

- ¹ Directly from source (supply center, DDR laboratory, or HQ DLA, as appropriate).
- ² Labor costs from source multiplied by 1.2955 (factor furnished by HQ DLA CAIL/Economic Analysis Team) to account for fringe benefits.
- ³ Labor costs from source multiplied by 1.20 (factor furnished by HQ DLA CAIL/Economic Analysis Team to account for nonproductive time) and by 1.2955 (to account for fringe benefits).
- ⁴ Labor costs from source multiplied by 1.2955 (to account for fringe benefits), then divided by 1.17 (to remove fringe benefits reported to have been included by source).
- ⁵ Labor costs (salaries and fringe benefits of 29.55 percent) for 18 people at GS-11, step 5, pay grade.
- ⁶ Directly from source for period 30 Apr 92 - 8 Apr 93.
- ⁷ Operating costs other than labor are assumed to be 16 percent of total operating costs (labor plus other operating costs) per report entitled "Analysis of DLA's Quality Assurance Testing Laboratories," DLA Operations Research and Economic Analysis Office, December 1991, page 12.
- ⁸ Equipment depreciation is assumed to have same relation to labor costs as was reported for DDRW.
- ⁹ No estimate provided. Assumed to be zero.
- ¹⁰ Data from DDRE and DDRW. Supply centers either provided somewhat different data or were unable to provide data.

APPENDIX B
ESTIMATES OF RETURN

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APPENDIX B.1
ESTIMATES OF RETURN BY SUPPLY CENTER, FY 92
PROGRAMMATIC PRE-ACCEPTANCE TESTING

	<u>DESC¹</u>			<u>Total</u>	<u>DISC</u>	<u>DPSC:C&T</u>
	<u>Electronic</u>	<u>Packaging</u>	<u>Other</u>			
A. Number of lots rejected	68	25	52		59	13
B. Average number of items per lot	289	308	509			25,985
C. Number of items tested in lots rejected	2,569				243	65
D. Number of items failed in lots rejected	416				98	
E. Number of items failed in lots accepted	14				0	
F. Average cost of repairing equipment damaged because of nonconforming items furnished ²	\$1,390	\$ 35	\$465		\$465	\$ 35
G. Total cost of nonconforming items in lots rejected and items rejected in lots accepted (000)				\$4,019		
H. Return before credit for cost of rejects (see footnote 3) (000)	\$4,443	\$270	\$12,308	\$17,021	\$46	\$11,823
I. Total return (G&H) (000)				\$21,040	\$46	\$11,823

¹Includes data from DESC Test and Evaluation Report for FY 92 for receiving inspection and TRISTAR program.

²Estimates for DISC and DPSC(C&T) were not available. The estimate provided by DESC for "other" items was used for DISC. The estimate provided by DESC for packaging was used for DPSC(C&T). The sources of the estimates are explained in the DESC Test and Evaluation Report for FY 92, page 21.

³Return before credit for cost of rejects was assumed to be $(\frac{D}{C} \times A \times B + E)F$ where values for all parameters were available.

For DESC (packaging), DESC (other), and DPSC(C&T) it was assumed to be $A \times B \times F$. For DISC it was assumed to be $D \times F$.

APPENDIX B.2
ESTIMATES OF RETURN BY SUPPLY CENTER, FY 92
PROGRAMMATIC POST ACCEPTANCE TESTING

	<u>DESC¹</u>			<u>Total</u>	<u>DGSC</u>	<u>DISC</u>
	<u>DCSC</u>	<u>Electronic</u>	<u>Mechanical</u>			
A. Number of lots rejected	229	34	0	9	86	1,962
B. Average number of items per lot	2,228	138	0	138	6	218
C. Number of items tested in lots rejected	1,169	2,400	0		387	196
D. Number of items failed in lots rejected	1,064	443	0		368	0
E. Number of items failed in lots accepted	0	93	191		15	465
F. Average cost of repairing equipment damaged because of nonconforming items furnished ²	\$ 465	\$ 1,390	\$ 1,390	\$ 465	\$ 465	\$ 912
G. Total return (000) ³	\$ 495	\$ 667	\$ 265	\$ 289	\$ 171	\$ 912

¹Includes data from DESC Test and Evaluation Report for FY 92 for Commercial Testing and Stock Quality Assurance.
²Estimates for DCSC, DGSC, and DISC were not available. The estimate provided by DESC for "other" items was used for these supply centers. The sources of the estimates are explained in the DESC Test and Evaluation Report for FY 92, page 21.

