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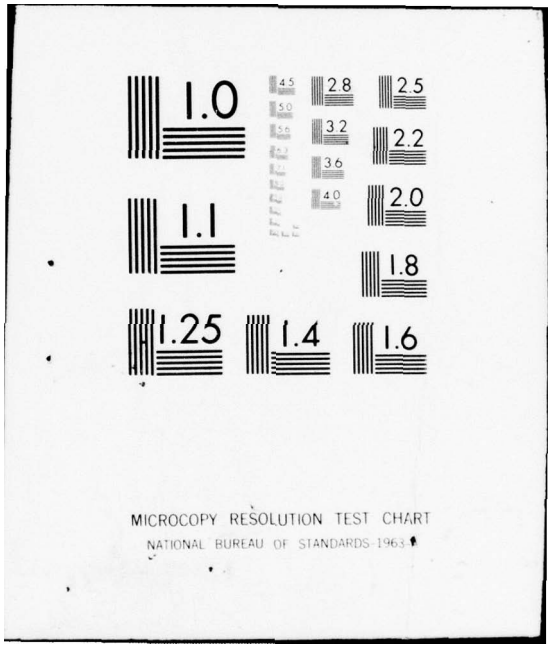
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PHASE III FINAL REPORT

ECONOMIC ANALYSIS OF SELECTED TEST MEASUREMENT AND DIAGNOSTIC EQUIPMENT FROM THE U. S. ARMY COMMUNICATIONS COMMAND PREFERRED ITEMS LIST

Volume 2: Technical Report

May 1975

Prepared for
THE U. S. ARMY ELECTRONICS COMMAND
FORT MONMOUTH, NEW JERSEY
and
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FORT HUACHUCA, ARIZONA
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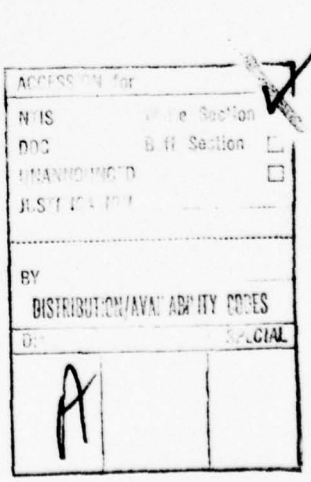
We are especially grateful to the assistance provided by C.W.O. A. Simmons of USACC and Mr. L. Loken and Mr. S. Austin of USAECOM.

FOREWORD

ARINC Research Corporation is conducting an economic analysis of Test Measurement and Diagnostic Equipment (TMDE) from the U.S. Army Communications Command (USACC) Preferred Items List (PIL). The analysis is being performed for the U.S. Army Electronics Command, Fort Monmouth, and USACC, Fort Huachuca.

This study is being conducted in five phases, with the overall objective being to evaluate the potential economic benefits of adoption of the complete PIL. Details of Phase III, an economic analysis of selected TMDE, are described in this report. The report is divided into two volumes, the first volume being a management summary and the second (this document) providing detailed results.

Phases I and II of the TMDE economic analysis were reported upon in previous publications of ARINC Research Corporation.



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Section 1

INTRODUCTION, SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

1.1 INTRODUCTION

This report presents the results of an economic analysis performed by ARINC Research Corporation for the U.S. Army Electronics Command (USAECOM), Fort Monmouth, New Jersey, and U.S. Army Communications Command (USACC), Fort Huachuca, Arizona. The analysis was conducted as Phase III of a projected five-phase program to assess the economic benefits of standardizing the USACC Preferred Items List (PIL) of Test Measurement and Diagnostic Equipment (TMDE). The five phases of the program are:

Phase I – Development of a TMDE life cycle cost (LCC) estimation methodology and selection of three PIL TMDE for detailed economic analysis.

Phase II – Determination of the availability of data required to conduct the economic analysis of the three selected TMDE.

Phase III – Conduct of the economic analysis of the selected TMDE.

Phase IV – Development of a methodology for evaluating the economic impact of standardizing the complete PIL, based upon the results of Phases I, II, and III.

Phase V – Evaluation of the economic impact of standardizing the complete PIL, using the methodology developed during Phase IV.

This report has been prepared in accordance with the format specified in data item A002 of the Contract Data Requirements List (DD Form 1423), dated 14 January 1975. The report comprises two sections. Section 1 presents an introduction and

description of the Phase III activity; a summary of the results of the study; and conclusions and recommendations that can be drawn from the findings. Section 2 describes the technical approach used to perform the tasks in Phase III, and presents the analytical results. Presented in the appendix are detailed analytic and support data.

1.1.1 Background

USACC has conceived a Management Improvement Program (MIP) for TMDE having the objectives of assuring that, for mission-essential TMDE, 100% are fully supportable and 95% are in a serviceable and calibrated status and available for immediate use. To achieve these objectives, the following goals must be met:

a. Reduction of the quantity of different makes and models of TMDE by establishing commonality and eliminating unnecessary duplication.

b. Control of TMDE proliferation through mandatory procurement of standard supportable TMDE.

c. Elimination of redundant and/or nonsupportable TMDE from the inventory.

Approximately 250 TMDE items were originally selected as the minimum essential needed to meet the above objectives, and were organized into a Preferred Items List. USACC has also prepared a TMDE cross-reference list (TCR) to correlate the present inventory of TMDE (non-PIL) with those TMDE selected for the PIL.

An analysis was then initiated in June 1974 to evaluate the potential cost benefits of implementation of the PIL and subsequent reduction and eventual elimination of redundant and/or nonsupportable TMDE. Responsibility for this study was assigned to USAECOM. Specific objectives of the economic study are:

a. To conduct a detailed LCC analysis of three specific TMDE from the PIL. and the non-PIL TMDE they would replace.

b. To assess the overall economic impact of the complete PIL.

USAECOM was assisted by ARINC Research in the development of the approach and requirements of a program to accomplish the above objectives. The program is divided into the five phases defined in Section 1.1. The Corporation has now completed the first three of these phases under Contract DAEA18-72-A-0005, a basic ordering agreement with USACC.

1.1.2 Review of Phase I

In Phase I of the program, ARINC Research developed a life cycle cost estimation methodology for TMDE. The methodology provides a technique for computing 11 TMDE-associated cost elements: training, purchasing, personnel, first destination transportation, maintenance transportation, consumables, introduction, holding, documentation, installation, and disposal.

Also during that phase, three PIL TMDE and the corresponding (functionally similar) non-PIL TMDE were selected for economic analysis, using detailed selection criteria developed by ARINC Research under the guidance of USACC. Results of the Phase I effort are presented in ARINC Research publication 1072-01-1-1316, dated August 1974.

1.1.3 Review of Phase II

Phase II entailed an evaluation of the sources and availability of the input data required to implement the life cycle cost methodology developed under Phase I. Considerable data on the selected PIL and the corresponding non-PIL TMDE were collected for use in the subsequent Phase III economic analysis.

Details of the Phase II study appear in ARINC Research publication 1072-01-2-1333, dated November 1974.

1.2 PHASE III ACTIVITY

Phase III of the study, described in this report, was an economic analysis of three selected PIL TMDE and the corresponding non-PIL TMDE. The objectives, tasks, and scope of this phase are described below.

1.2.1 Objectives of Phase III

Objectives of Phase III were:

a. To establish a data base for exercising the LCC methodology developed for PIL and non-PIL TMDE.

b. To develop a computation program for implementing the LCC methodology for the economic evaluation of the subject TMDE, and for application in Phases IV and V of the program.

c. To conduct an economic analysis of the three selected PIL TMDE, and the corresponding non-PIL TMDE, and provide the economic information required to initiate a Determination and Finding (D&F) procedure for that equipment.

d. To address in detail the impact of ASPR 3-213.2*, and the quantifiable and nonquantifiable benefits associated with complete standardization of PIL TMDE.

1.2.2 Phase III Tasks

The major tasks performed to accomplish the Phase III objectives were:

a. Task 1 – Establish an LCC data base for the economic analysis.

b. Task 2 – Develop a computation program for the LCC methodology.

c. Task 3 – Conduct the economic analysis.

d. Task 4 – Conduct a sensitivity analysis.

e. Task 5 – Analyze the results of the LCC analysis.

1.2.3 Scope of Phase III

The scope of Phase III was limited to the three PIL TMDE selected during Phase I and the non-PIL TMDE that they can replace. The TMDE were categorized into three major groups, each containing the PIL TMDE and corresponding non-PIL TMDE. A brief technical description of each PIL item is given in Appendix A-5. The general makeup of these groups is as follows:

a. Group A consists of spectrum analyzers: the AN/USM-366(V)1 (a PIL TMDE) and 11 non-PIL TMDE.

b. Group B includes frequency counters, both mainframe and plug-in TMDE items, in four subgroups:

   - Group 1B – CP-772A/U (a PIL TMDE), and 28 non-PIL TMDE
   - Group 2B – CV-2002/U (a PIL TMDE plug-in) and 6 non-PIL TMDE plug-ins.

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*ASPR 3-213, Technical Equipment Requiring Standardization and Interchangeability of Parts; ASPR 3-213.2, Application.

- Group 3B — CV-2003B/U (a PIL TMDE plug-in) and 2 non-PIL TMDE plug-ins.
- Group 4B — CV-3059/U (a PIL TMDE plug-in) and 2 non-PIL TMDE plug-ins.

c. Group C consists of rf power meters: the 432A (a PIL TMDE currently designated as the ME-441/U) and six non-PIL TMDE.

The complete nomenclature for the equipment in these groups is given in Appendix A-1.

The study assumptions and constraints defined in Section 1.4.1.2.1 of the Phase I report were applied to the Phase III analysis. A major assumption made during Phase I was that each PIL TMDE can potentially replace only one non-PIL TMDE in the USACC inventory. Therefore the potential for reducing the total USACC inventory of TMDE inherent in the PIL concept (because the more versatile PIL items can potentially replace more than one non-PIL TMDE) was not addressed quantitatively in this study. However, an analysis was performed to estimate the impact of this potential benefit on a parametric basis.

1.3 SUMMARY OF PHASE III RESULTS

During Task 1 of Phase III, the LCC equations for transportation and consumables were revised from the form developed during Phase I. A cost equation was obtained for transportation that depends on TMDE weight, distance to point of operation or maintenance, cost of transportation per pound, and number of times failed or calibrated. A cost equation was obtained for consumables that depends on the MTBF of the TMDE.

Additionally, an LCC model was developed for the economic analysis. The model considers the 11 cost elements defined during Phase I, and serves as the basis for determining the life cycle costs of the PIL and non-PIL TMDE selected for analysis.

The input data necessary for the LCC model were identified for the subject TMDE. Two major sets of data were established:

a. File data for each PIL and non-PIL TMDE, encompassing item characteristics data such as MTBF, unit cost, level of calibration, and item scenario data describing the quantity bought, operated, maintained and disposed of.

b. Program data, representing data items common to all of the TMDE. Examples of program data are the cost of training the military occupational specialty (MOS) performing A-level calibration, and the turnover rate of the different MOS operating TMDE within USACC.

The computer program for the life-cycle cost model was developed during Task 2. This program was validated and implemented on the Burroughs 5700 time sharing system at Fort Monmouth, and on the CDC KRONOS time-share system at ARINC Research. The program was designed to accept file data for each PIL TMDE and its corresponding non-PIL equipment, and compute the annual and cumulative life-cycle costs over a 10-year period. The computer program and development are discussed in Section 2.2.

The economic analysis of the three selected PIL-TMDE was performed during Task 3, premised on three different scenarios for the procurement and use of TMDE. Table A summarizes the life-cycle cost exercises performed.

TABLE A. SUMMARY OF SCENARIO EXERCISES

Scenario	Option	TMDE Group(s) Evaluated	Description of Exercise
1	—	A, B, C	LCC of PIL and non-PIL TMDE
2	1	A	Phase-in of PIL TMDE to replace non-PIL TMDE (10%)
2	2	A	Phase-in of non-PIL TMDE to replace non-PIL TMDE (10%)
2	3	A	Phase-in of PIL and non-PIL TMDE mix (10%)
3	1	A, B, C	Phase-in of PIL TMDE to replace non-PIL TMDE (USACC plan)
3	2	A, B, C	Phase-in of non-PIL TMDE to replace non-PIL TMDE (USACC plan)
3	3	A	Phase-in of PIL and non-PIL TMDE mix (USACC plan)

The first scenario considers the life cycle cost of TMDE and assumes that each type is procured in 1975, operated and maintained for 10 years, and disposed of in 1984. This baseline scenario was utilized to calculate the life cycle costs of the three PIL TMDE and their corresponding non-PIL TMDE. A comparison of the resultant data clearly demonstrates that significant cost benefits are to be derived from standardization of the PIL.

The second and third scenarios represent various alternatives for the procurement and use of TMDE by USACC or USAECOM. Scenario 2 involves the replacement of the non-PIL TMDE at a fixed rate of 10% per year during the 10-year life cycle. Scenario 3 is a replacement approach developed by USACC, based on a variable rate of annual replacement of non-PIL TMDE.

Scenarios 2 and 3 were designed to permit investigation of the economic impact of replacing non-PIL TMDE according to three options: 1) phasing-in PIL TMDE to replace non-PIL TMDE, i.e., complete standardization of the PIL; 2) replacement of non-PIL TMDE with non-PIL TMDE, a situation that might occur if standardization were not implemented or if the PIL did not exist; and 3) selective replacement of existing non-PIL TMDE by phasing in a mixture of PIL and non-PIL TMDE. Since scenario 3 represents a more realistic approach to the replacement of non-PIL TMDE, it was examined before scenario 2 and is therefore also discussed in that relative sequence throughout this report.

Results of the different scenario exercises revealed that option 1, replacement of non-PIL TMDE with PIL TMDE, is the most economically favorable.

Scenario 1 was further evaluated in terms of three different cases (see Table B) considered to have a possible economic impact on standardization of the PIL TMDE. Case 1 was defined to measure the benefits that might accrue from the introduction of an initial parts stockage concept for TMDE maintenance, i.e., the economic advantage of a consumables provisioning inventory. Back-up TMDE are maintained in the inventory as spare equipment, used to replace mission-critical TMDE in need of repair; and serve as substitutes for equipment awaiting repair due to the unavailability of necessary spare parts or consumables. Whereas the low density of each non-PIL TMDE precludes consideration of such an inventory program, the PIL concept increases the density of specific TMDE to a point where such a program might be of value. Results of this case demonstrate that standardization will provide cost benefits when an initial stockage program for consumables is adopted for high-density PIL TMDE.

TABLE B. SUMMARY OF CASE EXERCISES

Case	TMDE Group(s) Evaluated	Description of Exercise
1	A	Initial stockage of consumables for PIL TMDE
2	A	LCC of PIL and non-PIL TMDE; 0% inflation, 0% discounted cash flow
2	A	LCC of PIL and non-PIL TMDE: 0% inflation
2	A	LCC of PIL and non-PIL TMDE; 0% discounted cash flow
3	B, C	LCC of PIL TMDE with volume discount

Case 2 was evaluated to indicate the relative effects (PIL vs. non-PIL) of inflation and discounted cash flow on TMDE life cycle costs. Computations were made for the life cycle costs of each PIL TMDE using various combinations of inflation and discounted cash flow factors. No significant changes were noted in the relative life cycle costs of PIL and non-PIL TMDE from these computations.

Case 3 was evaluated to demonstrate the economic impact upon standardization of the PIL if the procurement quantity of one type of TMDE increases sufficiently to result in a discount from the manufacturer through volume procurements. Results of this evaluation show that with the advent of standardization, the life cycle costs of PIL TMDE will be further decreased from the amounts determined for the scenario exercises by virtue of the benefits obtained from volume discounts.

The computer exercises for the three cases are discussed in Section 2.3.

The sensitivity of the life cycle costs developed in this study to variations in certain key input data (e.g., MTBF) was investigated during Task 4, and is described in Section 2.4. The sensitivity analysis was performed for a full range of values of each input-data element analyzed.

An important observation during this study was that the MTBF of the PIL TMDE of Group B (CP772A/U) is lower than any of the non-PIL TMDE it can potentially replace. Therefore, standardization could provide a nonquantifiable benefit, i.e., the density of the item would be increased to the extent that a design study to improve the MTBF and consequently decrease life cycle costs would be justified.

Another observation from the sensitivity analysis was that the number of hours spent operating TMDE is critical to the life cycle cost. Therefore the potential non-quantifiable benefit of improved personnel efficiency could reduce the life cycle costs for PIL TMDE because of the attendant reductions in the number of hours the PIL TMDE is operated. An attendant benefit would be improved morale among the USACC personnel associated with TMDE.

A third major nonquantifiable benefit noted is that certain PIL TMDE, such as the CP772A/U (a subject of this study), have extended functional capability over many of the non-PIL TMDE it can replace. This added capability could result in a decrease in the density of TMDE required to support C-E end items within USACC.

1.4 CONCLUSIONS AND RECOMMENDATIONS

The section presents the major conclusions and recommendations from the Phase III economic analysis for the TMDE groups addressed in the Summary and defined in Section 1.2.3.

1.4.1 Conclusions

a. For the baseline scenario (1), the life cycle costs of PIL TMDE are significantly less for all three groups than those of the corresponding non-PIL TMDE. If the three PIL items were standardized, the cost savings for Groups A, B, and C would be $1.46 million, $1.97 million, and $1.85 million, respectively. The percent differences in LCC between the PIL and non-PIL TMDE would be 61%, 10%, and 82%, respectively.

b. For scenario 2 (10% fixed replacement), the life cycle costs of option 1 (phase-in of PIL items) is $1.06 million less than that of option 2 (phase-in of non-PIL items). The life cycle costs of option 1 are 70% less than for option 2.

c. For scenario 2, the life cycle costs of option 3 (phase-in of PIL and non-PIL TMDE mixture) are approximately $1 million less than for option 2 (phase-in of non-PIL TMDE). For scenario 3, the life cycle costs of option 3 are $1.2 million less than for option 2. From this it is concluded that when PIL TMDE are standardized, technology upgrading by phasing in a second PIL TMDE would not result in significantly higher life cycle costs.

d. For scenario 3 (USACC deployment), the total life cycle cost of option 1 (phase-in of PIL TMDE) is significantly less than that for option 2 (phase-in of non-PIL TMDE) for all three TMDE groups. If the three PIL items were standardized, the cost savings for Groups A, B, and C would be $1.23 million, $1.55 million, and $1.18 million, respectively. The respective percent differences in LCC would be 68%, 9%, and 89%.

e. The differences in life cycle costs for option 1 of scenarios 2 and 3 confirm that different replacement conditions impact on the life cycle costs of TMDE.

f. Standardization of PIL TMDE could result in further cost benefits attributable to the greater usage of specific equipment types as demonstrated below by the results of cases 1 and 3, respectively:

   — Case 1: A more cost-effective stocking system could be established for provisioning. If an initial parts stockage program were implemented for the PIL TMDE of Group A, their life cycle costs would be 10% less than that shown in item a, above, if the current system of "backup TMDE" were maintained.