³Total return was assumed to be $\frac{(D \times A \times B + E)F}{C} \times 0.5$ except as noted below:

- a. For DCSC return was assumed to be DxF, since it was not sure that most items in failed lots were withdrawn from stock.
- b. For DESC (mechanical) return was assumed to be ExF since there were no rejected lots.
- c. For DESC (other) return was assumed to be AxBxF in accordance with the DESC Test and Evaluation Report.
- d. For DGSC return was assumed to be DxF because the data provided on lot size had a different meaning than that used herein.
- e. For DISC return was assumed to be AxF because there was no information on average lot size.

APPENDIX B.3
ESTIMATES OF RETURN BY DLA LABORATORY, FY 92

HANDLING AND SHIPPING

Avg Costs per Test		<u>DCSC</u>	<u>DDRE</u>	<u>DDRW</u>
Handling				
MRO, Shipping	(1)	\$ 5.741	\$ 5.448	\$ 6.055
MRO, Receiving	(2)	<u>10.973</u>	<u>12.121</u>	<u>14.807</u>
Total	(3) = (1)+(2)	\$16.714	\$17.569	\$20.862
IMAS, Shipping	(4)	1.462	1.495	1.679
IMAS, Receiving	(5)	<u>3.401</u>	<u>2.914</u>	<u>4.604</u>
Total	(6) = (4)+(5)	<u>\$ 4.863</u>	<u>\$ 4.409</u>	<u>\$ 6.283</u>
Net Savings	(7) = (3) - (6)	\$11.851	\$13.160	\$14.579
 Shipping				
One Way	(8)	\$10.978	\$10.932	\$11.259
Round trip	(9) = 2x(8)	<u>21.956</u>	<u>21.864</u>	<u>22.518</u>
Total Net Savings	(10) = (7)+(9)	\$33.807	\$35.024	\$37,097
 Number of Tests Conducted(11)		714	19	954
Total Savings	(12) = (10)x(11)	\$24,138	\$ 665	\$35,391

APPENDIX C
EXTERNAL LABORATORY TESTING

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C-2	Estimated Cost Avoidance For External Laboratory Testing, FY 92	C-6

APPENDIX C
EXTERNAL LABORATORY TESTING

Return on investment for a DLA in-house laboratory on a stand alone basis is not apparent from the data given elsewhere in this report. In particular, the cost of operating a laboratory is the cost before reimbursements. Thus, the relevant investment figures for laboratories which are independent of supply centers (i.e., DDRE and DDRW) are the costs before reimbursements.

Returns for such laboratories include:

1. Handling and shipping costs that are avoided when testing is performed by a DLA laboratory collocated with a depot that supplies the tested items (addressed in Section 4.2.3 of this report).
2. Reimbursements received for tests performed for non-DLA requesters (addressed in Section 3.9 of this report as a cost deduction).
3. Costs avoided because tests performed by DLA in-house laboratories otherwise would have been performed by non-DLA governmental laboratories or by commercial laboratories. This is a major item not addressed elsewhere in this report. Estimates for FY 92 are provided below.

An estimate of the external laboratory testing cost avoidance per test may be based upon the average cost of tests by commercial laboratories and non-DLA governmental laboratories as reported by the DLA supply centers for FY 92. Table C-1 shows the numbers provided. The average cost of \$1,096 per test was assumed to be an appropriate estimate of costs avoided because of tests conducted at all DLA in-house laboratories. Admittedly, this ignores significant differences in the nature of the tests conducted.