   — Case 3: USACC could procure items at reduced cost, such as associated with manufacturer discounts. For Group B TMDE, the life cycle costs would be approximately 10% less than shown in item a, above, upon procurement of sufficient volume to obtain a manufacturer's discount.

g. The application (per Case 2) of inflation and discounted cash flow to the economic analysis does not impact significantly on any of the conclusions of this study.

h. Standardization of PIL TMDE would lead to a reduction in the number of different TMDE items with which operation, calibration, and maintenance personnel have to be concerned, and hence their efficiency would improve. While this benefit is nonquantifiable, there would doubtless be an attendant decrease in the time required to utilize (i.e., operate) the TMDE and, consequently, a reduction in the total life cycle costs of PIL TMDE beyond that computed during this study.

i. Another nonquantifiable benefit, potential reliability improvement of TMDE, could be realized upon standardization of PIL TMDE. Standardization would permit closer attention to TMDE reliability problems (there

being fewer equipment types with which to be concerned), and the product improvement programs thus encouraged could result in improved reliability. The overall effect of this improvement in reliability would be a decrease in life cycle costs as well as greater availability of the TMDE.

j. A major nonquantifiable benefit of standardization is the implementation of items that provide extended capability for test measurement and diagnosis beyond that available for the TMDE currently in the inventory. The CP772A/U (Group B) offers an extended range for frequency measurements – up to 12.4 GHz with the use of three different plug-ins.* At least six different non-PIL TMDE would be required to perform similar measurements. If this possible reduction in the density of PIL TMDE of Group B is realized, a significant cost savings would result (e.g., about $4 million for a 20% reduction).

k. For the baseline scenario exercises, the total life cycle costs obtained are sensitive to variations in key parameters as follows:

1) A 20% increase in the number of hours of personnel operation for PIL TMDE of Groups B and C would be necessary to make their life cycle costs equal to that on the non-PIL TMDE within these groups.

2) A 100% increase in the number of hours of personnel operation for PIL TMDE of Group A would be necessary to make its life cycle costs equal to that of the non-PIL in the group.

3) The life cycle costs of PIL TMDE of Groups A and C are not changed appreciably by a 50% increase in the cost of consumables.

4) The cost of consumables would have to increase 50% to make the life cycle cost PIL TMDE of Group B equal to that of the non-PIL TMDE within the group.

5) Life cycle costs for all equipment groups are not appreciably affected by variations in the cost per page of documentation.

6) Life cycle costs of Groups A and C equipment are not appreciably affected by variations in MTBF or MTTR.

*A fourth plug-in now exists for the CP772A/U which extends the range of frequency measurements to 18 GHz. This plug-in was not considered in the Phase III economic analysis because it was not identified during the selection of items for the Phase I activity.

7) A decrease in MTBF of 50% for Group B PIL TMDE would make their life cycle cost equal to that of the non-PIL TMDE in the group.

l. The cost elements of transportation, installation, and disposal have minor impact on the life cycle costs of the three PIL TMDE analyzed during Phase III.

1.4.2 Recommendations

Based on the results of this investigation, it is recommended that:

a. USACC implement standardization for the three PIL TMDE analyzed in this study.

b. Efforts be initiated to evaluate the economic effects of standardizing the complete PIL, through the performance of Phases IV and V of the economic analysis.

c. An evaluation be made of the implementation of a consumables stockage program for TMDE, based upon an initial-stockage approach. Such a program should result in a decrease in the life cycle costs of TMDE.

d. A detailed cost analysis be made of the effects of using PIL TMDE that have a functional capability beyond that of the non-PIL TMDE they replace. Such an analysis would provide information on ways that USACC could reduce the density of TMDE, and possibly the number of personnel needed to operate these TMDE.

e. A study be made to optimize (i.e., minimize) the life cycle costs associated with phasing in PIL TMDE to replace non-PIL TMDE.

f. An investigation be made to determine if a reliability improvement program would be economical and result in improved MTBF for the PIL TMDE of this study. Such a program would assure that the MTBF of PIL TMDE of Group B, which is low relative to the MTBFs of other TMDE, would improve and thus lead to substantial cost savings.

Section 2

TECHNICAL APPROACH, DETAILED RESULTS, AND ANALYSIS

The technical approach to accomplishing Phase III of the economic analysis of three selected PIL TMDE and the non-PIL they can replace consisted of seven major tasks, as follows:

- Task 1 was the development of the life cycle cost model for the economic analysis, and the acquisition of the data required to exercise the model.
- Task 2 was the preparation of a software program to implement the cost model on a computer system.
- Task 3 was the conduct of the economic analysis for more than 60 TMDE items.
- Task 4 was an investigation of the dependence of the results of Task 3 upon variations of certain key input data.
- Task 5 was an evaluation of the results of the life cycle cost analysis and sensitivity analysis.
- Task 6 was to provide USAECOM with monthly progress reports and this final report.
- Task 7 comprised the activities necessary to brief USAECOM and USACC at two steering committee meetings. During the first meeting, the activities and results of Tasks 1 through 3 of Phase III were discussed. The second meeting included a briefing on the remaining tasks and a review of the draft final report.

The activities and findings of Tasks 1 through 5 are presented in Sections 2.1 through 2.5 respectively.

2.1 PREPARATION OF LIFE CYCLE COST MODEL AND DATA BASE

The major objectives of Task 1 were to establish the data base for the economic analysis, and to prepare the life cycle cost model. Various activities performed to accomplish the objectives are discussed in the remainder of Section 2.1.

2.1.1 Life Cycle Cost Model

The life cycle cost model for PIL and non-PIL TMDE consists of a summation of 11 cost elements; the general equation may be expressed as:

$$\begin{aligned} \text{Cost}_{\text{TMDE}} = {} & C_{\text{Training}} + C_{\text{Hardware}} + C_{\text{Personnel}} \\ & + C_{\text{Transportation (First Destination)}} \\ & + C_{\text{Transportation (Maintenance)}} \\ & + C_{\textit{Consumables}} + C_{\textit{Introduction}} \\ & + C_{\text{Holding}} + C_{\text{Documentation}} \\ & + C_{\text{Installation}} - C_{\text{Disposal}} \end{aligned}$$

where the following conditions apply:

a. Disposal is treated as a cost asset.

b. The elements of training, personnel, maintenance transportation, consumables, and holding are treated as recurring costs.

c. The elements of hardware, first destination transportation, introduction, installation and disposal are nonrecurring costs.

d. Documentation costs for technical manuals are nonrecurring.

e. The life cycle of 10 years for TMDE begins in 1975 and terminates in 1984.

f. Inflation and discounted cash flow are included in the cost model.

2.1.1.1 Cost of Training

The cost of training is that incurred for training MOS to calibrate (A or C level), operate, and repair PIL and non-PIL TMDE. The cost of training is dependent on the turnover rate of the MOS. The general expression for annual training is:

$$\text{Annual Training Cost} = \frac{\text{Density of TMDE}}{\text{Total Density of all TMDE}} \Big\{ \Big[\text{Number of Persons Calibrating (A or C Level)} \times \text{Cost of Training Calibration Personnel} \times \text{Turnover Rate} \Big] + \Big[\text{Number of Persons Repairing} \times \text{Cost of Training Repair Personnel} \times \text{Turnover Rate} \Big] + 0.1 \Big[\text{Number of Persons Operating} \times \text{Cost of Operator Training} \times \text{Turnover Rate} \Big] \Big\} \text{(Inflation)} \div \text{(Discounting)}$$

The mathematical equation for total life cycle training cost is:

$$ECOS(I,J,1) = \frac{NDEN(I,J)}{NTDEN} \Big\{ LCAL(I)*TR(6)*NPERC(1)*CTC(1) + \big[1-LCAL(I)\big]*TR(7)*NPERC(2)*CTC(2) + TR(7)*NPERR*CTR + 0.1 \sum_{K=1}^{5} TR(K)*NPERO(K)*CTOP(K) \Big\} \frac{XINF(J)}{(1+DIS)^J}$$

where:

NDEN(I,J) = Density of item I in year J
NTDEN = Total number of TMDE
LCAL(I) = 1 if the I^{th} item has A-level calibration, = 0 if C-level
TR( ) = Turnover rate of the ( ) MOS
NPERC( ) = Number of persons calibrating at A, (1), and C, (2), levels
CTC( ) = Cost to train for calibration of A, (1), and C, (2), levels
NPERR = Number of persons repairing TMDE
CTR = Cost to train for repair of TMDE
NPERO(K) = Number of personnel operating TMDE having the K^{th} MOS
CTOP(K) = Cost to train for K^{th} MOS for TMDE operation
XINF(J) = Inflation factor for year J
DIS = Discount rate

2.1.1.2 Cost of Hardware

The cost of hardware is that incurred in the purchase of TMDE, i.e.,

Cost of Hardware = (Number of TMDE Bought)(Cost per TMDE)(Inflation) ÷(Discounting)

The equation used in the cost model is:

$$ECOS(I,J,2) = NEQB(I,J)*\left[UCOS(I)+20\right]\frac{XINF(J)}{(1+DIS)^{J}}$$

where:

NEQB(I,J) = Number of item I purchased in year J
UCOS(I) = Unit cost of item I

2.1.1.3 Cost of Personnel

The cost of personnel is that for labor to calibrate, operate, and repair TMDE. The general expression is:

Annual Personnel Cost

$$= \text{Density of TMDE}\left[\frac{\text{Annual Maintenance Manhours} \times \text{Labor Rate}}{\text{Productivity}} + \frac{\text{Hours per Year Calibrated (A or C Level)} \times \text{Labor Rate}}{\text{Productivity}} + \frac{\text{Number of Operating Hours}}{5} \times \frac{\text{Labor Rate}}{\text{Productivity}}\right]$$

(Inflation) ÷ (Discounting)

The mathematical equation for personnel cost over the entire life cycle of TMDE is:

$$ECOS(I,J,3) = NDEN(I,J)\left\{\frac{XMH(I)*DLH(7)}{PROD(7)}+LCAL(I)*\frac{HSC(I)*DLH(6)}{PROD(6)} + \left[1-LCAL(I)\right]*\frac{HSC(I)*DLH(7)}{PROD(7)} + \frac{NHO}{5}\sum_{K=1}^{5}\frac{DLH(K)}{PROD(K)}\right\}\frac{XINF(J)}{(1+DIS)^{J}}$$

where:

XMH(I) = Average manhours per year to repair an I^{th} item
DLH( ) = Labor rate for the $(\ )^{th}$ MOS
PROD( ) = Productivity factor for the $(\ )^{th}$ MOS
HSC(I) = Average hours per year to calibrate an I^{th} item
NHO = Average number of hours of operation per year

The factor XMH(I) is determined from the item's mean time between failures, MTBF(I), and the mean time to repair, MTTR(I), as:

$$XMH(I) = \frac{NHO*MTTR(I)}{MTBF(I)}$$

2.1.1.4 Cost of First Destination Transportation*

The cost of first destination transportation is that incurred in shipping TMDE from a point of origin to any of three locations (Europe, Pacific, or CONUS). The general expression for this element is:

Cost of Transportation = (Number of Units Bought) (Weight)
(Shipping Rate × Mileage) (Inflation) ÷ (Discounting)

The mathematical equation is:

$$ECOS(I,J,4) = NEQB(I,J)*WT(I)*XMI(I)*SHC*\frac{XINF(J)}{(1+D.S)^{J}}$$

where:

WT(I) = Weight of the I^{th} item
XMI(I) = First destination mileage for the I^{th} item
SHC = Shipping cost rate per pound per mile

*This expression is revised from that given in the Phase II report to reflect conditions of actual occurrence within the mission profile rather than cost estimating relationships.

2.1.1.5 Cost of Maintenance Transportation*

The cost of maintenance transportation is that for shipping TMDE for repair and C-level calibration from the C-E site to the repair/calibration facility at the AMSF or to CONUS facilities. The expression for this cost is:

$$\begin{aligned}\text{Cost of Transportation} = 2\Big\{&[\text{Density of Each TMDE Type} \times \text{Weight} \\ &\times \text{Average One-Way Mileage} \times \text{Shipping Rate}] \\ &\times [\text{Number of Failures/Year} + \text{Number of} \\ &\text{Calibrations Requiring Shipping}]\Big\} \\ &(\text{Inflation}) \div (\text{Discounting})\end{aligned}$$

The mathematical equation for transportation cost is:

$$\begin{aligned}ECOS(I,J,5) = {} & 2*NDEN(I,J)*WT(I)*FMI(I)*SHC\Big\{FAIL(I) \\ & + [1-LCAL(I)]*NCAL(I)\Big\}\frac{XINF(J)}{(1+DIS)^J}\end{aligned}$$

where:

FMI(I) = Average one-way distance between the A and C levels for the I^{th} item

FAIL(I) = Average number of failures per year of I^{th} item = $\frac{NHO}{MTBF(I)}$

NCAL(I) = Number of times per year the I^{th} item is calibrated

2.1.1.6 Cost of Consumables**

The cost of consumables is that for spare parts to repair TMDE. The general expression is:

$$\begin{aligned}\text{Cost of Consumables} = {} & (0.125 \times \text{Density of a TMDE Type} \\ & \times \text{Number of Failures/Year} \\ & \times \text{Unit Cost of TMDE}) \ (\text{Inflation}) \div (\text{Discounting})\end{aligned}$$

*This expression is revised from that given in the Phase II report to reflect conditions of actual occurence within the mission profile rather than cost estimating relationships.

**This expression is revised from that given in the Phase II report to reflect a dependence on MTBF.

The mathematical equation for the cost model is:

$$ECOS(I,J,6) = 0.125*NDEN(I,J)*FAIL(I)*UCOS(I)*\frac{XINF(J)}{(1+DIS)^J}$$

2.1.1.7 Cost of Introduction

The cost of introducing the TMDE into the supply system is expressed as:

Cost of Introduction = (Number of Line Items × One-Time Cost of Introducing Item + Annual Cost of Item) (Inflation) ÷ (Discounting)

The mathematical equation used in the cost model is:

$$ECOS(I,J,7) = \left\{NLIN\left[480*MLIN(I)+510\right]+160*LL\right\}\frac{XINF(J)}{(1+DIS)^J}$$

where:

NLIN = 1 on the year introduced; 0 otherwise
MLIN(I) = Number of units comprising I^{th} item
LL = 1 on every year following introduction; 0 otherwise

and the constant values are derived from Pamphlet ECOM 11-4 of DA Comptrollers Office and described in the Phase II report.

The cost of introduction includes a recurring cost of $160 for each year the item is kept in the supply system.

2.1.1.8 Cost of Holding

The cost of holding is that incurred for retaining the item in the supply system. The expression is:

Cost of Holding = 0.23 [(Density of TMDE) (Unit Cost)] × (Inflation) ÷ (Discounting)

The equation for the cost model is:

$$ECOS(I,J,8) = 0.23*NDEN(I,J)*UCOS(I)*LL*\frac{XINF(J)}{(1+DIS)^J}$$

2.1.1.9 Cost of Documentation

The cost of documentation is that incurred for preparation and publication of technical manuals for operation, repair and calibration, and Repair Parts Spares Tools Listings (RPSTLs). Revisions and updating changes in documentation are covered by adding 20% to the original page count. The expression for this cost is:

Cost of Documentation = (Cost per Page) (Total Pages of Documentation) (Inflation) ÷ (Discounting)

The equation for the cost model is:

$$ECOS(I,J,9) = NN*AQPP(I)*CPP*\frac{XINF(J)}{(1+DIS)^J}$$

where:

NN = 1 on first year introduced, 0 otherwise
AQPP(I) = Total number of pages of documentation for I^{th} item
CPP = Cost per page of documentation

2.1.1.10 Cost of Installation

The cost of installation is that for installing a TMDE at a site to make the item portable. The general expression is:

Cost of Installation = (Number of Units Installed) (Cost per Installation) (Inflation) ÷ (Discounting)

The equation for the cost model is:

$$ECOS(I,J,10) = NEQB(I,J)*CPC*\frac{XINF(J)}{(1+DIS)^J}$$

where CPC = Cost of materials for rack mounting, cart, etc., as required for installation.

2.1.1.11 Cost of Disposal

The cost of disposal is that incurred in disposing or salvaging TMDE at the end of its life cycle. The general expression is:

Cost of Disposal = -0.1 [(Number of TMDE Disposed) (Unit Cost of TMDE)] (Inflation) ÷ (Discounting)

The equation for the cost model is:

$$ECOS(I,J,11) = -0.1*NEQD(I,J)*UCOS(I)*\frac{XINF(J)}{(1+DIS)^{J}}$$

where:

NEQD(I,J) = Number of items I disposed of in year J

During Phase I it was determined that the disposal operation, which results in the salvage of equipment, represents an asset to the life cycle cost.

2.1.2 Data Base for LCC Model

The data requirements for computing the life cycle costs of the PIL and non-PIL TMDE were identified by reviewing the cost equations of the LCC model. Two major data categories were identified:

a. Program data, which are common to all TMDE; an example is personnel productivity rate.

b. File data, consisting of two subsets: 1) item characteristics, which are unique to each TMDE, e.g., unit cost; and 2) item scenario data, or the quantity of TMDE bought, operated and maintained, and disposed of during each year of the life cycle.

The program and file data are discussed below.

2.1.2.1 Program Data

Program data requirements were identified for all TMDE. Table 1 identifies the data types and gives the values used for the economic analysis. These values were held constant throughout the scenario 1, 2, and 3 computations. Certain of the data were varied for the case exercises and sensitivity analysis, as discussed in Sections 2.3 and 2.4, respectively.

The manner in which the MOS and operate-hour data were addressed as program data is described in Sections 2.1.2.1.1 and 2.1.2.1.2, respectively.

TABLE 1. PROGRAM DATA FOR TMDE ECONOMIC ANALYSIS
(Sheet 1 of 2)

Description	Code	Value
1. Inflation Factor for Each Year	X1NF	1975 = 1.000, 1976 = 1.12, 1977 = 1.22, 1978 = 1.33, 1979 = 1.40, 1980 = 1.46, 1981 = 1.53, 1982 = 1.60, 1983 = 1.67, 1984 = 1.75
2. Discount Rate	DIS	10% each year, 1975 - 1984
3. Total Density of TMDE Calibrated, Repaired, Operated	NTDEN	32,411
4. Turnover Rate:		
a. MOS 26	TR(1)	0.41
b. MOS 32	TR(2)	0.36
c. MOS 31	TR(3)	0.46
d. MOS 34	TR(4)	0.33
e. MOS 36	TR(5)	0.35
f. MOS 35H	TR(6)	0.50
g. MOS 35B	TR(7)	0.59
5. Cost of Operator Training		
a. MOS 26	CTOP(1)	$ 31,630
b. MOS 32	CTOP(2)	$ 25,083
c. MOS 31	CTOP(3)	$ 31,233
d. MOS 34	CTOP(4)	$ 21,127
e. MOS 36	CTOP(5)	$ 17,360
6. Cost of Repair Training, MOS 35B20	CTR	$ 22,080
7. Cost of A-Level Calibration Training, MOS 35H	CTC(1)	$ 25,024
8. Cost of C-Level Calibration and Repair Training, MOS 35B30	CTC(2)	$ 41,226

TABLE 1. (Sheet 2 of 2)

Description	Code	Value
9. Number of Persons Calibrating, A-Level (MOS 35H)	NPERC(1)	143
10. Number of Persons Calibrating, C-Level (MOS 35B)	NPERC(2)	32
11. Number of Persons Repairing (MOS 35B20)	NPERR	42
12. Number of Persons Operating		
a. MOS 26	NPERO(1)	1,616
b. MOS 32	NPERO(2)	2,326
c. MOS 31	NPERO(3)	445
d. MOS 34	NPERO(4)	251
e. MOS 36	NPERO(5)	848
13. Labor Rate, All MOS	DLH	$ 6.91 per hour
14. Productivity Rate All MOS	PROD	0.75
15. Number of Hours per Year Operated	NHO	
a. PIL		300
b. Non-PIL		365
16. Shipping Cost/Pound/Mile	SHC	$0.000169
17. Cost of Install. Materials	CPC	$ 95
18. Cost per Page of Original Documentation	CPP	$ 175

2.1.2.1.1 MOS Classification – The MOS classifications identified during Phase II as performing the functions of operation, maintenance, and calibration of TMDE were expanded to include additional information provided by USACC during the data preparation activities of Phase III. More than 50 different MOS classifications were identified for which data on training, turnover rate, etc., had to be obtained. The 50 different MOS classifications performing the functions of operation were grouped into major categories. For example, the MOS 26L10, 26L20, and 26L40, and the 26V10, 26V20, and 26V40 categories were combined as a 26-series MOS. In this process, the pertinent data, such as turnover rate, training costs, etc., for each level (e.g., 26V10) were averaged to provide single values for each grouping. The final grouping of operator MOS used in this analysis were of the 26, 32, 31, 34, and 36 classifications.

Another reason for grouping the MOS classifications is that the particular MOS level operating TMDE could not be determined since the C-E sites have many different TMDE and MOS types. The LCC methodology developed in Phase I accounted for this condition in the personnel cost equation.

It was not necessary to group the MOS classifications doing calibration or maintenance, since the number of types was limited and, therefore, resulted in no problems in the retrieval or implementation of data for the computer program.

2.1.2.1.2 Number of Hours of Operation – The number of hours that the operating MOS spend on TMDE per year was estimated during Phase II as being equal for PIL and non-PIL TMDE. During Phase III, additional information was obtained from USACC that resulted in this ground rule being changed. USACC estimates that less time will be spent in performing such operations as testing and diagnosis with PIL TMDE than with non-PIL TMDE.

The rationale provided by USACC supporting this position can be best explained by example. Suppose that a requirement exists at a USACC site for performing five tests or diagnostic procedures each day using five different frequency counters as the TMDE. For this example, the operator performing the tests will follow a procedure prescribed in a formal specification, which directs the following eight steps:

1) Select the TMDE and remove from stored location.

2) Review the technical manuals to determine set-up and connection requirements.

3) Connect the TMDE to the end item.

4) Turn on the TMDE to allow warm-up.

5) Review manuals for precheck and operating procedures.

6) Adjust and check-out the TMDE.

7) Perform testing or diagnosis, read measurements, and record measurement values.

8) Disconnect the TMDE from the end item and replace it in a storage area.

When five different types or makes (e.g., non-PIL TMDE) are used to perform the five tests required, the operator will spend the time to become familiar with the procedures by reviewing five different technical manuals for details on connections, measurement techniques, etc.

When only one model of TMDE is used to perform the five tests or diagnoses, only one technical manual will be reviewed. Moreover, when the operator is familiar with the connections and measurement techniques by virtue of using the same frequency counter, the time spent by the operator is reduced. In essence, steps 2 and 5 are eliminated from the four successive tests done with the PIL TMDE, and the time required for step 3 is reduced accordingly.

If the above test or diagnostic procedure normally requires 1 hour of operator time, the average time spent for steps 2 through 7 is 10 minutes each. Thus by eliminating steps 2 and 5, 20 minutes is saved, reducing the operations time to 40 minutes or 20% less than for non-PIL TMDE. In addition, the time spent on the other steps will be reduced significantly because of familiarty with the procedural requirements. This factor was not considered in the above 20% savings, making the estimate very conservative.

The values used to establish the data for hours that MOS operate TMDE in this economic analysis reflect the 20% estimated reduction for PIL TMDE over that for non-PIL TMDE.

2.1.2.2 File Data

2.1.2.2.1 Item Characteristics Data – Item characteristics relevant to the life cycle cost analysis of the PIL and non-PIL TMDE were identified, and are listed in Table 2. Sixty-one sets of data were established for these characteristics, one set for each PIL and non-PIL TMDE. Certain items of data were not directly retrievable and were based on estimates and value-averaging, as discussed in the following paragraphs.

TABLE 2. ITEM CHARACTERISTICS RELEVANT TO TMDE ECONOMIC ANALYSIS

Item Characteristic	Code
1. Level of calibration	LCAL
2. Unit cost	UCOS
3. Maintenance man-hours	XMH
4. Hours per year calibrated	HSC
5. Weight	WT
6. First destination mileage	XMI
7. Number of failures per year or MTBF	FAIL
8. Average mileage to repair or calibrate	FMI
9. Quantity of pages (TM, TB, and RPSTL)	AQPP
10. Number of line items	NLIN
11. Number of times per year calibrated	NCAL

2.1.2.2.1.1 Unit Cost of TMDE – The source for TMDE unit-cost data was identified in Phase II as SB 700-20* and manufacturers' catalogs. However, one problem encountered in retrieving the data from these sources was that certain

*HDQ, DA, Army Adapted/Other Items Selected for Authorization/List of Reportable Items, SB 700-20, July 1974

non-PIL TMDE, although in the USACC inventory, are no longer manufactured. Therefore, recent costs are not available for these items from catalogs. Further, certain non-PIL TMDE are not listed in SB 700-20.

To resolve the above problems, two other sources of cost information were considered; Army Master Data File (AMDF) records and Command Density "C" reports of the USACC TMDE Management Improvement Program. The necessary cost information for the non-PIL TMDE was obtained from these latter sources when it was not located in the sources identified during Phase II.

Since it was determined that the unit cost values from these latter sources were approximately 2 years out of date, the TMDE unit costs obtained from these sources were increased by 20%. This 20% increase was considered conservative, since comparable unit costs of non-PIL TMDE that were found in manufacturers' manuals tended to be 50% or more higher than the values given in either AMDF or the "C" reports.

2.1.2.2.1.2 MTBF, MTTR and Hours of Calibration – MTBF values were available for the majority of TMDE in the identified sources. Where MTBFs were not available, the values were derived by averaging the available MTBF of all other TMDE of the same function (e.g., frequency counter). The same technical approach was used for MTTR and hours of calibration when data were not available.

2.1.2.2.1.3 Cost per Page of Documentation – An effort was made during this task to obtain information on the cost per page of documentation for technical manuals covering operation, maintenance, and calibration. A thorough review was made of the data supplied during Phase II on this subject. The main source was reports or publication costs prepared by the Army Materiel Command (AMC). Since more precise information could not be obtained, it was decided to use a value of $175 which is an average value for electronic equipment provided by the comptroller at USAECOM. This value was derived from a statistical analysis performed by AMC.

2.1.2.2.1.4 First Destination Mileage – This data item was not identified in the Phase II report, since it was provided as a cost estimating relationship by the Comptrollers Office of USAECOM. However, USAECOM decided during the second steering committee meeting of Phase II that it would be desirable to have actual cost

equations for both first destination and maintenance destination included in the cost model. As a result of these changes, data requirements for first destination mileage were established.

The values for the first destination mileage were determined for the three major theaters of USACC – Pacific, Europe, and CONUS. This approach was taken since TMDE is usually shipped to the regional Army Maintenance Supply Facility (AMSF) of the Pacific or European theaters and the depots or regional facilities of CONUS. The location of the theatre for a given TMDE was obtained from the TMDE MIP Command Density "C" Reports that provide the unit identity code and location.

The first destination mileage values used in this analysis were 2500 miles for CONUS, 5000 for Europe, and 8000 for the Pacific. These distances are average values based on the location of the AMSF and CONUS facilities within each theatre from the point of origin of the TMDE depots in either California or Kentucky.

2.1.2.2.1.5 Maintenance Mileage – Maintenance transportation mileage was determined as the distance that TMDE within each of the three theatres travels from the operational sites to the AMSF or CONUS facility for repair or C-level calibration. Average values used for maintenance mileage were 150 for Pacific area, 100 for Europe, and 50 for CONUS.

2.1.2.2.1.6 Number of Pages of Documentation – The number of pages of documentation required by each TMDE was based upon 1) technical manuals for operation, maintenance, and calibration, and 2) RPSTLs. It was originally intended that each manual for a specific TMDE be reviewed to obtain the quantity of pages per publication. However, only a limited number of official publications could be found for most of the non-PIL TMDE. A large portion of those which exist are manufacturers' manuals for operation and repair.

To obtain representative page quantities for the non-PIL TMDE, a count was made using the manuals for PIL TMDE. The quantity of pages determined for each PIL TMDE was assigned to the counterpart non-PIL TMDE they can potentially replace. The representative values for total pages were increased by 20% for each TMDE since it was determined from USAECOM that publications undergo revisions amounting to an average of 20% of the initial value during the life cycle of the equipment.

2.1.2.2.2 Item Scenario Data – The item scenario data requirements for the LCC exercises stipulate the quantity of TMDE bought, operated and maintained, and disposed for each year from 1975-1984. Each scenario uses a specific set of these data to describe conditions of USACC deployment and management of TMDE. An example of how the implementation data were established is shown in Table 3. In that example, NEQB is the quantity bought, NEQD is the quantity disposed, and NDEN is the TMDE density (operated and maintained) for the year shown.

TABLE 3. EXAMPLE OF ITEM SCENARIO DATA

```
00160 1975 NEQB 53 NEQD 0 NDEN 53
00170 1976 NEQB 0 NEQD 0 NDEN 53
00180 1977 NEQB 0 NEQD 0 NDEN 53
00190 1978 NEQB 0 NEQD 0 NDEN 53
00200 1979 NEQB 0 NEQD 0 NDEN 53
00210 1980 NEQB 0 NEQD 0 NDEN 53
00220 1981 NEQB 0 NEQD 0 NDEN 53
00230 1982 NEQB 0 NEQD 0 NDEN 53
00240 1983 NEQB 0 NEQD 0 NDEN 53
00250 1984 NEQB 0 NEQD 53 NDEN 53
```

2.1.2.2.3 Complete Data Files – An example of the complete data file, comprising both scenario and item characteristic data is shown in Table 4. The first line (100) gives the file name; "00110" is the quantity of non-PIL TMDE in that file; and "00120" is the nomenclature of the TMDE for which the data are shown in lines 00130 through 00250.

TABLE 4. FILE DATA FOR TMDE ITEM

```
100 GRPAT DATA FILE
00110 NPIL 11
00120 OSM366
00130 LCAL 1 UCCS 4500. AMH 5.33
00140 HSC 8.06 FI 48. AMI 6058. FAIL .89
00150 FMI 55. ACPP 310. MLIN 1 NCAL 2
00160 1975 NEQB 53 NEQD 0 NDEN 53
00170 1976 NEQB 0 NEQD 0 NDEN 53
00180 1977 NEQB 0 NEQD 0 NDEN 53
00190 1978 NEQB 0 NEQD 0 NDEN 53
00200 1979 NEQB 0 NEQD 0 NDEN 53
00210 1980 NEQB 0 NEQD 0 NDEN 53
00220 1981 NEQB 0 NEQD 0 NDEN 53
00230 1982 NEQB 0 NEQD 0 NDEN 53
00240 1983 NEQB 0 NEQD 0 NDEN 53
00250 1984 NEQB 0 NEQD 53 NDEN 53
```

2.2 LIFE CYCLE COST COMPUTER PROGRAM

The objectives of Task 2 were to prepare and implement a program for the TMDE life cycle cost model.

2.2.1 Development of Software Program

A computer program was developed in FORTRAN for exercising the life cycle cost model. The program evaluates the life cycle costs of PIL and non-PIL TMDE from 1975 through 1984 under different conditions of USACC deployment. These conditions are evaluated in the form of scenarios, each having various options. For each scenario, the options permit replacement of non-PIL TMDE with PIL TMDE, with non-PIL TMDE, or with a mixture of the two.

The quantitative conditions associated with an option are input to the program as file data, as described in Sections 2.1 and 2.3.

Two main programs, designated "TMDE" and "TMDE-1", were developed for the life cycle cost model. The equations and FORTRAN structure for each of these programs are given in Appendix A-4. Either program can accept the file data for any scenario and then output life cycle costs. The major difference between the two programs is that "TMDE" outputs the cost of each cost element and the total cost by year, but only sums the annual PIL and non-PIL TMDE costs. "TMDE 1" outputs the sum of each cost element, as well as the total life cycle costs. Examples are given in the following paragraphs. For each example, the units for cost and cumulative cost are in dollars.

2.2.1.1 Outputs of Program "TMDE"

Program "TMDE" is designed to yield the outputs shown by the following examples.

a. The yearly and cumulative-yearly costs of each PIL TMDE:

ITEM	NO.	YEAR	COST	CUMCOST
USM366	1			
		1975	499776.59	499776.59
		1976	229069.53	728846.12
		1977	226838.33	955686.45
		1978	224809.97	1180496.42
		1979	215129.16	1395625.57
		1980	203953.62	1599579.19
		1981	194302.01	1793881.20
		1982	184719.66	1978600.86
		1983	175273.79	2153874.67
		1984	150881.24	2304755.91

b. The yearly and cumulative-yearly costs of each non-PIL TMDE:

UPM84 2

1975	18343.38	18343.38
1976	16282.13	34625.51
1977	93139.93	127765.44
1978	18329.59	146095.03
1979	17540.28	163635.31
1980	16629.10	180264.41
1981	15842.17	196106.58
1982	15060.88	211167.46
1983	14290.73	225458.19
1984	11868.33	237326.52

c. The yearly and cumulative-yearly costs for the entire non-PIL TMDE group:

NON-PIL GROUP COSTS

YEAR	COST	CUMCOST
1975	1206966.63	1206966.63
1976	325084.48	1532051.10
1977	321918.07	1853969.17
1978	319039.52	2173008.69
1979	305300.98	2478309.67
1980	289441.18	2767750.85
1981	275744.09	3043494.95
1982	262145.30	3305640.25
1983	248740.15	3554380.40
1984	212789.17	3767169.57

These non-PIL group costs are for all TMDE in the group under analysis. For example, using Group A, the costs are for a total of 53 non-PIL TMDE units in the USACC inventory.

d. The cost element breakout for the non-PIL group:

YEAR	ELEMENT	COST
1975		
	TRAINING	9482.32
	PURCHASE	95284.55
	PERSONNEL	134430.07
	FIRST DEST	1309.17
	TRANSPORT	9.15
	CONSUMBLES	3793.40
	INTRODUCE	1800.00
	HOLDING	21735.63
	DOCUMENTS	47727.27
	INSTALL	3713.64
	DISPOSAL	0.
1976		
	TRAINING	9475.19
	PURCHASE	0.
	PERSONNEL	134329.07
	FIRST DEST	0.
	TRANSPORT	9.14
	CONSUMBLES	3790.55
	INTRODUCE	290.69
	HOLDING	21719.30
	DOCUMENTS	0.
	INSTALL	0.
	DISPOSAL	0.

Following this printout, the user is given the option of having the program output the same breakout for PIL TMDE. The program "TMDE" then provides on request a cost element breakdown on any specific TMDE item.

2.2.1.2 Output of Program "TMDE 1"

The program "TMDE 1" was developed to facilitate computation and provide certain outputs in a sequence different from "TMDE". For program "TMDE 1" the following outputs are provided in the sequence shown.

a. Yearly and cumulative-yearly costs of PIL TMDE

b. Yearly and cumulative-yearly costs of the non-PIL TMDE group

c. The sum of each of the cost elements for 10 years for PIL TMDE

d. The sum of each of the cost elements for 10 years for the non-PIL TMDE group.

2.2.2 Features of LCC Computer Program

The computer program for determining life cycle costs of PIL and non-PIL TMDE has been implemented on the Burroughs B5700 time share system at USAECOM, Fort Monmouth, and on the Control Data Corporation "Kronos 2.1" time-share system at ARINC Research Corporation. All of the data files used for the program are stored in the time share system until required. The data files, called "GRPxyz", represent the group (x) and the scenario/option (yz). At the beginning of the program exercises, the particular scenario (and its attendant data file)

are specified from the teletype terminal keyboard. In the Kronos system, this is accomplished by typing in the file name (e.g., GRPA1), whereupon the program calls the designated file and reads it to obtain the specific data required by that scenario. In the Burroughs system, the file is called by means of a file number corresponding to a given group. The main program stores the program data described in Section 2.1.

The computer program is very flexible – data changes are readily implemented, additional cases and options can be evaluated, and sensitivity analyses can be conducted.

2.3 LIFE CYCLE COST COMPUTATION

Various computer exercises were designed for evaluation of the cost effectiveness of standardizing the selected PIL TMDE. Three scenarios were investigated, two concerning different approaches that USACC might implement to deploy TMDE, and the third designed to provide a comparison of the total life cycle cost of each of the three PIL TMDE and the corresponding non-PIL TMDE that they can replace. These scenarios are described in Sections 2.3.2 through 2.3.4 and summarized in Table 5.

In addition, three separate cases were evaluated to investigate certain other potential cost benefits that could be realized if the PIL were standardized. These cases are discussed in Sections 2.3.5 through 2.3.7 and summarized in Table 6.

Computation results for these scenarios and cases are presented in Section 2.5.

TABLE 5. LCC DATA FILES AND DESCRIPTION OF SCENARIO EXERCISES
(Sheet 1 of 2)

Scenario/Option	TMDE Group	File Name	Description of LCC Exercises
1	A	GRPA1	PIL and Non-PIL TMDE Baseline LCC Comparison
	1B	GRP1B1	
	2B	GRP2B1	
	3B	GRP3B1	
	4B	GRP4B1	
	C	GRPC1	

TABLE 5. (Sheet 2 of 2)

Scenario/Option	TMDE Group	File Name	Description of LCC Exercise
2/1	A	GRPA2	Phase-in of PIL TMDE at 10% of Total Density per Year
2/2	A	GRPA3	Phase-in of Non-PIL TMDE at 10% of Total Density per Year
2/3	A	GRPA7	Phase-in of PIL and Non-PIL TMDE mix at 10% of Total Density per Year
3/1	A	GRPA4	Phase-in of PIL TMDE per USACC Plan
	1B	GRP1B2	
	2B	GRP2B2	
	3B	GRP3B2	
	4B	GRP4B2	
	C	GRPC4	
3/2	A	GRPA5	Phase-in of Non-PIL TMDE per USACC Plan
	1B	GRP1B3	
	2B	GRP2B3	
	3B	GRP3B3	
	4B	GRP4B3	
	C	GRPC5	
3/3	A	GRPA8	Phase-in of PIL and Non-PIL Mix per USACC Plan

TABLE 6. LCC DATA FILES AND DESCRIPTION OF CASE EXERCISES

Case	TMDE Group	File Name	Description of LCC Exercise
1	A	GRPA1	Initial Stockage
2	A	GRPA1	Inflation and Discounted Cash Flow
	1B	GRP1B1	
	2B	GRP2B1	
3	3B	GRP3B1	Volume Discount
	4B	GRP4B1	
	C	GRPC1	

2.3.1 TMDE Groupings

The PIL and non-PIL TMDE of interest in the Phase III investigation were categorized into three major groups containing PIL TMDE and corresponding non-PIL TMDE that they can replace. These groups are defined as follows:

Group	TMDE Included	Comment
A	AN/USM-336V (PIL) 11 Non-PIL	Spectrum Analyzer
1B	CP-772A/U (PIL) 28 Non-PIL	Frequency Counter
2B	CV-2002/U (PIL) 6 Non-PIL	
3B	CV-2003B/U (PIL) 2 Non-PIL	
4B	CV-3059/U (PIL) 2 Non-PIL	
C	432A (PIL) 6 Non-PIL	RF Power Meter

Appendix A-1 presents a detailed listing of the TMDE nomenclature and the specific group in which each is located.