TABLE C-1. COSTS FOR NON-DLA LABORATORIES, FY 92

<u>Supply Center</u>	<u>No. of Tests</u>	<u>Total Cost</u>	<u>Average Cost Per Test</u>
<u>Commercial Laboratories</u>			
DCSC*	30	\$ 19,351	\$ 645
DESC	67	38,890**	580
DISC	<u>1,402</u>	<u>1,583,345</u>	<u>1,129</u>
Subtotal	1,499	\$1,641,586	\$1,095
<u>Governmental Laboratories</u>			
DCSC*	107	36,632	342
DGSC	118	120,632	1,022
DISC	889	656,900	739
DPSC:C&T	<u>357</u>	<u>800,000</u>	<u>2,241</u>
Subtotal	1,471	\$1,614,164	\$1,097
GRAND TOTAL	2,970	\$3,255,750	\$1,096

* DCSC for 30 April 92 - 31 March 93.

** DESC costs for tests made in FY 92 rather than expenses recorded for FY 92.

Estimates of the costs avoided for each DLA in-house laboratory are provided in Table C-2. The large cost avoidance shown for DPSC(C&T) may be inflated due to the assumption of equal costs per test discussed above.

TABLE C-2. ESTIMATED COST AVOIDANCE FOR EXTERNAL LABORATORY TESTING, FY 92

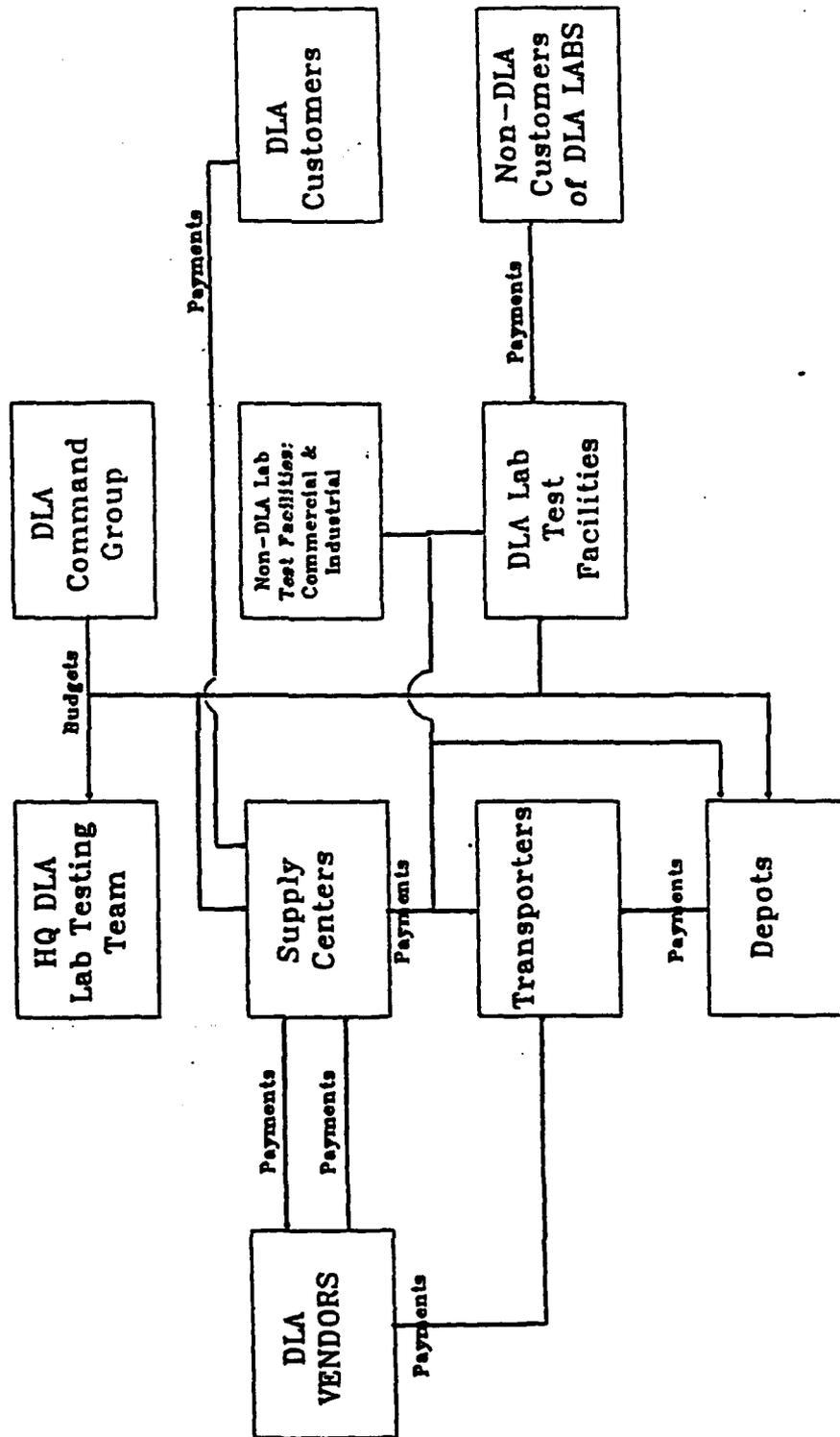
<u>DLA Laboratory</u>	<u>Number of Tests Performed</u>	<u>Return (Costs Avoided)</u>	
		<u>Per Test</u>	<u>Total (000)</u>
DCSC	752	\$1,096	\$ 824
DESC	2,507	1,096	2,748
DPSC(C&T)	4,451	1,096	4,878
DDRE	44	1,096	48
DDRW	<u>1,366</u>	<u>1,096</u>	<u>1,497</u>
TOTAL	9,120	\$1,096	\$9,995