2.3.2 Scenario 1

2.3.2.1 Description

Scenario 1 was designed to determine and compare the total life cycle costs of PIL and non-PIL TMDE in Groups A, B, and C under equivalent conditions. This scenario is based on the current quantity of each non-PIL TMDE in the USACC inventory for a 10-year period, beginning with acquisition and continuing through disposal. For this scenario, it is assumed that all of the non-PIL TMDE are bought at the beginning of 1975 in the densities shown in Appendix A. These non-PIL TMDE are operated and maintained each year until the end of 1984, at which time they are disposed of. An equivalent density of PIL TMDE are also bought in 1975, operated and maintained each year and then disposed of at the end of 1984. During this 10-year life cycle, the recurring and nonrecurring costs defined by the life cycle cost model are computed separately for the total non-PIL and PIL TMDE of the group under analysis.

2.3.2.2 Scenario 1 Data Files

The data files for Scenario 1 were developed in accordance with the above baseline concept. The procedure employed for this purpose is illustrated by the following example. For Group A, the total density of non-PIL TMDE is 53 items, comprised of 11 different makes and models. In compliance with the baseline condition, the 1975 purchase includes three AN/UPM-84, four DU-2A, one LCA-6, one RTA-5, one SA-84W, one TSA-W2, two 1L20, one 1L30, twenty-five 1L40, two 851A, and twelve 851B. These TMDE are operated and maintained through 1984 and then disposed of. Since a total of 53 non-PIL TMDE are addressed, a comparable number of PIL TMDE (USM-366(V)1) are also bought in 1975; operated and maintained for 10 years; then disposed of in 1984.

This procedure is summarized in Table 7, which presents item scenario data for the USM-366 and the UPM-84. For 1975, as shown in the table, 53 PIL items are bought (NEQB), none are disposed of (NEQD), and 53 are operated and maintained (NDEN). These 53 USM-366(V)1 items are operated and maintained each year through 1984 and then disposed of. For the UPM 84, three items are bought in 1975, none are disposed of, and three are operated and maintained; and the three items continue in service until being disposed of in 1984.

TABLE 7. SAMPLE DATA FILE

Line No.

```
00120 U2M366
00130 LCAL 1 UCCS 4500. AMH 5.33
00140 HSC 8.06 W1 48. AMI 6058. FAIL .89
00150 FMI 55. ACPP 310. MLIN 1 NCAL 2
00160 1975 NFGB 53 NFCD 0 NDEN 53
00170 1976 NFGB 0 NFCD 0 NDEN 53
00180 1977 NFGB 0 NFCD 0 NDEN 53
00190 1978 NFGB 0 NFCD 0 NDEN 53
00200 1979 NFGB 0 NFCD 0 NDEN 53
00210 1980 NFGB 0 NFCD 0 NDEN 53
00220 1981 NFGB 0 NFCD 0 NDEN 53
00230 1982 NFGB 0 NFCD 0 NDEN 53
00240 1983 NFGB 0 NFCD 0 NDEN 53
00250 1984 NFGB 0 NFCD 53 NDEN 53
00260 UM84
00270 LCAL 1 UCCS 6624. AMH 5.33
00280 HSC 8.06 W1 50. AMI 5500. FAIL .89
00290 FMI 55. ACPP 310. MLIN 1 NCAL 2
00300 1975 NFGB 3 NFCD 0 NDEN 3
00310 1976 NFGB 0 NFCD 0 NDEN 3
00320 1977 NFGB 0 NFCD 0 NDEN 3
00330 1978 NFGB 0 NFCD 0 NDEN 3
00340 1979 NFGB 0 NFCD 0 NDEN 3
00350 1980 NFGB 0 NFCD 0 NDEN 3
00360 1981 NFGB 0 NFCD 0 NDEN 3
00370 1982 NFGB 0 NFCD 0 NDEN 3
00380 1983 NFGB 0 NFCD 0 NDEN 3
00390 1984 NFGB 0 NFCD 3 NDEN 3
00400 DU2A
```

The other 10 non-PIL TMDE items are addressed in a similar manner for Scenario 1. Six data files used to exercise the LCC program are described in Table 5 and detailed in Appendix A-2.

2.3.2.3 Scenario 1 Computations

The life cycle cost model computes the total life cycle costs of the entire group of non-PIL TMDE and the PIL TMDE. Table 8 is an example of the total life cycle costs for Group A TMDE.

Referring to Table 8, the cumulative cost in 1984 of $2,304,755 is the life cycle cost of 53 type USM-366 items. The non-PIL group costs ($3,767,169) are the total life cycle costs for 53 of the eleven different non-PIL TMDE in Group A.

Life cycles costs of TMDE groups A, B, and C are detailed in Appendix A-3.

TABLE 8. GROUP A LIFE CYCLE COSTS, SCENARIO 1

ITEM NO.	YEAR	COST	CUMCOST
USM366 1			
	1975	499778.59	499778.59
	1976	229069.53	728848.12
	1977	226838.33	955686.45
	1978	224809.97	1180496.42
	1979	215129.16	1395625.57
	1980	203953.62	1599579.19
	1981	194302.01	1793881.20
	1982	184719.66	1978600.86
	1983	175273.79	2153874.67
	1984	150881.24	2304755.91
NON-PIL GROUP COSTS			
	YEAR	COST	CUMCOST
	1975	1206966.63	1206966.63
	1976	325084.48	1532051.10
	1977	321918.07	1853969.17
	1978	319039.52	2173008.69
	1979	305300.98	2478309.67
	1980	289441.18	2767750.85
	1981	275744.09	3043494.95
	1982	262145.30	3305640.25
	1983	248740.15	3554380.40
	1984	212789.17	3767169.57

2.3.3 Scenario 3

2.3.3.1 Description

Scenario 3 was designed to evaluate the economic impact of standardization of the three PIL TMDE by computing the life cycle costs associated with three possible situations.* For option 1, it is assumed that PIL TMDE are phased in to replace non-PIL TMDE according to the TMDE phasing plan developed by USACC, and shown in Appendix A-1. This plan projects the USACC TMDE needs from 1975 through 1984. For option 2, it is assumed that non-PIL TMDE replace the present type of non-PIL TMDE within the USACC inventory. The non-PIL replacement under option 2 is also performed in accordance with the USACC 10-year phasing plan.

For each option, the appropriate PIL or non-PIL TMDE are bought the year after the non-PIL TMDE are disposed of, and then operated and maintained each year until the end of 1984, at which time the phased-in TMDE are disposed of.

Option 1 and 2 are computed for all three groups of TMDE.

A third option for scenario 3 was designed to evaluate the economic impact of having to phase in a mixture of PIL and non-PIL TMDE during the 10-year life cycle to replace non-PIL TMDE, while still satisfying the USACC phasing plan. Whereas it was originally intended that option 3 provide for the phasing in a mixture of PIL and non-PIL TMDE, no suitable rationale could be developed for such a deployment situation. Therefore it was determined by ARINC Research to be more meaningful to investigate the economic impact of phasing in two PIL items. A condition such as this might arise after several years of standardization when an advanced state-of-the-art TMDE becomes available for deployment, and it is considered advantageous from a mission point of view to implement the new PIL TMDE. This option is evaluated for Group A only, and calls for the phasing in of one type of PIL TMDE to replace ten different types (UPM-84, DU-2A, LCA-6, RTA-5, SA-84W, TSA-W2, 1L20, 1L30, 851A, and 851B), and then the phasing in of another PIL TMDE type to replace the 1L40. The second PIL TMDE is assumed to have the same basic cost features as the 1L40. No consideration was given to functional capability of the 1L40 for this option, but rather it was used only to demonstrate economic factors. The same item

*This scenario was evaluated before scenario 2, as discussed in Section 1.3, and is presented in that order in this report.

characteristic data used for the 1L40 in other options was used for option 3. Only the item scenario data were revised to show that the 1L40 is replaced by phasing in a second PIL TMDE.

2.3.3.2 Scenario 3, Option 1

2.3.3.2.1 Description – The scenario data for option 1 of scenario 3 were developed in compliance with the USACC 10-year phasing plan. The manner in which this was done is described in the following paragraphs, using TMDE Group A as an example. Examples of Group A item scenario data are given in Table 9.

The USACC phasing plan identifies all TMDE in the current inventory, and the year in which they are to be replaced. In Group A, one each of the LCA-6, RTA-5, SA-84W, and TSA-W2 are to be replaced in 1975. Upon PIL standardization, these four TMDE would be replaced by phasing in four PIL TMDE (USM-366). These PIL items would be bought in 1975, operated and maintained through 1984, and then disposed of. At the end of 1975, the four DU-2A and one 1L30 TMDE that have been operated and maintained during that year are disposed of in anticipation of being replaced in 1976. The handling of this deployment activity can be observed in the item scenario data file shown in Table 9. For the USM-366, four items are bought (B), none disposed of (D), and four are operated and maintained (N) in 1975. For the LCA-6, TRA-5, SA-84W, and TSA-W2, the item scenario data show that no items are bought, disposed, or operated and maintained in 1975, or any year thereafter. No disposal occurs for these four TMDE since it was assumed for this study that TMDE would be disposed of at the end of the year preceding their replacement. The costs for items disposed of in 1974 are treated as sunk costs in this study. For the DU-2A and 1L30, the item scenario data show these TMDE operated, maintained, and disposed of in 1975.

The same logic used for the above actions of option 1 is applied to the other TMDE for the remaining years of the life cycle. All of the PIL TMDE phased in each year are added to the previous year's density of operated and maintained items. This condition is cumulative for 10 years.

At the end of 1984, all PIL TMDE are disposed of at the same time. For this scenario, the costs of purchase, first destination, documentation, installation and introduction for non-PIL TMDE replaced are regarded as sunk costs, since these TMDE are already in the USACC inventory.

TABLE 9. EXAMPLE OF ITEM SCENARIO DATA, OPTION 1 OF SCENARIO 3
(Sheet 1 of 2)

```
00120 USA366
00130 LCAL 1 UCOS 4500. XMH 5.33
00140 HSC 8.06 WI 48. XMI 6050. FAIL .69
00150 FMI 55. AGPP 310. MLIN 1 NCAL 2
160 1975 B 4 D 0 N 4
170 1976 B 5 D 0 N 9
180 1977 B 8 D 0 N 17
190 1978 B 10 D 0 N 27
200 1979 B 8 D 0 N 35
210 1980 B 5 D 0 N 40
215 1981 B 5 D 0 N 45
220 1982 B 4 D 0 N 49
240 1983 B 2 D 0 N 51
250 1984 B 2 D 53 N 53
00260 UPMA4
00270 LCAL 1 UCOS 8624. XMH 5.33
00280 HSC 8.06 WI 50. XMI 5500. FAIL .69
00290 FMI 55. AGPP 310. MLIN 1 NCAL 2
300 1975 B 0 D 0 N 3
310 0976 B 0 D 3 N 3
320 1977 B 0 D 0 N 0
330 1978 B 0 D 0 N 0
340 0979 B 0 D 0 N 0
350 1980 B 0 D 0 N 0
360 1981 B 0 D 0 N 0
370 1982 B 0 D 0 N 0
380 1983 B 0 D 0 N 0
390 1984 B 0 D 0 N 0
00400 D02A
00410 LCAL 1 UCOS 13785. XMH 8.98
00420 HSC 6.02 WI 135. XMI 8000. FAIL 1.5
00430 FMI 50. AGPP 310. MLIN 1 NCAL 2
435 1975 B 0 D 4 N 4
440 1976 B 0 D 0 N 0
460 1977 B 0 D 0 N 0
470 1978 B 0 D 0 N 0
480 1979 B 0 D 0 N 0
490 1980 B 0 D 0 N 0
500 1981 B 0 D 0 N 0
510 1982 B 0 D 0 N 0
520 1983 B 0 D 0 N 0
530 1984 B 0 D 0 N 0
```

TABLE 9. (Sheet 2 of 2)

```
00540 ECAG
00550 ECAL 1 UCCS 8000. XMH 5.33
00560 RSC 8.06 FI 50. XMI 8000. FAIL .89
00570 FMI 50. AGPP 310. MLIN 1 NCAL 2
580 1975 B 0 D 0 N 0
590 1976 B 0 D 0 N 0
600 1977 B 0 D 0 N 0
610 1978 B 0 D 0 N 0
620 1979 B 0 D 0 N 0
630 1980 B 0 D 0 N 0
640 1981 B 0 D 0 N 0
650 1982 B 0 D 0 N 0
660 1983 B 0 D 0 N 0
670 1984 B 0 D 0 N 0
680 KIA5
685 ECAL 1 UCCS 4675. XMH 5.33
00690 RSC 8. FI 50. XMI 8000. FAIL .89
00710 FMI 50. AGPP 310. MLIN 1 NCAL 4
720 1975 B 0 D 0 N 0
730 1976 B 0 D 0 N 0
740 1977 B 0 D 0 N 0
750 1978 B 0 D 0 N 0
760 1979 B 0 D 0 N 0
770 1980 B 0 D 0 N 0
780 1981 B 0 D 0 N 0
790 1982 B 0 D 0 N 0
800 1983 B 0 D 0 N 0
810 1984 B 0 D 0 N 0
00820 SAB4A
00830 ECAL 1 UCCS 8827. XMH 5.33
00840 RSC 23.08 FI 50. XMI 8000. FAIL .89
00850 FMI 50. AGPP 310. MLIN 1 NCAL 4
860 1975 B 0 D 0 N 0
870 0976 B 0 D 0 N 0
880 1977 B 0 D 0 N 0
890 1978 B 0 D 0 N 0
900 1979 B 0 D 0 N 0
910 1980 B 0 D 0 N 0
920 1981 B 0 D 0 N 0
930 1982 B 0 D 0 N 0
940 1983 B 0 D 0 N 0
950 1984 B 0 D 0 N 0
00960 15AE2
00970 ECAL 1 UCCS 13785. XMH 3.79
00980 RSC 18. FI 50. XMI 8000. FAIL .63
00990 FMI 50. AGPP 310. MLIN 4 NCAL 4
1000 1975 B 0 D 0 N 0
1010 1976 B 0 D 0 N 0
1020 1977 B 0 D 0 N 0
1030 1978 B 0 D 0 N 0
1040 1979 B 0 D 0 N 0
1050 1980 B 0 D 0 N 0
1060 1981 B 0 D 0 N 0
1070 1982 B 0 D 0 N 0
1080 1983 B 0 D 0 N 0
1090 1984 B 0 D 0 N 0
1095 L20
1215 L30
```

2.3.3.2.2 Life Cycle Costs – The total life cycle costs for option 1 of Scenario 3 are the sum of the cumulative costs for the PIL and non-PIL TMDE computed by the life cycle cost model. For example the total life cycle costs of Group A for option 1 of scenario 3 are $2,575,782. This value was derived by adding the 1984 cumulative costs of the USM366 and non-PIL groups costs shown in Table 10. Option 1 was computed for the TMDE of Groups A, B, and C.

TABLE 10. GROUP A LIFE CYCLE COSTS, OPTION 1 OF SCENARIO 3

ITEM NO.	YEAR	COST	CUMCOST
USM366	1		
	1975	64147.27	64147.27
	1976	60607.66	144754.93
	1977	107060.46	251815.39
	1978	156966.57	408781.96
	1979	174549.60	583331.56
	1980	173178.94	756510.50
	1981	183302.20	939812.71
	1982	184713.07	1124525.78
	1983	175270.65	1299796.43
	1984	157175.04	1456971.47
NON-PIL GROUP COSTS			
	YEAR	COST	CUMCOST
	1975	288946.76	288946.76
	1976	252837.05	541783.81
	1977	201649.08	743432.89
	1978	146246.31	889679.20
	1979	97269.97	987149.17
	1980	66482.34	1053631.51
	1981	38438.63	1092070.14
	1982	18331.19	1110401.33
	1983	8410.06	1118811.39
	1984	0.	1118811.39

2.3.3.3 Scenario 3, Option 2

2.3.3.3.1 Description – The scenario data for option 2 were developed in accordance with the USACC 10-year phasing plan. For this option the non-PIL TMDE in the inventory were replaced by other non-PIL TMDE of the same make and model. This option addresses the effects prior to, or in the event that, standardization is not implemented.

Using Group A as an example, the data were developed as follows. In Group A one each of the LCA-6, RTA-5, SA-84W, and TSA-W2 are to be replaced in 1975. In

the absence of standardization of the PIL, these four TMDE would be replaced by four other LCA-6, RTA-5, SA-84W, and TSA-W2 type TMDE. The latter four items would be bought in 1975 and operated and maintained through 1984. In 1975, the four DU-2A and one 1L30 TMDE that have been operated and maintained during 1975 are disposed at the end of 1975. This occurs because TMDE are disposed at the end of the year preceding the year they are replaced. The item scenario data shown in Table 11 demonstrate the above discussion for the DU-2A and LCA-6.

TABLE 11. ITEM SCENARIO DATA

```
00400 DU2A
00410 LCAL 1 UCLS 13785. AMH 5.98
00420 RSC 6.02 WT 135. AMI 8000. FAIL 1.5
00430 FMI 50. ACMP 310. MLIN 1 NCAL 2
435  1975 1 0 D 4 N 4
440  1976 B 4 D 0 N 4
460  1977 B 0 D 0 N 4
470  1978 B 0 D 0 N 4
480  1979 B 0 D 0 N 4
490  1979 B 0 D 0 N 4
500  1981 B 0 D 0 N 4
510  1982 B 0 D 0 N 4
520  1983 B 0 D 0 N 4
530  1984 B 0 D 4 N 4
00540 LCA6
00550 LCAL 1 UCLS 8000. AMH 5.33
00560 RSC 6.06 WT 50. AMI 8000. FAIL .59
00570 FMI 50. ACMP 310. MLIN 1 NCAL 2
580  1975 B 1 D 0 N 1
590  1976 B 0 D 0 N 1
600  1977 B 0 D 0 N 1
610  1978 B 0 D 0 N 1
620  1979 B 0 D 0 N 1
630  1980 B 0 D 0 N 1
640  1981 B 0 D 0 N 1
```

For the LCA6, one item is bought as a replacement, no items are disposed of (since they were disposed of in 1974), and the item purchased is operated and maintained through 1984. That item is disposed of at the end of 1984. The data for the RTA-5, SA-84W, TSA-W2, are addressed similarly (see Appendix data files for Group A5). The item scenario data for the DU-2A show none bought in 1975, but four disposed and four operated and maintained in that year. Since four DU-2A TMDE are bought in 1976 to replace these items, the item scenario shows four bought, operated and maintained in 1976. These four TMDE are operated and maintained through 1984,

at which time they are disposed of. The other TMDE in Group A are addressed in a similar manner until all are replaced.

For this option, no costs are incurred for the purchase of TMDE being replaced since these units already exist in the USACC inventory

2.3.3.3.2 Life Cycle Costs – The total life cycle cost for option 2 are cumulative costs for the non-PIL TMDE only. For group A, the total life cycle costs are $3,807,432. This value was computed by the life cycle cost model and shown by the example in Table 12. Option 2 was computed for the TMDE of Groups A, B, and C.

TABLE 12. CUMULATIVE LIFE CYCLE COSTS FOR NON-PIL TMDE, OPTION 2 OF SCENARIO 3

NON-PIL GROUP COSTS

YEAR	COST	CUMCOST
1975	555309.81	555309.81
1976	485560.72	1040870.53
1977	578681.61	1619552.14
1978	409755.72	2029307.87
1979	396901.12	2426208.98
1980	314653.69	2740862.66
1981	300144.46	3041007.34
1982	282309.96	3323317.30
1983	260745.04	3584062.34
1984	223370.00	3807432.34

2.3.3.4 Scenario 3, Option 3

2.3.3.4.1 Description – The scenario data for option 3 of scenario 3 were developed in accordance with the USACC 10-year phasing plan. For this option, a procedure similar to that used for option 2 was followed. All of the TMDE except for the 1L40 were replaced by phasing in PIL items. Since the option was designed to show the effects of phasing in two PIL TMDE types, it was assumed that all of the lowest density types (the LCA-6, UPM-84, DU-2A, RTA-5, SA-84W, TSA-W2, 1L20, 1L30, 851A, and 851B) would be replaced by the USM-366, a PIL item. It was then assumed that the remaining TMDE, the 1L40, the highest-density item in Group A, would be replaced by a second PIL item rather than the USM-366. The second PIL item selected had item characteristics the same as the 1L40.

The functional and technical capabilities of the 1L40 were not considered in its selection; rather it was chosen as representing the item of highest density.

2.3.3.4.2 Life Cycle Costs – The total life cycle costs for option 3 of scenario 3 are the sum of the cumulative costs for the PIL and non-PIL TMDE computed by the cost model. Option 3 was computed for Group A TMDE only.

2.3.4 Scenario 2

2.3.4.1 Description

Scenario 2 was designed to evaluate the economic impact of standardization according to the situation described for options 1, 2, and 3 of scenario 3, but under different conditions of replacement. For this scenario, it was assumed that replacement of the current inventory of TMDE would be done in such a way that approximately 10% of the total TMDE density would be replaced each year from 1975 through 1984.

This 10% rate was selected on the premise that it would provide information for a phasing plan in the event that USACC was unable to pursue the TMDE phasing plan discussed earlier. This 10% scenario was evaluated also to demonstrate the overall impact on life cycle costs that phasing might have, and provide data aid in optimizing some future phase-in program.

2.3.4.2 Scenario 2, Option 1

The scenario 2 data were based on the logic that if 53 items were to be replaced from 1975 - 1984, either five or six would be affected each year. Also, the priority for replacing the TMDE was to eliminate those of the lowest density first, continuing up to those of highest density until all TMDE are replaced. PIL items are phased in to replace the non-PIL items.

The item scenario data of Table 13 illustrate option 1. Here, five PIL TMDE are bought, operated and maintained in 1975 to replace five non-PIL TMDE (three UPM84 and two DU2A) disposed of in 1974. The two remaining DU2A items are operated, maintained, and disposed of in 1975. In 1976, five more PIL TMDE are phased in to replace the two DU2A and one each LCA-6, RTA-5, and SA-84W. This same logic is followed throughout option 1 until 1984, when only PIL TMDE remain in the USACC inventory.

The life cycle costs for option 1 are the sum of the cumulative costs for the PIL and non-PIL TMDE computed by the life cycle cost model.

TABLE 13. EXAMPLE OF DATA FILE FOR OPTION 1 OF SCENARIO 2

```
00120 USM366
00130 LCAL 1 UCOS 4500. XMH 5.33
00140 HSC 8.06 WT 45. XMI 6058. FAIL .89
00150 FMI 55. ACPP 310. MLIN 1 NCAL 2
160 1975 B 5 D 0 N 5
170 1976 B 5 D 0 N 10
180 1977 B 6 D 0 N 16
190 1978 B 5 D 0 N 21
200 1979 B 5 D 0 N 26
210 1980 B 6 D 0 N 32
220 1981 B 5 D 0 N 37
230 1982 B 5 D 0 N 42
240 1983 B 5 D 0 N 47
250 1984 B 6 D 53 N 53
00260 UPM84
00270 LCAL 1 UCOS 8624. XMH 5.33
00280 HSC 8.06 WT 50. XMI 5500. FAIL .89
00290 FMI 55. ACPP 310. MLIN 1 NCAL 2
300 1975 B 0 D 0 N 0
310 1976 B 0 D 0 N 0
320 1977 B 0 D 0 N 0
330 1978 B 0 D 0 N 0
340 1979 B 0 D 0 N 0
350 1980 B 0 D 0 N 0
360 1981 B 0 D 0 N 0
370 1982 B 0 D 0 N 0
380 1983 B 0 D 0 N 0
390 1984 B 0 D 0 N 0
00400 DG2A
00410 LCAL 1 UCOS 13785. XMH 8.98
00420 HSC 6.02 WT 135. XMI 8000. FAIL 1.5
00430 FMI 50. ACPP 310. MLIN 1 NCAL 2
440 1975 B 0 D 2 N 2
450 1976 B 0 D 0 N 0
460 1977 B 0 D 0 N 0
470 1978 B 0 D 0 N 0
480 1979 B 0 D 0 N 0
490 1980 B 0 D 0 N 0
500 1981 B 0 D 0 N 0
510 1982 B 0 D 0 N 0
520 1983 B 0 D 0 N 0
530 1984 B 0 D 0 N 0
```

2.3.4.3 Scenario 2, Option 2

The item scenario data for option 2 was developed in the same manner as for option 1, except that non-PIL TMDE were phased in to replace non-PIL TMDE. The data files for this option are provided in Appendix A-2.

The life cycle costs for option 2 are those for non-PIL TMDE only.

2.3.4.4 Scenario 2, Option 3

The item scenario data for option 3 was developed as described above for option 1. For option 3, the 1L40 was assumed to represent the second PIL TMDE (as it was in option 3 of scenario 3). The data files for option 3 are presented in Appendix A-2.

The life cycle costs for option 3 are those for the PIL and non-PIL group. The non-PIL group also includes the 1L40, until it is replaced by the second PIL item.

2.3.5 Case 1

Case 1 was designed to evaluate the economic impact of increased item density that would occur upon standardization of the PIL. This case was exercised using the conditions of scenario 1, and utilized the same data files. The life cycle cost computations were performed by implementing changes to the main computer program, "TMDE 1". For case 1 it was determined from an estimate by USACC that 10% to 15% backup items exist for TMDE (i.e., approximately 10% to 15% additional TMDE are procured to act as spares). The backup items are maintained because initial stockage of spares is not possible in the logistics system for TMDE, due to the low density resulting from the use of many different makes and models of TMDE. To employ an initial stockage of spares in place of the backup system would require a substantial increase in the density of TMDE of the same make and model as would occur upon standardization. For example, in Group B the density of TMDE would increase to more than 600 of one type if the PIL item were adopted.

To demonstrate the impact of an initial stockage supply system for consumables, case 1 considers a 10% reduction in TMDE density for PIL TMDE, and increases the unit cost of the PIL TMDE by 10%. This latter value represents an estimated cost for an initial stockage system for consumables. Life cycle cost computations were performed for Group A TMDE only, since that group has the lowest density of the three PIL TMDE in this study. The computations for cases 1 through 3 are detailed in Appendix A.

2.3.6 Case 2

Case 2 was designed to evaluate the effects of inflation and discounted cash flow on life cycle costs of the PIL and non-PIL TMDE. Three different life cycle cost computations were performed, using the conditions and data files of scenario 1. Table 14 shows the exercises performed for Case 2.

TABLE 14. CASE 2 LCC MODEL EXERCISES

TMDE Group	File Name	Description of LCC Exercise
A	GRPA1	0% inflation, 0% discounted cash flow
A	GRPA1	0% inflation, 10% discounted cash flow
A	GRPA1	LCC-defined inflation, 0% discounted cash flow

2.3.7 Case 3

Case 3 was evaluated to demonstrate the economic effects of volume discounting realized from standardization of the PIL. This could occur because the manufacturer of the item may discount the unit cost of TMDE when USACC purchases larger quantities of TMDE of one type.

For this case, Groups B and C were evaluated by reducing the cost of hardware in accordance with the following:

Group	Hardware Cost Reduction
1B	20%
2B, 3B, 4B	10%
C	15%

The percentage values used were estimates provided by the manufacturer of the pertinent items.

2.4 SENSITIVITY ANALYSIS

The life cycle cost model was exercised during Task 4 to determine the effects on TMDE life cycle costs of variations in certain key input parameters. This section describes the various sensitivity analyses performed. Results of this task are detailed in Section 2.5.

2.4.1 Variations in Mean Time Between Failures (MTBF)

The sensitivity of life cycle costs to variations in MTBF was examined for the PIL TMDE in Groups A, B, and C by varying the nominal values used in the data files for scenario 1. The MTBF values and the groups to which these pertained are as follows:

PIL TMDE	Group	Nominal MTBF, hr
USM-366	A	411
CP-772A/U	1B	218
CV-2002/U	2B	1351
CV-2003B/U	3B	3040
CV-3059/U	4B	960
432A	C	598

The computations were performed by changing the failure-rate equation in the main program "TMDE 1" to reflect a 50% decrease in MTBF for each PIL TMDE. This variation in MTBF was also made in the equation used to derive annual maintenance manhours, by changing the main program "TMDE 1" to reflect a 50% decrease in MTBF. The life cycle cost values obtained were plotted with life cycle costs for the nominal MTBF value.

For Group B, four computations were performed, one for each subgroup. These life cycle cost values were summed and plotted against the life cycle costs for the nominal MTBF value.

2.4.2 Variations in Mean Time to Repair (MTTR)

The sensitivity of life cycle costs to variations in mean time to repair was examined for the PIL TMDE in Groups A, B, and C by varying the nominal values

used in the data files for scenario 1. The MTTR values and the groups to which these pertained are as follows:

PIL TMDE	Group	Nominal MTTR, hr/yr
USM-366	A	5.33
CP-772A/U	1B	10.0
CV-2002/U	2B	1.59
CV-2003B/U	3B	0.73
CV-3059/U	4B	2.29
432A	C	1.83

The life cycle cost values obtained were plotted with the life cycle costs for the nominal value of MTTR varied by ±50%.

2.4.3 Variations in Consumables Cost

The sensitivity of life cycle costs to variations in the cost of consumables was examined for Groups A, B, and C by varying the consumables cost value used in the main program. Consumables costs are computed by the LCC model as a percentage of the unit cost of TMDE. The computations for sensitivity analysis of consumables cost were made by varying this percentage over a ±50% range.

2.4.4 Variations in Operating Hours (NHO)

The sensitivity of life cycle costs to variations in the number of hours spent in the operation of TMDE was examined for Groups A, B, and C. For these exercises, the nominal value of NHO for PIL TMDE, which is 300 hours per year, was varied over ±50%.

2.5 LCC RESULTS AND ANALYSIS

Results of the LCC and sensitivity analyses performed for the various scenarios, cases, and parameter variations described earlier are presented in this section. Implications of these results in terms of their potential effects on USACC operations are evaluated in Section 2.5.1 and 2.5.2 for the LCC and sensitivity analyses, respectively. Certain nonquantifiable benefits associated with standardization are discussed in Section 2.5.3.

2.5.1 Life Cycle Cost Results

The values obtained by exercising the LCC model for the various scenarios and cases defined for the Phase III investigation are discussed in the following paragraphs and summarized in Table 15. Visual presentations of the data appear in Figures 1 through 3, in which the LCC data are shown in bar-graph form comparing the TMDE standardization alternatives.

2.5.1.1 Results of Scenario 1

2.5.1.1.1 Life Cycle Costs – The life cycle costs for each of the three PIL TMDE of Groups A, B, and C are significantly lower than the corresponding costs of the non-PIL TMDE they can replace if standardization were implemented. The largest cost differential is in Group B, which contains the main frame (1B) and three related plug-ins (2B, 3B, and 4B). The USACC cost of ownership for the Group B PIL items is $2 million less than the cost of the 38 different non-PIL items they could replace. This condition for Group B is especially significant since the unit price of the PIL item (CP 772A/U) is considerably above the average price of the non-PIL TMDE it replaces. Also, the MTBF of the CP 772A/U is the lowest of all the TMDE in Group B. Nevertheless, the lower LCC and increased versatility of the CP 772A/U in the USACC force structure outweighs these encumberances.

The LCC of the PIL TMDE in Group A is $1.5 million less than that for the 11 different non-PIL types they can replace; while the LCC of the PIL items in Group C are $1.8 million less than for the six different non-PIL items.

If the three selected PIL TMDE of Groups A, B, and C were standard items, USACC would realize a reduction of more than $5 million in life cycle costs over that for the 55 different types of TMDE that could potentially be replaced.

TABLE 15. SUMMARY OF LCC RESULTS (Sheet 1 of 2)

Scenario	Option	Case	TMDE Group	Description	Life Cycle Cost ($)
1	–	–	A	LCC of PIL TMDE	2,304,755
	–	–	A	LCC of non-PIL TMDE	3,767,169
	–	–	B	LCC of PIL TMDE	24,521,617
	–	–	B	LCC of non-PIL TMDE	26,497,229
	–	–	C	LCC of PIL TMDE	8,673,076
	–	–	C	LCC of non-PIL TMDE	10,523,410
2	1	–	A	PIL Phased-in to replace non-PIL TMDE (10%)	2,653,756
	2	–	A	Non-PIL Phased in to replace non-PIL TMDE (10%)	3,722,082
	3	–	A	Phase in of PIL and non-PIL mix to replace non-PIL TMDE (10%)	2,855,722
3	1	–	A	PIL Phased-in to Replace non-PIL TMDE; USACC Plan	2,575,782
	2	–	A	Non-Pil Phased-in to Replace non-PIL TMDE; USACC Plan	3,807,432
	3	–	A	Phase-in of PIL and non-PIL mix to replace non-PIL TMDE; USACC Plan	2,777,649
	1	–	B	PIL Phased-in to Replace non-PIL TMDE; USACC Plan	24,769,282
	2	–	B	Non-PIL Phased-in to Replace non-PIL TMDE; USACC Plan	26,319,607
	1	–	C	PIL TMDE Phased-in to Replace non-PIL TMDE; USACC Plan	9,312,654
	2	–	C	Non-PIL TMDE Phased-in to Replace non-PIL TMDE; USACC Plan	10,493,277

TABLE 15. (Sheet 2 of 2)

Scenario	Option	Case	TMDE Group	Description	Life Cycle Cost ($)
1	–	1	A	Initial Stockage for PIL TMDE	2,127,129
	–	2	A	LCC of PIL TMDE with 0% Inflation	1,786,242
	–	2	A	LCC of non-PIL TMDE with 0% Inflation	3,031,892
		2	A	LCC of PIL TMDE with 0% Inflation and 0% Discounted Cash Flow	2,753,198
	–	2	A	LCC of Non-PIL TMDE with 0% Inflation and 0% Discounted Cash Flow	3,745,016
	–	2	A	LCC of PIL TMDE with 0% Discounted Cash Flow	3,745,016
		2	A	LCC of Non-PIL TMDE with 0% Discounted Cash Flow	5,858,762
	–	3	B	LCC of PIL TMDE with Volume Discount	23,046,432
	–	3	C	LCC of PIL TMDE with Volume Discount	8,573,450
	–	–	B	Reduced Density from Extended Functional Capability	19,611,094

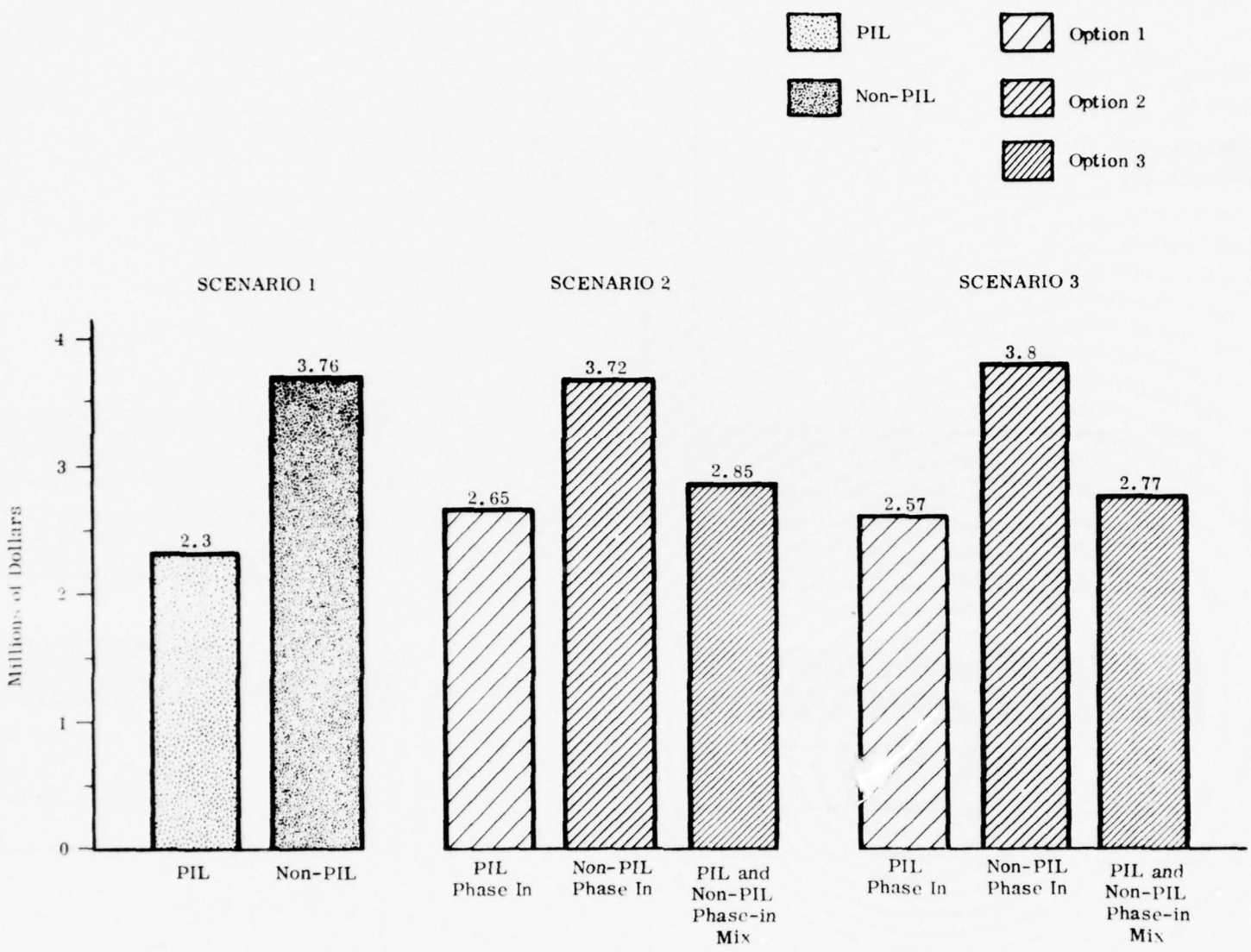

Figure 1. Ten-Year Life Cycle Cost Comparisons, Group A (Spectrum Analyzers)