**APPENDIX D
FLOW CHARTS**

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DLA LAB TESTING ROI MODEL MONEY FLOW



**APPENDIX E
POINTS OF CONTACT**

**APPENDIX E
POINTS OF CONTACT**

The principal point of contact for each location which furnished the data used in this report is shown below:

DLA Headquarters

**Mr. Alex Melnikow
Action Officer, Product Conformance
DSN 667-0505**

Supply Centers

**DCSC
Mr. John Copeland
Chief, Test Facility
DSN 850-3589**

**DESC
Mr. Brian McNicholl
Chief, Test Facility
DSN 986-6964**

**DGSC
Mr. Charles Bates
Chief, Testing
DSN 695-3598**

**DISC
Ms. Mickie Joyce
Manager, CAPE Program
DSN 442-0564**

**DPSC(C&T)
Mr. Algie L. Manuel
Assistant Chief, Quality
DSN 444-3241**

Distribution Regions

**DDRE
Mr. Michael N. Yakubick
Chief, Test Laboratory
DSN 977-4098**

**DDRW
Mr. David Clarimo
Chief, Test Laboratory
DSN 462-2631**

APPENDIX F
ANALYTICAL SERVICE AGREEMENT

**ANALYTIC SERVICES AGREEMENT
DEFENSE LOGISTICS AGENCY (DLA) LABORATORY TESTING
RETURN ON INVESTMENT (ROI) MODEL
DLA-XX-P20253**

SECTION 1 - STUDY DESCRIPTION

- 1.1 PROBLEM STATEMENT.** DLA's Quality Assurance Directorate (DLA-QL) management requires a sound approach for measuring the returns (value added) from its laboratory testing program.
- 1.2 OBJECTIVES.**
- 1.2.1 Develop a methodology for measuring DLA investments in and returns from its laboratory testing program.
 - 1.2.2 Develop initial measures of DLA investments and returns from its laboratory testing program.
 - 1.2.3 Provide DLA management with the capability to run "what if" simulations on the financial impacts of changes in workload levels, use of in-house vs outside laboratories, new investments in laboratory facilities, expanded or curtailed lab testing programs, etc.
- 1.3 BACKGROUND.**
- 1.3.1 During the past year DLA greatly strengthened its laboratory testing program. This included increased emphasis on inspecting items as they are received at depots, monitoring the quality of depot stocks, and verifying conformance of items before they leave vendor plants (eg. TRISTAR program). Also substantial investments were made in DLA in-house laboratory testing facilities.
 - 1.3.2 This study builds upon DLA-XX-P10146, "Analysis of DLA's Quality Assurance Testing Laboratories," published as a "white cover" report in December 1991.
- 1.4 SCOPE.**
- 1.4.1 The study will include financial investments (costs incurred) and financial returns to DLA and its customers from the agency's Laboratory Testing Program at all DLA supply centers (except the Defense Fuel Supply Center) and Distribution Region laboratories.
 - 1.4.2 Costs charged to DLA supply centers for tests run at non-DLA government and commercial

- laboratories will be included in the costs of the supply centers.
- 1.4.3 Initial measures of DLA investments and returns from its lab testing program will cover FY 92. Time series data will cover future periods as it becomes available.