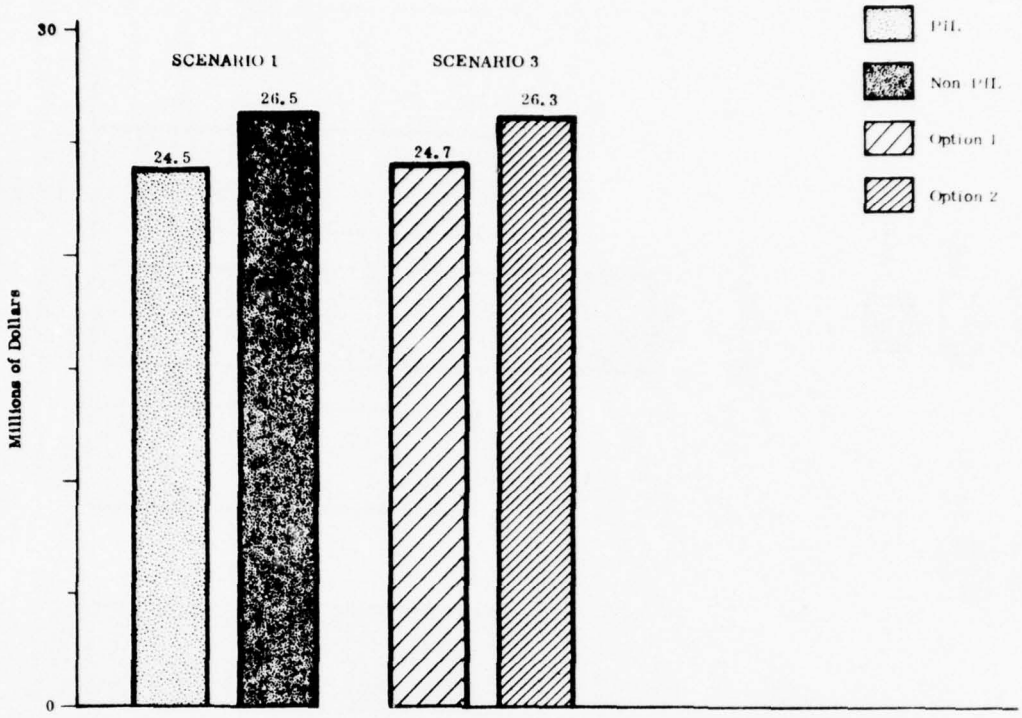

Figure 2. Ten-Year Life Cycle Cost Comparison, Group B

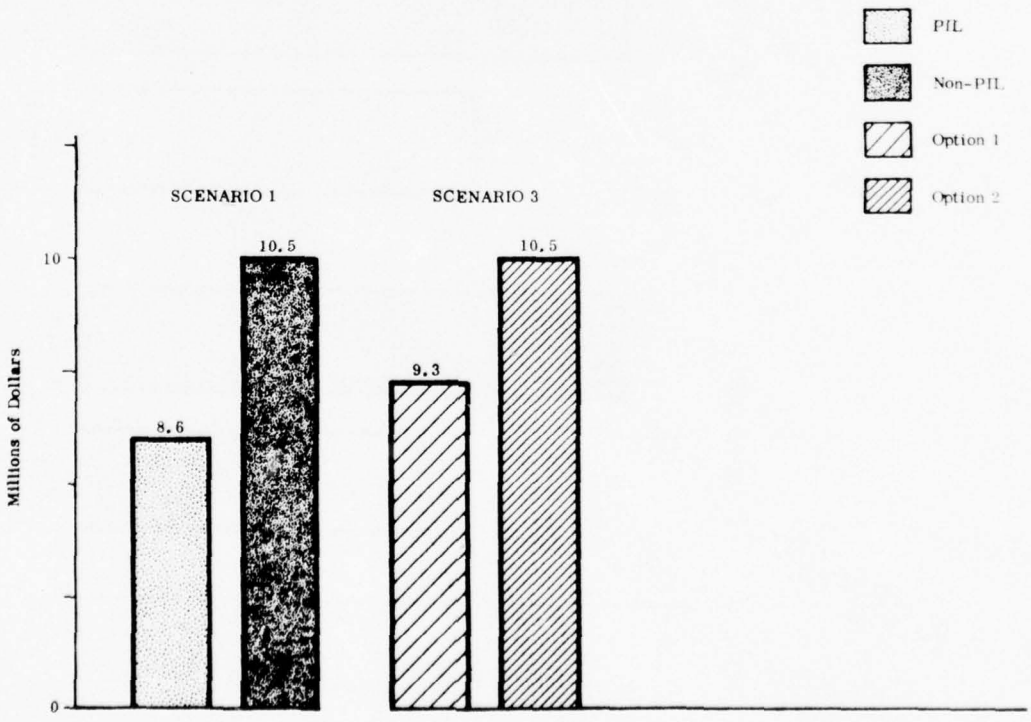

Figure 3. Ten-Year Life Cycle Cost Comparison, Group C

The foregoing data will now be discussed in terms of the individual elements of the life cycle cost.

2.5.1.1.2 Breakdown of Cost Elements – The costs incurred for the 11 elements of the TMDE LCC are presented in Tables 16 through 18 for Groups A, B, and C. As can be seen the predominant cost element for all groups is that for personnel to operate, maintain, and calibrate (A- and C-level) TMDE in the USACC force structure. More than 80% of the LCC of Group B is personnel costs, while for Groups A and C the figure is in the order of 50%.

The effects of standardization (I.e., less time spent by personnel operating PIL TMDE), impact on the differences in personnel costs between the PIL and non-PIL items. This difference is likely to become even greater when the nonquantifiable benefits of standardization described in Section 2.5.3 impact on the operating personnel.

Other cost elements that play a major role in creating the LCC difference between PIL and non-PIL TMDE are those of introduction, holding, and documentation. These cost elements are directly affected by the quantity of different types of TMDE in the USACC inventory.

The costs of documentation for the three PIL items contribute only a small percentage of the LCC, whereas the costs of documentation for the non-PIL items is substantial. The major reason is that only one set of documents is required for each PIL item (TM, TB and RPSTL's), while each of the more numerous PIL items requires its own set of documents. For the non-PIL item in this study, there are 55 different TMs, TBs, and RPSTLs, for a total of 165 different documents versus the 18 if PIL standardization were implemented.

Extra costs for introduction and holding are also associated with the proliferation of different TMDE. Each item type introduced and maintained in the inventory has an associated expense that can be reduced if there are fewer types in inventory.

For Group B PIL items, the effects of high unit price and low MTBF can be observed for the cost elements of purchase and consumables. These two cost elements are higher for the PIL than for the non-PIL TMDE. The higher cost of consumables results from the greater frequency of failure experienced by the CP772A/U.

TABLE 16. LCC COST ELEMENTS FOR SCENARIO 1, GROUP A

Cost Element	PIL TMDE		Non-PIL TMDE		Cost Diff.* (%)
	Cost ($)	Pct of Total	Cost ($)	Pct of Total	
Training	106,290	4.6	99,844	2.65	6.45
Purchase	217,781	9.4	326,639	8.67	- 33.32
Personnel	1,265,199	54.9	1,563,338	41.50	- 19.07
First Dest. Trans.	2,367	.10	3,925	.10	- 39.68
Transportation	347	<0.1	1,172	0.1	- 70.309
Consumables	219,366	9.52	543,528	14.43	- 59.64
Introduction	2,077	<0.1	24,596	.65	- 91.55
Holding	453,520	19.68	681,218	18.08	- 33.42
Documentation	49,318	2.14	542,500	14.40	- 90.91
Installation	4,577	.20	4,577	.12	0
Disposal	- 16,091	- .70	- 24,170	- .64	- 33.42
Total	2,304,755		3,767,169		

*Cost Difference (%) = $\frac{\text{(Cost of Element for PIL TMDE) - (Cost of Element for Non-PIL TMDE)}}{\text{Cost of Element for Non-PIL TMDE}}$

TABLE 17. LCC COST ELEMENTS FOR SCENARIO 1, GROUP B

Cost Element	PIL TMDE		Non-PIL TMDE		Cost Diff. (%)
	Cost ($)	Pct of Total	Cost ($)	Pct of Total	
Training	1,283,510	5.2	1,248,183	4.7	2.83
Purchase	1,621,780	6.6	1,232,694	4.6	31.56
Personnel	15,356,587	62.6	18,311,835	69.1	- 16.13
First Dest. Trans.	20,869	<0.1	18,572	<0.1	12.36
Transportation	5,325	<0.1	7,512	<0.1	- 29.11
Consumables	2,798,202	11.4	1,387,394	5.2	101.68
Introduction	8,308	<0.1	78,938	.3	- 89.47
Holding	3,367,957	13.7	2,554,084	9.6	31.86
Documentation	123,293	.5	1,686,362	6.3	- 92.68
Installation	55,271	.2	55,271	.2	0
Disposal	- 119,498	- .4	- 90,621	- .3	31.86
Total	24,521,617		26,490,229		

TABLE 18. LCC COST ELEMENTS FOR SCENARIO 1, GROUP C

Cost Element	PIL TMDE		Non-PIL TMDE		Cost Diff. (%)
	Cost ($)	Pct of Total	Cost ($)	Pct of Total	
Training	631,728	7.2	603,105	5.7	4.74
Purchase	184,704	2.1	190,650	1.8	- 3.11
Personnel	7,314,189	84.3	8,964,568	85.1	- 18.41
First Dest. Trans.	3,569	<0.1	4,049	<0.1	- 11.85
Transportation	543	<0.1	2,509	<0.1	- 78.34
Consumables	124,111	1.4	202,594	1.9	- 38.73
Introduction	2,077	<0.1	12,464	.1	- 83.33
Holding	374,368	4.3	386,806	3.6	- 3.21
Documentation	23,863	.2	143,181	1.3	- 83.33
Installation	27,204	.3	27,204	.2	0
Disposal	- 13,283	- .1	- 13,724	- .1	- 3.21
Total	8,673,076		10,523,410		

Certain cost elements have no significant impact on the LCC or on the differences in LCC between PIL and non-PIL TMDE. These cost elements are first destination transportation, maintenance transportation, and installation, each of which contributes less than 1% of the total LCC. The cost element of disposal has little impact on the LCC results for scenario 1; the asset values from disposal (i.e., salvage) for Groups A, B, and C are less than 1% of the LCC.

2.5.1.2 Results of Scenario 3

The LCC results obtained from the phase-in scenario demonstrate that substantial cost benefits will be derived by USACC if the current inventory of non-PIL TMDE is replaced by PIL TMDE (Option 1). This condition would occur if the three selected PIL items of this Phase III economic analysis were standardized.

If standardization were not implemented, and USACC replaced the current inventory with the same types of non-PIL TMDE (option 2), a higher LCC would occur.

The cost benefits from phasing in PIL items to replace non-PIL types are $1.3 million for Group A, $1.7 million for Group B, and $1.1 million for Group C. For these three groups, therefore, a saving of $4 million is realized in favor of option 1 over option 2.

The largest percent cost difference between PIL and non-PIL TMDE life cycle costs is in Group A, wherein a 47% lower LCC occurs for the PIL items of option 1.

The LCC results for option 3 indicate that USACC would still obtain significant cost benefits if two PIL types were phased in to replace the non-PIL TMDE, rather than replacing by non-PIL of 11 different types. The LCC costs of option 3 are slightly higher than those for option 1. However the results of option 3 imply that USACC can update its inventory with new equipment of advanced design without excessive cost penalties.

The factors contributing to the cost differences of options 1, 2, and 3 are described below.

2.5.1.2.1 Breakdown of Cost Elements - Scenario 3 – For scenario 3, the total LCC of each option comprises the recurring costs for the non-PIL items being

replaced and both the recurring and nonrecurring costs for the TMDE being phased in. The costs for purchasing, documentation, first transportation, and installation are sunk costs for the items being replaced since it is assumed for scenario 3 that these items are already in the USACC inventory.

The cost elements that constitute the largest percentage of the total LCC for scenario 3 are indicated in Tables 19 through 22. The differences in these cost elements, for PIL and non-PIL items, represent cost benefits attendant to the phasing in of PIL items to replace non-PIL types.

For Group A, the largest difference in cost elements between PIL and non-PIL items is for purchasing, consumables, holding, and documentation. Except for purchasing, these cost elements are influenced by the quantity of different types of TMDE in the inventory. This condition was described for scenario 1.

The cost elements of Group B which contribute most to the LCC differences are personnel and documentation. Since the MTBF of the PIL item in Group B is low in comparison with the corresponding non-PIL items, it causes higher costs for consumables for the PIL items. Nevertheless, the cost benefits of standardization (e.g., reduction in different types) impact on personnel and documentation to the extent that the effects of high MTBF are outweighed and the LCC of the PIL item is still lower than that of the non-PIL item.

For Group C, the predominant cost differences are for personnel, documentation, and consumables. The cost benefits of standardization are not as great as for Group B, since only six different types are replaced. However, the effects of standardization still result in over $1 million savings for Group C in option 1.

The same cost element impact noted for Group A in option 1 holds for option 3 when two PIL items are phased in to replace the non-PIL items. For option 3, the cost elements of personnel, documentation, consumables, and holding have the major influence on the differences in LCC between that option and option 2. The cost elements for option 3 are slightly higher than those of option 1, since two PIL items are being phased in which tends to reduce the advantages gained by reduction of types.

TABLE 19. LCC COST ELEMENTS FOR SCENARIO 3, OPTIONS 1 AND 2, GROUP A

Cost Element	Option 1: PIL PHASE-IN		Option 2: NON-PIL PHASE-IN		Cost Diff. (%)
	Cost ($)	Pct of Total	Cost ($)	Pct of Total	
Training	102,281	3.9	99,844	2.6	2.44
Purchase	205,359	7.9	334,130	8.7	- 38.53
Personnel	1,388,913	53.9	1,563,772	41.0	- 11.18
First Dest. Trans.	2,232	<0.1	2,903	<0.1	- 23.11
Transportation	777	<0.1	981	<0.1	- 20.79
Consumables	359,429	13.9	565,670	14.8	- 36.45
Introduction	5,048	.2	24,619	.6	- 79.49
Holding	502,411	19.5	723,775	19.0	- 30.58
Documentation	49,318	1.9	543,764	14.2	- 90.93
Installation	4,316	.1	4,316	<0.1	0
Disposal	- 44,309	- 1.7	- 56,346	- 1.4	- 21.36
Total	2,575,782		3,807,432		

TABLE 20. LCC COST ELEMENTS FOR SCENARIO 3, OPTIONS 3 AND 2, GROUP A

Cost Element	Option 3 PIL and Non-PIL Mix Phase-In		Option 2 Non-PIL Phase-In		Cost Diff. (%)
	Cost ($)	Pct of Total	Cost ($)	Pct of Total	
Training	99,397	3.58	99,844	2.6	- .447
Purchase	212,318	7.64	334,130	8.7	- 36.45
Personnel	1,437,167	51.74	1,563,772	41.0	- 8.09
First Dest. Trans.	2,599	<0.1	2,903	<0.1	- 10.44
Transportation	935	<0.1	981	<0.1	- 4.58
Consumables	437,625	15.76	565,670	14.8	- 22.63
Introduction	5,878	.21	24,619	0 .6	- 76.12
Holding	519,779	18.71	723,775	19.0	- 28.18
Documentation	96,477	3.47	543,764	14.2	- 82.25
Installation	4,316	.16	4,316	<0.1	0
Disposal	- 38,846	- 31.05	- 56,346	- 1.4	- 31.05
Total	2,777,649		3,807,432		

TABLE 21. LCC COST ELEMENTS FOR SCENARIO 3, OPTIONS 1 AND 2, GROUP B

Cost Element	Option 1: PIL PHASE-IN		Option 2: NON-PIL PHASE-IN		Cost Diff. (%)
	Cost ($)	Pct of Total	Cost ($)	Pct of Total	
Training	1,273,565	5.0	1,281,910	4.8	- 0.65
Purchase	1,545,009	6.1	1,164,218	4.4	32.70
Personnel	16,330,337	64.7	18,293,058	69.5	- 10.72
First Dest. Trans.	19,832	<0.1	17,861	<0.1	11.03
Transportation	5,817	<0.1	4,289	<0.1	35.62
Consumables	2,362,612	9.3	1,387,282	5.2	70.30
Introduction	15,376	<0.1	78,611	.3	- 80.44
Holding	3,257,853	12.9	2,553,002	9.7	27.60
Documentation	123,293	.49	1,680,778	6.3	- 92.66
Installation	52,956	.21	53,532	.20	- 1.07
Disposal	- 217,395	- .86	- 194,949	- .74	11.51
Total	24,769,282		26,319,607		

TABLE 22. LCC COST ELEMENTS FOR SCENARIO 3, OPTIONS 1 AND 2, GROUP C

Cost Element	Option 1: PIL TMDE		Option 2: NON-PIL TMDE		Cost Diff. (%)
	Cost ($)	Pct of Total	Cost ($)	Pct of Total	
Training	625,857	6.7	603,105	5.7	3.77
Purchase	175,830	1.8	181,812	1.7	- 3.29
Personnel	7,950,110	85.3	8,964,568	85.4	- 11.32
First Dest. Trans.	3,397	<0.1	3,883	<0.1	- 12.52
Transportation	1,032	<0.1	2,509	<0.1	- 58.87
Consumables	156,414	1.6	202,594	1.9	- 22.79
Introduction	5,060	<0.1	12,327	.1	- 58.95
Holding	374,214	4.02	386,806	3.6	- 3.26
Documentation	23,863	.26	138,865	1.3	- 82.82
Installation	25,897	.28	25,897	.2	0
Disposal	- 29,028	- .31	- 29,094	- .2	- 0.23
Total	9,312,654		10,493,277		

2.5.1.3 Results of Scenario 2

The life cycle cost results for scenario 2 show that USACC will still attain cost benefits when PIL items are phased in to replace the non-PIL items in the inventory by some other logical phasing plan than that used for Scenario 3. Moreover, when the results of scenario 2 and 3 are compared for Group A TMDE, it is observed that the LCC of option 1 (PIL phase-in) can be further optimized if desired by USACC through examination and analysis of the variables of quantity, time, and type of TMDE associated with a phasing plan. An example of how this might be accomplished is to phase in PIL items to replace the non-PIL items having the highest operating and maintenance (O&M) costs first, thereby reducing the excessive recurring costs of these items over the 10-year period from 1975 through 1984. For Group A, the LCC results for option 1 of scenario 2 are slightly higher than those for the same option of scenario 3. This difference is explained by the fact that in scenario 3, the USACC plan calls for an earlier phase in of PIL items for non-PIL items having higher O&M costs.

2.5.1.3.1 Breakdown of Cost Elements - Scenario 2 – The cost element breakdown for options 1, 2, and 3 of scenario 2 are presented in Tables 23 and 24. The cost elements impacting most significantly on the LCC for scenario 3 are similar to those for scentario 2.

2.5.1.4 Results of Case 1

The present provisioning system of USACC is based on demand for parts and spares; that is, those items are reordered only if a demand for them exists within a specific time period (e.g., 120 days). Since the current proliferation of TMDE results in low densities, it is not practical or economically feasible to introduce a different stockage program. Therefore, USACC uses the operational readiness float system to prevent TMDE failures from causing an availability problem in fulfilling the mission profile.

If the density of one type TMDE increased (e.g., such as if standardization occurred) USACC would find it cost effective to have an initial stockage program for provisioning of TMDE rather than having to depend on the operational readiness float system. Using Group A as an example, USACC would realize cost savings of 10% above that if standardization occurred and no initial stockage system were implemented. The effect gained from standardization is shown by case 1 as a reduction in

TABLE 23. LCC COST ELEMENTS FOR SCENARIO 2, OPTIONS 1 AND 2, GROUP A

Cost Element	Option 1: PIL PHASE-IN		Option 2: NON-PIL PHASE-IN		Cost Diff. (%)
	Cost ($)	Pct of Total	Cost ($)	Pct of Total	
Training	101,912	3.84	99,844	2.68	2.07
Purchase	197,766	7.45	302,797	8.14	- 34.68
Personnel	1,412,600	53.23	1,563,338	42.00	- 9.64
First Dest. Trans.	2,150	<0.1	3,576	.10	- 39.87
Transportation	723	<0.1	1,172	<0.1	- 38.31
Consumables	386,542	14.56	543,528	14.60	- 28.88
Introduction	6,149	.23	24,662	6.04	- 75.06
Holding	541,788	20.41	681,218	18.30	- 20.46
Documentation	49,318	1.85	545,849	14.67	- 90.96
Installation	4,156	.15	4,155	.11	.02
Disposal	- 49,352	- 1.86	- 48,060	- 1.29	2.68
Total	2,653,756		3,722,082		

TABLE 24. LCC COST ELEMENTS FOR SCENARIO 2, GROUP A, OPTIONS 3 AND 2

Cost Element	Option 3: PIL and Non-PIL Mix Phase-In		Option 2: NON-PIL PHASE-IN		Cost Diff. (%)
	Cost ($)	Pct of Total	Cost ($)	Pct of Total	
Training	99,397	3.48	99,844	2.68	2.07
Purchase	212,318	7.44	302,797	8.14	- 34.68
Personnel	1,437,166	50.33	1,563,338	42.00	- 9.64
First Dest. Trans.	2,599	0.1	3,576	.10	- 39.87
Transportation	935	0.1	1,172	0.1	- 38.31
Consumables	437,625	15.33	543,528	14.60	- 28.88
Introduction	5,878	.21	24,662	6.04	- 75.06
Holding	519,778	18.20	681,218	18.30	- 20.46
Documentation	96,476	3.38	545,849	14.67	- 90.96
Installation	4,315	.15	4,155	.11	.02
Disposal	38,846	1.36	- 48,060	- 1.29	2.68
Total	2,855,722		3,722,082		

life cycle costs through the elimination of the LCC costs for the extra 10% density of items used for the readiness float system.

2.5.1.5 Results of Case 2

The results of the computer exercises conducted to examine the effects of inflation and discounted cash flow indicate that these conditions have no significant impact on the relative LCC for PIL and non-PIL TMDE. If discounted cash flow were applied and no inflation occurred for a 10-year period, the life cycle cost difference between PIL and non-PIL TMDE would increase by 6%. If no discounted cash flow or inflation occurred for a 10-year period, the cost differences between PIL and non-PIL TMDE would lessen by approximately 2%. A 7% decrease in the cost difference would occur if no discounted cash flow were applied but inflation occurred during the 10-year period.

It is unlikely that any of the above three conditions will be seen. However, if they do occur, they will not have a noticeable effect on any decision to implement standardization of the three PIL TMDE in the study.

2.5.1.6 Results of Case 3

The life cycle costs of PIL TMDE in Groups B and C will be further decreased over that of the non-PIL TMDE in Groups B and C if volume discounts are applied by the manufacturer to the purchase price. This condition would probably occur for the PIL items of Groups B and C, since the density of each will increase to over 500 items when all of the corresponding non-PIL items are replaced in the USACC inventory. The economic effects of volume discounts for PIL items of the two groups examined are projected as follows:

Group	LCC Benefit* Volume Discounts	LCC Benefit* No Volume Discounts
B	$ 3,443,797	$ 1,975,612
C	$ 1,949,960	$ 1,850,334

*Benefit defined as the difference between the LCC of PIL and non-PIL TMDE.

2.5.2 Sensitivity Analysis Results

2.5.2.1 Variations in MTBF

Figure 4 shows the effects on PIL item life cycle costs from scenario 1 if the nominal values for MTBF differed from those used in this study. For Group A, an approximate 100% decrease in MTBF (from 411 hours to 200 hours), would cause the PIL LCC to be $2.4 million as compared with $3.7 million for the non-PIL TMDE. The nominal MTBF would have to decrease by several hundred percent (e.g., 500%), to less than 50 hours, to show a significant influence on the LCC results of this study for Group A TMDE.

Four Group B, an approximate 100% decrease in MTBF (218 to 100 hours) would result in equal LCC for the PIL and non-PIL TMDE. The current MTBF of the Group B PIL item is now lower than any non-PIL TMDE it can replace. It is unlikely that the nominal MTBF for Group B is significantly less than shown in the AMC records that were the source of these data.

It is worth noting that if the MTBF of Group B doubled to 400 hours, the life cycle cost savings would be about $2 million more than for the LCC of the nominal value. Thus, early action by USACC to improve the reliability of the Group B PIL item is clearly indicated.

For Group C, the nominal value of 600 hours for MTBF would have to decrease by several hundred percent, to less than 120 hours, for the life cycle costs to be equal to that of the non-PIL items.

2.5.2.2 Variations in MTTR

Figure 5 shows the effects on PIL item life cycle costs from scenario 1 if the nominal values of mean time to repair were different from those used in this study. For Groups A and C TMDE, the MTTR would have to be several hundred percent of the nominal value, of 5.3 and 1.83 respectively, before the LCC cost of the PIL TMDE would be approximately equal to that of the non-PIL TMDE.

In Group B, if the MTTR increased to 20 hours, from the nominal value of 10 hours, the life cycle cost of the PIL item would be approximately equal to that of the non-PIL items. This condition is unlikely since, because of the modular design of the PIL item, the MTTR for the PIL items are likely to be close to that value used in this study.

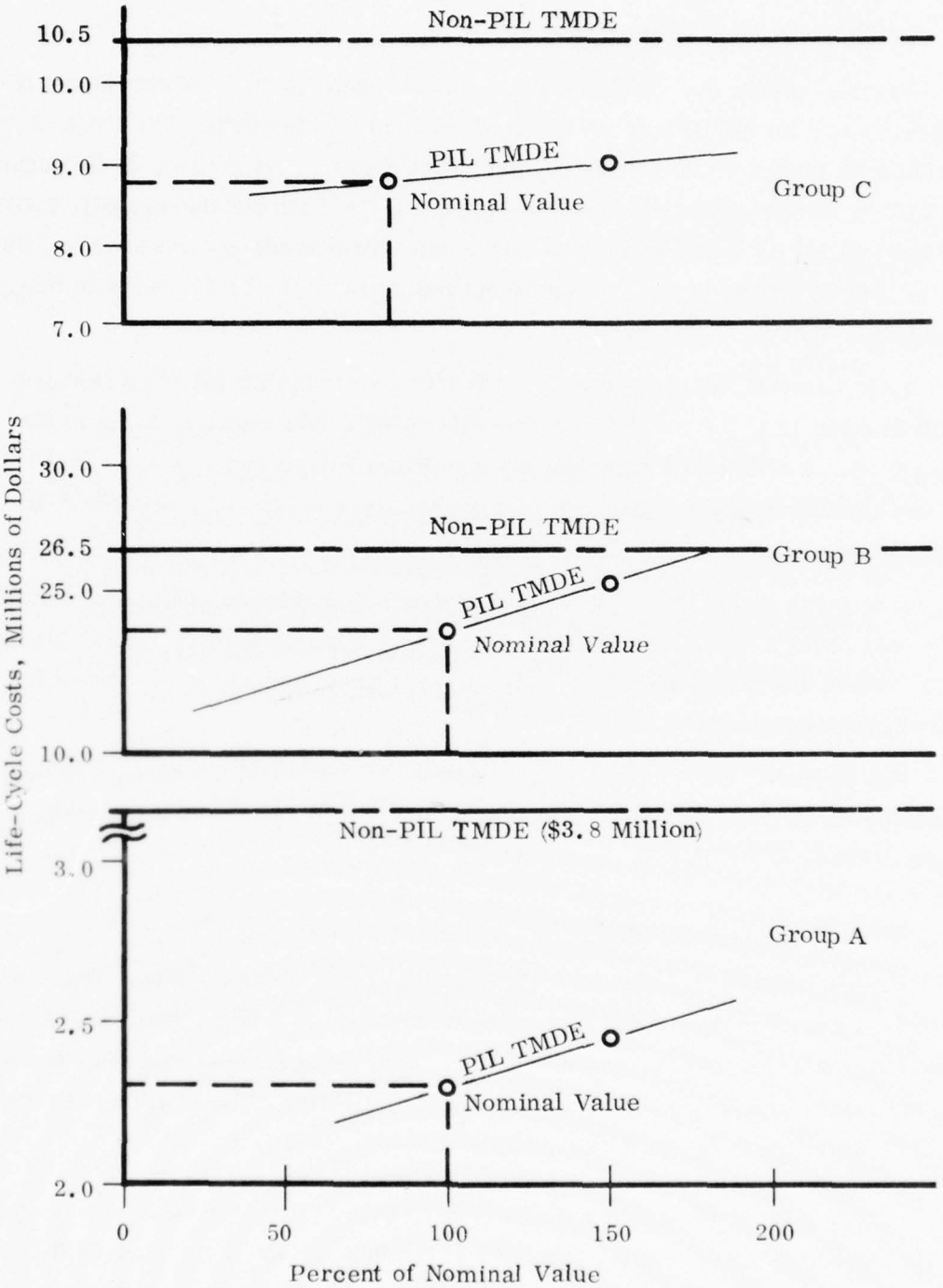

Figure 4. Life Cycle Cost of PIL TMDE Vs. MTBF

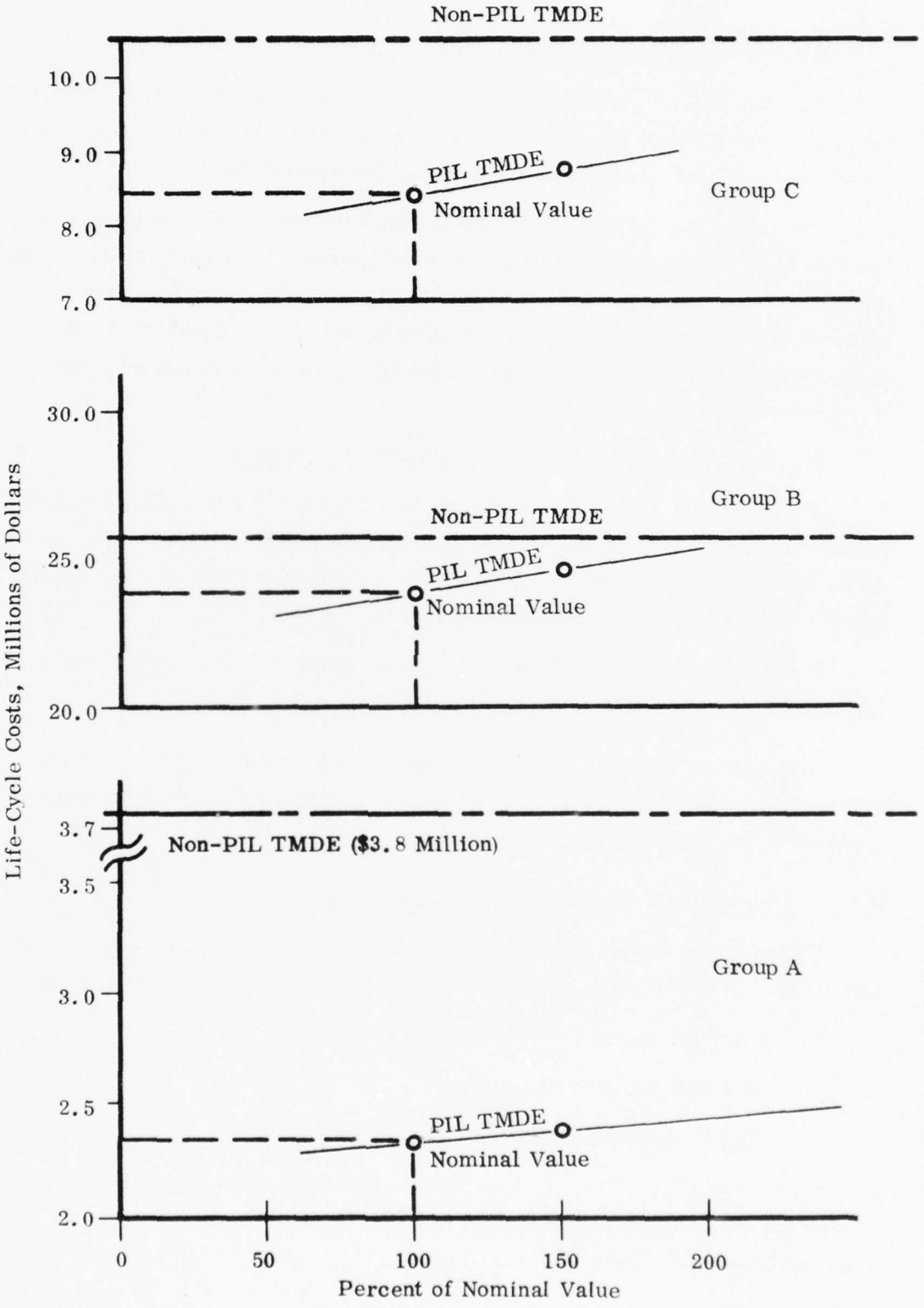

Figure 5. Life Cycle Cost of PIL TMDE Vs. Mean Time to Repair (MTTR)

2.5.2.3 Variations in Consumables Cost

The cost of consumables for Groups A and C PIL TMDE would have to be more than five times greater than the nominal value of this study before the LCC of the PIL items becomes approximately equal to that of the non-PIL items.

For Group B PIL TMDE, the cost of consumables would need to be more than 1.5 times the value used before the LCC were approximately equal to that of non-PIL items. The cost of consumables is computed by the LCC model as a percentage of the unit cost of TMDE. The percentage value used was 12.5%, considered a firm figure;* an increase to 20% is needed to equalize the LCC. Figure 6 illustrates this analysis for the three TMDE groups.

2.5.2.4 Variations in Number of Hours of Operation

The number of hours that personnel spend operating PIL TMDE has a significant impact on its life cycle costs. For Group A, if the number of hours increased by 100%, the life cycle cost of the PIL TMDE would be approximately equal to that of the non-PIL TMDE. This condition is shown in Figure 7.

If the number of hours of operation increased by 20% for Groups B or C, the LCC would be approximately equal to that of the non-PIL items.

Since USACC has provided data on NHO which indicates that the NHO for non-PIL is higher than for PIL items, it is unlikely that the values for this study would increase by these orders of magnitude.

2.5.3 Nonquantifiable Benefits of Standardization

Three major nonquantifiable benefits that would be realized upon standardization of the TMDE PIL were identified during the Phase III economic analysis:

a. Improved morale of personnel

b. Enhanced TMDE reliability

c. Improved functional capability of TMDE.

Each of these nonquantifiable factors will contribute to increasing the cost benefits noted from the LCC exercises described in earlier sections of this report. These nonquantifiable benefits are discussed below.