SECTION 2 - STUDY APPROACH

2.1 ANALYTICAL TECHNIQUES APPLIED.

- 2.1.1 A flow chart will be developed which defines the scope and operational processes of the DLA Lab Testing Program. This chart will provide the foundation for subsequent analyses.
- 2.1.2 The total cost of the DLA lab testing program for FY 92 by location will be developed. This will include:
- 2.1.2.1 The total cost of operating DLA laboratory testing facilities, including labor, other operating costs, maintenance, and depreciation.
 - 2.1.2.2 Costs of non-DLA government and commercial laboratories used in support of the DLA laboratory testing program.
 - 2.1.2.3 Cost of the Quality Assurance Test Division of each supply center (or whichever division accomplishes this function).
 - 2.1.2.4 Applicable costs of the Laboratory Testing Team at HQ DLA.
- 2.1.3 A comprehensive list of quantitative and qualitative benefits from the DLA laboratory testing program will be developed.
- 2.1.4 Measures of return from the DLA laboratory testing program for each supply center will be developed and analyzed. These measures will be in the form of time series spanning several (up to ten) years. They will include at least the following:
- 2.1.4.1 Nonconformity rates for product received.
 - 2.1.4.2 Numbers of product Quality Deficiency Reports submitted by the services, DLA activities, and from previously completed lab tests.
 - 2.1.4.3 Total dollars collected from vendors (reimbursements) as a compensation for supplying non-conforming product.

2.1.5 A comprehensive laboratory testing cost avoidance model will be developed which results in data to satisfy the study objectives. Characteristics of the model include:

- Tangible measures of both investments (costs actually incurred) and returns (costs avoided).
- Scope is limited primarily to the discretionary portion of the lab testing program. Directed testing, by its nature, does not result in true cost avoidances because there is no alternative to testing. In other words, because the testing is mandated, benefits will be accrued whether or not other testing is accomplished.
- Modules for each supply center and DLA Distribution Region laboratory.
- Use the Defense Electronics Supply Center (DESC) Cost Avoidance Model as the initial point of departure for model development.

Investments used will be the portions of total DLA laboratory testing program costs (para 2.1.2) that relate to discretionary programs. Returns measured will include at least the following:

- Avoidance of costs to repair equipments by DLA and its customers due to detection of non-conforming lots and faulty parts.
- Avoidance of costs to replace parts due to detection of non-conforming lots and faulty parts.
- Net savings due to the use of DLA labs in lieu of non-DLA government and commercial labs for required testing.
- Avoidance of shipping costs when items tested are taken from depots collocated with the DLA test labs.
- Avoidance of depot handling costs when items tested are taken from depots collocated with the DLA test labs or are tested at vendors' plants (TRISTAR program).

- Reimbursement for lab - tests performed for other agencies (e.g. Army, Navy, Air Force, NASA, etc.).

2.2 SPECIAL REQUIREMENTS. The project will require extensive data collection.

- 2.2.1 DLA-QL and DORO jointly will develop the definitions of the data required.
- 2.2.2 DLA-QL will be responsible for insuring that data needed are provided in a timely manner.
- 2.2.3 DLA-QL and DORO jointly will visit supply centers and DLA labs as required.
- 2.2.4 DLA-QL will be responsible for maintaining the cost avoidance model.

SECTION 3 - DELIVERABLES

- 3.1 Monthly progress reports.
- 3.2 Flow chart of DLA Lab Testing process.
- 3.3 Measures of total costs of DLA lab testing program by supply center and distribution region laboratory.
- 3.4 List of quantitative and qualitative benefits of DLA Lab Testing Program.
- 3.5 Measures of returns over time with analysis by supply center.
- 3.6 Comprehensive lab testing cost avoidance model with modules for each supply center and laboratory facility and with measures for FY 92.
- 3.7 Documentation (User's Guide) for cost avoidance model.
- 3.8 Final briefings
- 3.9 Final written report.

SECTION 4 - MILESTONES

	Organization	
	Primarily Responsible	
	<u>LO/DORO</u>	<u>DLA-OL</u>
4.1 ASA approval		1 Jan 93
4.2 Deliver flow chart	15 Jan 93	
4.3 Flow chart decision		15 Jan 93
4.4 Define data requirements	31 Jan 93	31 Jan 93
4.5 Data requests to all data sources		15 Feb 93
4.6 Receipt of all data		15 Apr 93
4.7 In-Process Review	15 May 93	
4.8 Deliver: Measures of total cost	15 May 93	
List of benefits	15 May 93	
Measures of returns overtime	15 May 93	
Model modules for DDRE lab	15 May 93	
Model Modules for DDRW lab	15 May 93	
4.9 Complete model modules for DESC	31 May 93	
Complete model modules for DCSC	30 Jun 93	

Complete model modules for DISC	31 Jul 93
Complete model modules for DGSC	15 Aug 93
Complete model modules for DPSC, C&T, Medical, Subsistence	31 Aug 93
4.10 Deliver final production model with documentation	30 Sep 93
4.11 Final brief to sponsor	30 Sep 93
4.12 Draft Report	15 Oct 93
4.13 Final Report	30 Nov 93
4.14 Anticipated Level-of-Effort:	1350 hours equating to a cost of approximately \$78,300.

SECTION 5 - STUDY MANAGEMENT

5.1 SPONSORING ORGANIZATION POCs.

DLA-QL Contact: COL Levi D. Lowman, Jr., USAF
Chief, Laboratory Testing Team
Study Sponsor
Phone: (DSN) 284-4127
FAX: (DSN) 284-4498

Contact: Major Sarah Satterfield, USA
Action Officer
Phone: (DSN) 284-6456
FAX: (DSN) 284-4498

Contact: Mr. Paul LaBute
Action Officer
Phone: (DSN) 284-6456
FAX: (DSN) 284-4498

5.2 PERFORMING ORGANIZATION POCs.

DLA-LO Contact: Mr. Jim Russell
Senior Study Director,
Acquisition Management
Phone: (DSN) 284-7227
FAX: (DSN) 284-3831

DLA-DORO Contact: MAJ Mark Melius, USA
Lead Analyst
Phone: (DSN) 695-5198
FAX: (DSN) 695-5319

Contact: Mr. Burnham Gould
Associate Analyst
Phone: (DSN) 695-4972
FAX: (DSN) 695-5319

ANALYTIC SERVICES AGREEMENT
DEFENSE LOGISTICS AGENCY (DLA) LABORATORY TESTING
RETURN ON INVESTMENT (ROI) MODEL
DLA-XX-P20253

for Christine L. Gallo
ROGER C. ROY
Assistant Director
Policy and Plans

1/29/93
Date

T.C. Hruskocy
T.C. HRUSKOCY, BRIG GEN, USAF
Executive Director
Quality Assurance

25 JAN 93
Date

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6. AUTHOR(S) Burnham S. Gould, Jr.	
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13. ABSTRACT (Maximum 200 words)
This report represents an initial effort to develop a sound approach for measuring DLA's return on its investment in its laboratory testing program. It provides a way of measuring both investment (costs incurred) and quantitative indicators of return (savings and costs avoided) broken down by supply center and in-house laboratory. It also provides initial measures of investment and return based upon data for FY 92. Investment is estimated to be about \$12 million. Quantitative estimates of return are \$36 million. Qualitative indicators of return are far larger. Thus, the total return on investment in laboratory testing is highly favorable.

14. SUBJECT TERMS Testing, Laboratories, Costs, Savings	15. NUMBER OF PAGES 82
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17. SECURITY CLASSIFICATION OF REPORT UNCLASSIFIED	18. SECURITY CLASSIFICATION OF THIS PAGE UNCLASSIFIED	19. SECURITY CLASSIFICATION OF ABSTRACT UNCLASSIFIED	20. LIMITATION OF ABSTRACT
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