*ECOMP 11-4, Department of Army Cost Estimating Guide

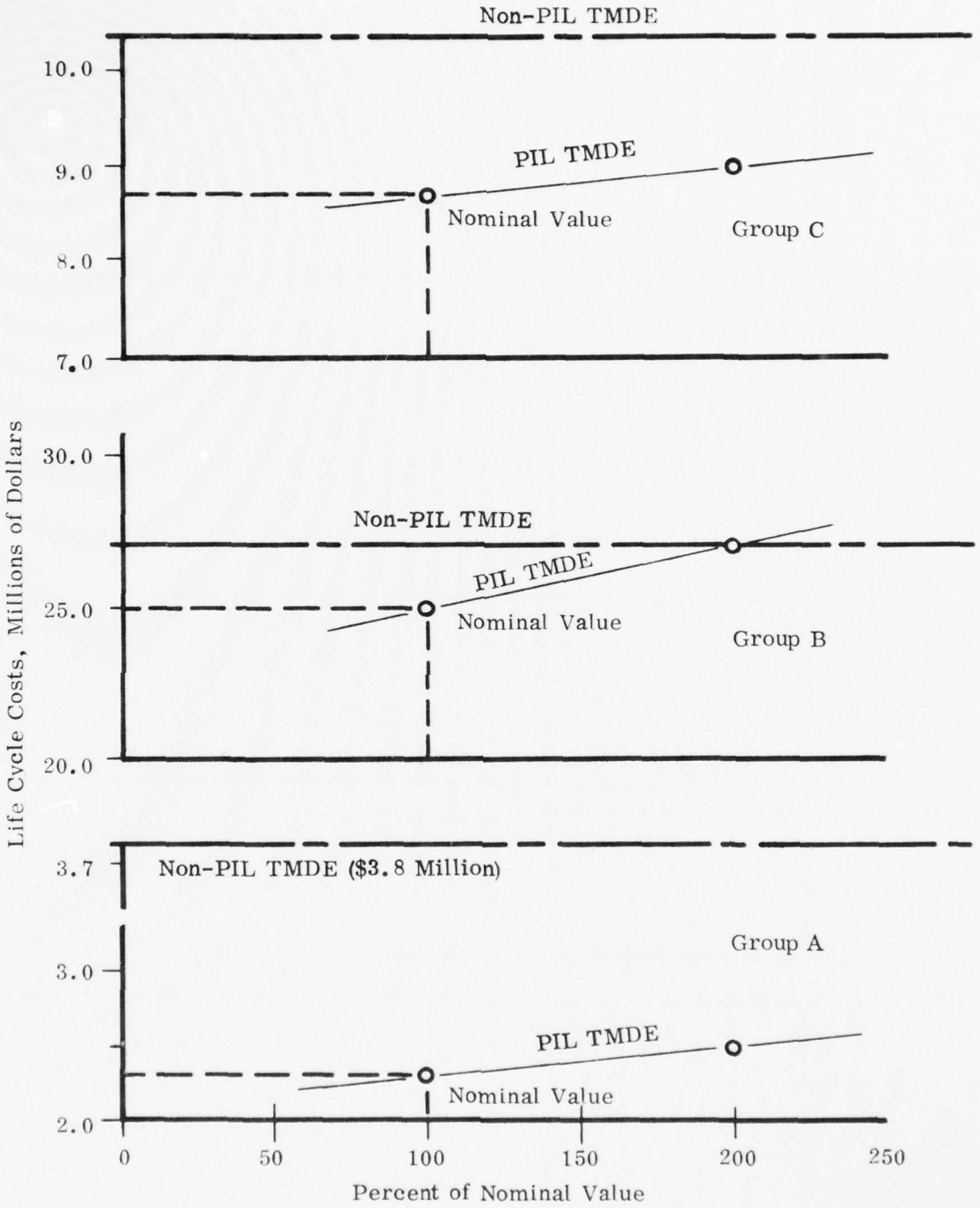

Figure 6. Life Cycle Cost of PIL TMDE Vs. Cost of Consumables

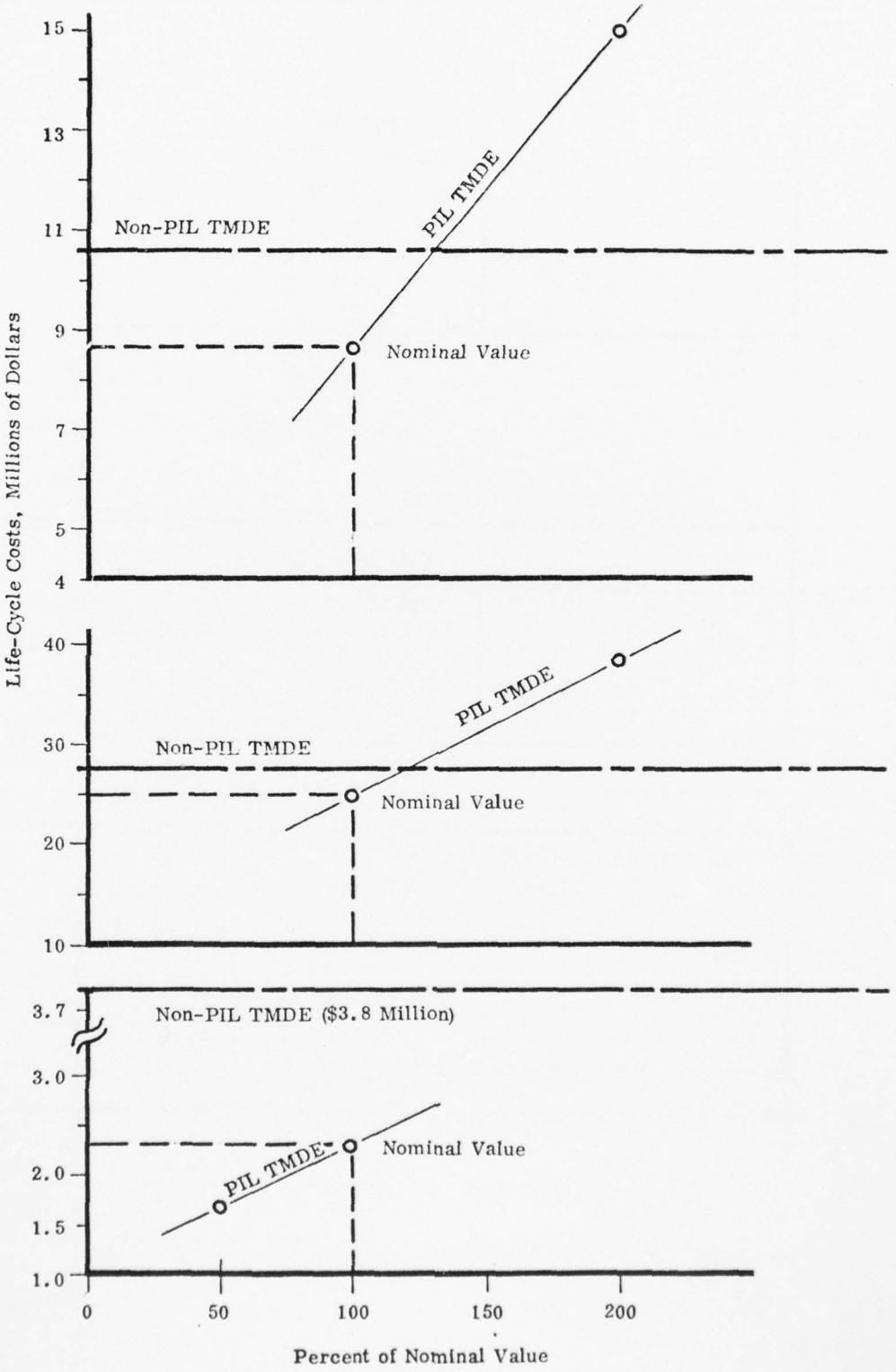

Figure 7. Life Cycle Cost of PIL TMDE Vs. Number of Hours of Operation

2.5.3.1 Improved Morale

With PIL TMDE standardization, the morale of USACC personnel would improve by virtue of the reduction in different types of TMDE in the inventory. The following factors would contribute:

a. The number of different types of manuals for operation, calibration and repair and the large volume of pages associated with the non-PIL TMDE would decrease markedly. As a result, personnel will be relieved of the concern and burden associated with the proliferation of documents.

b. Personnel could be trained in the DA schools on the actual types of TMDE they would encounter in the force structure, rather than on a broad range of items. Personnel thus specifically trained would function with greater confidence and efficiency when encountering items with which they are familiar.

c. TMDE operators would use the same equipment types more often, in everyday activities, thus gaining increased familiarity. This would result in increased personnel efficiency for repair, calibration, and operation of TMDE.

2.5.3.2 Improved Reliability

If the number of different TMDE types were reduced through standardization, the following conditions would promote an improvement in equipment reliability:

a. Because of their increased familiarity with an item, personnel would find it easier to diagnose faults and analyze the failure modes and mechanisms that cause the reliability problems.

b. With this situation, more complete and more accurate failure information could be recorded and made available for analyses. As a result, the TMDE experiencing reliability problems could be addressed through a program designed specifically to aid in increasing reliability.

2.5.3.3 Increased Functional Capability

If standardization were implemented for the PIL items, USACC would derive certain benefits from the increased functional capability of the standardized items which are not quantifiable at this time. An example would be the CP772A/U of Group B, a main frame unit capable of making measurements up to 50 MHz without any plug-ins and up to 12.4 GHZ with its three plug-ins of Group B. The main frame unit can perform the functions of several non-PIL TMDE having only a limited measurement range. With the three plug-ins, the Group B items can perform frequency measurements that require as many as six to ten different TMDE. Therefore the implementation of the PIL TMDE would result in a reduction in the number of items required in the USACC inventory to perform these test measurements.

USACC is investigating this potential benefit at certain sites to determine the effects on availability of TMDE to accomplish the mission profile. No specific data are available at this time to perform an LCC analysis on the subject of reduced density, nor was such an analysis within the scope of this Phase III study. However, to demonstrate the impact of this potential benefit on LCC, a computer exercise was accomplished for an assumed reduction in TMDE density of 20%. Results of this exercise demonstrate that USACC will derive a $3 million cost benefit if the density can be reduced by that amount. Cost benefits derivable from various specific reductions in density are illustrated in Figure 8.

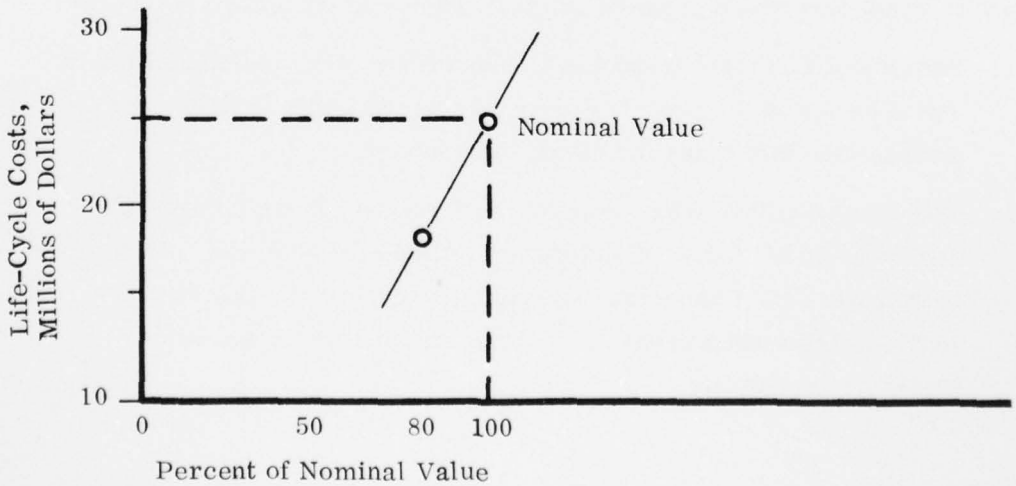

Figure 8. Life Cycle Cost of Group B PIL TMDE Vs. Density

APPENDIX A-1

USACC TMDE PHASING PLAN

APPENDIXES

TMDE PHASING PLAN (Sheet 1 of 5)

PIL TMDE	Non-PIL TMDE	Current Density (units)	Projected Needs (units) by Year									
			75	76	77	78	79	80	81	82	83	84
AN/USM-366(V)1 (491) (Group A)	AN/UPM-84	3			3							
	DU-2A	4		4								
	LCA-6	1	1									
	RTA-5	1	1									
	SA-84W	1	1									
	TSA-W2	1	1									
	IL20	2			2							
	IL30	1		1								
	IL40	25					7	5	5	4	2	2
	851A/8551A	2			2							
	851B/8551B	12			1	10	1					
	Total Req	53										
	Total to be Procured by FY		4	5	8	10	8	5	5	4	2	2

TMDE PHASING PLAN (Sheet 2 of 5)

PIL TMDE	Non-PIL TMDE	Current Density (units)	Projected Needs (units) by Year									
			75	76	77	78	79	80	81	82	83	84
CP-772A/U (5245L) (Group 1B)	AN/TSM-16	136		27	75	34						
	AN/URM-79	14		14								
	AN/USM-26	3	3									
	AN/USM-102	7	6	1								
	AN/USM-159	48				48						
	AN/USM-207	194					28	50	50	25	25	16
	CP-1026/U	1	1									
	CP-1033/U	5	5									
	CP-1049P/U	11				11						
	FR-67	6	6									
	FR-174	5		5								
	1020	1	1									
	1150B	1	1									
	1191B	1	1									
	2565A	16					16					
	3F112A	1	1									

TMDE PHASING PLAN (Sheet 3 of 5)

PIL TMDE	Non-PIL TMDE	Current Density (units)	Projected Needs (units) by Year									
			75	76	77	78	79	80	81	82	83	84
CP-772A/U (5245L) (Group 1B) (Continued)	3734A	2	2									
	59	1	1									
	524C - 523D	4	4									
	5211A	7				7						
	5212A	6	6									
	5221B	3				3						
	5243L	6	6									
	602A	2	2									
	6H86	3	3									
	6152	3	3									
	6316A	16					16					
	800A	1	1									
	Total Req	504										
	Total to be Procured by FY		53	47	75	103	60	50	50	25	25	16

TMDE PHASING PLAN (Sheet 4 of 5)

PIL TMDE	Non-PIL TMDE	Current Density (units)	Projected Needs (units) by Year									
			75	76	77	78	79	80	81	82	83	84
CV-2002/U (5253B) (Group 2B)	CV-1921/U	40			15	20	5					
	MX-1637A/U	10	3	7								
	CV-394/USA-5	4	4									
	525C	3	3									
	5251A	9					9					
	5253A	4					4					
	Total Req	70										
	Total to be Procured by FY		10	7	15	20	18					
CV-2003B/U (5254C) (Group 3B)	CV-2003/U	22	12	10								
	CV-2003A/U	1		1								
	Total Req	23										
	Total to be Procured by FY		12	11								

TMDE PHASING PLAN (Sheet 5 of 5)

PIL TMDE	Non-PIL TMDE	Current Density (units)	Projected Needs (units) by Year									
			75	76	77	78	79	80	81	82	83	84
CV-3059/U (5255A) (Group 4B)	2590A	1	1									
	2590B	42	13	15	14							
	Total Req	43										
	Total to be Procured by FY		14	15	14							
432A (Group C)	AN/URM-98	109	1	30	45	33						
	AN/USM-161	26	26									
	AN/USM-260	74				35	39					
	TS-125A/P	2	2									
	431B	55					6	30	19			
	454A	49							11	30	8	
	Total Req	315										
	Total to be Procured by FY		29	30	45	68	45	30	30	30	8	

APPENDIX A-2

LCC DATA FILES

Note: Data not presented in this appendix can be obtained from the data files provided to USAECOM in the form of punched cards.

Subject: Data Files; GRPA1

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00110 NPIL 11
00120 USM366
00130 LCAL 1 UC0S 4500. XMH 5.33
00140 HSC 8.06 WT 48. XMI 6058. FAIL .89
00150 FMI 55. AQPP 310. MLIN 1 NCAL 2
00160 1975 NEQB 53 NEQD 0 NDEN 53
00170 1976 NEQB 0 NEQD 0 NDEN 53
00180 1977 NEQB 0 NEQD 0 NDEN 53
00190 1978 NEQB 0 NEQD 0 NDEN 53
00200 1979 NEQB 0 NEQD 0 NDEN 53
00210 1980 NEQB 0 NEQD 0 NDEN 53
00220 1981 NEQB 0 NEQD 0 NDEN 53
00230 1982 NEQB 0 NEQD 0 NDEN 53
00240 1983 NEQB 0 NEQD 0 NDEN 53
00250 1984 NEQB 0 NEQD 53 NDEN 53
00260 UPM84
00270 LCAL 1 UC0S 8624. XMH 5.33
00280 HSC 8.06 WT 50. XMI 5500. FAIL .89
00290 FMI 55. AQPP 310. MLIN 1 NCAL 2
00300 1975 NDQB 3 NEQD 0 NDEN 3
00310 1976 NEQB 0 NEQD 0 NDEN 3
00320 1977 NEQB 0 NEQD 0 NDEN 3
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00350 1980 NEQB 0 NDQD 0 NDEN 3
00360 1981 NEQB 0 NEQD 0 NDEN 3
00370 1982 NEQB 0 NEQD 0 NDEN 3
00380 1983 NEQB 0 NEQD 0 NDEN 3
00390 1984 NEQB 0 NEQD 3 NDEN 3
00400 DU2A
00410 LCAL 1 UC0S 13785. XMH 8.98
00420 HSC 6.02 WT 135. XMI 8000. FAIL 1.5
00430 FMI 50. AQPP 310. MLIN 1 NCAL 2
00440 1975 NEQB 4 NEQD 0 NDEN 4
00450 1976 NEQB 0 NEQD 0 NDEN 4
00460 1977 NEQB 0 NEQD 0 NDEN 4
00470 1978 NEQB 0 NEQD 0 NDEN 4
00480 1979 NEQB 0 NEQD 0 NDEN 4
00490 1980 NEQB 0 NEQD 0 NDEN 4
00500 1981 NEQB 0 NEQD 0 NDEN 4
00510 1982 NEQB 0 NEQD 0 NDEN 4
00520 1983 NEQB 0 NEQD 0 NEDN 4
00530 1984 NEQB 0 NEQD 4 NEDE 4
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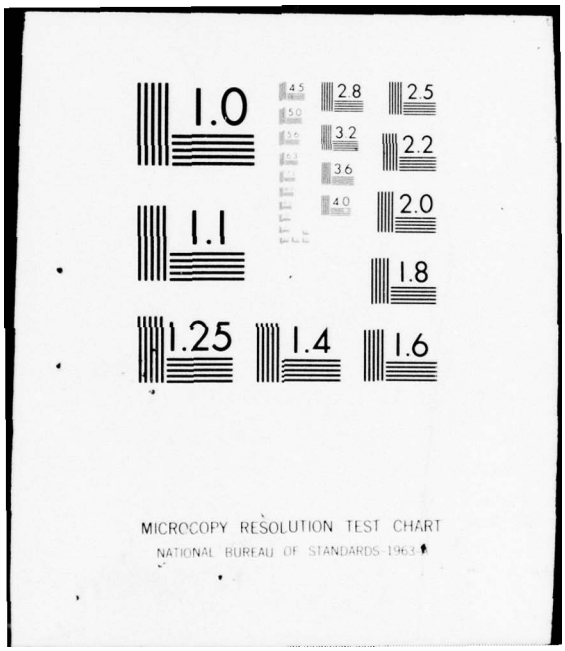
AD-A052 161 ARINC RESEARCH CORP ANNAPOLIS MD F/G 15/5
ECONOMIC ANALYSIS OF SELECTED TEST MEASUREMENT AND DIAGNOSTIC E--ETC(U)
MAY 75 H ROSENBERG, J WITT DAEA18-72-A-0005
UNCLASSIFIED 1072-02-3-1403 NL

2 OF 3
AD
A052161


1.0
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1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
5.6
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

Subject: Data Files; GRPA1 (Continued)

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00540 LCA6
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00560 HSC 8.06 WT 50. XMI 8000. FAIL .89
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00680 RTA5
685 LCAL 1 UC0S 4675. XMH 5.33
00690 HSC 8. WT 50. XMI 8000. FAIL .89
00710 FMI 50. APPP 310. MLIN 1 NCAL 4
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00730 1976 NEQB 0 NDEN 0 NDEN 1
00740 1977 NEQB 0 NDEN 0 NDEN 1
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00810 1984 NEQB 0 NEQD 1 NDEN 1
00820 SA84W
00830 LCAL 1 UC0S 8827. XMH 5.33
00840 HSC 23.08 WT 50. XMI 8000. FAIL .89
00850 FMI 50. AQPP 310. MLIN 1 NCAL 4
00860 1975 NEQB 1 NEQD 0 NDEN 1
00870 1976 NEQB 0 NEQD 0 NDEN 1
00880 1977 NEQB 0 NEQD 0 NDEN 1
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01090 1984 NQEB 0 NQED 1 NDEN 1
1095 L20
01100 LCAL 1 UC0S 4850. XMH 6.2
01110 HSC 19.04 WT 50. XMI 4000. FAIL .97
01120 FMI 30. AOPP 310. MLIN 2 NCAL 4
01130 1975 NEQB 2 NEQD 0 NDEN 2
01140 1976 NEQB 0 NEQD 0 NDEN 2
01150 1977 NEQB 0 NEQD 0 NDEN 2
01160 1978 NEQB 0 NEQD 0 NDEN 2
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1195 1982 NEQB 0 NEQD 0 NDEN 2
01200 1983 NEQB 0 NEQD 0 NDEN 2
01210 1984 NEQB 0 NEQD 2 NDEN 2
1215 L30
01220 LCAL 1 UC0S 4850. XMH 11.59
01230 HSC 19.04 WT 50. XMI 2500. FAIL 1.93
01240 FMI 10. AOPP 310. MLIN 1 NCAL 4
01250 1975 NEQB 1 NEQD 0 NDEN 1
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Subject: Data Files; GRPA1 (Continued)

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01400 1976 NEQB 0 NEQD 0 DDEN 25
01410 1977 NEQB 0 NEQD 0 NDEN 25
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01480 1984 NEQB 0 NEQD 25 NDEN 25
01490 H851B
01500 LCAL 1 UCOS 7262. XMH 4.98
1510 HSC 17.24 WT 134. XMI 5000. FAIL .83
01520 FMI 65. AQPP 310. MLIN 1 NCAL 4
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01560 1978 NEQB 0 NEQD 0 NDEN 12
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01590 1981 NEQB 0 NEQD 0 NDEN 12
01600 1982 NEQB 0 NEQD 0 NDEN 12
01610 1983 NEQB 0 NEQD 0 NDEN 12
01620 1984 NEQB 0 NEQD 12 NDEN 12
01630 H851A
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01660 FMI 10. AQPP 310. MLIN 1 NCAL 4
01670 1975 NEQB 2 NEQD 0 NDEN 2
01680 1876 NEQB 0 NEQD 0 NDEN 2
01690 1977 NEQB 0 NEQD 0 NDEN 2
01700 1978 NEQB 0 NEQD 0 NDEN 2
01710 1979 NEQB 0 NEQD 0 NDEN 2
01720 1980 NEQB 0 NEQD 0 NDEN 2
01730 1981 NEQB 0 NQED 0 NDEN 2
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01750 1983 NEQB 0 NEQD 0 NDEN 2
01760 1984 NEQD 0 NEQD 2 NDEN 2
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Subject: Data Files; **GRP1B1**

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110 LCAL 1 UC0S 3150. XMH 10.
120 HSC 7.84 WI 40. XMI 6302. FAIL 1.67
130 FMI 56. AGPP 325. MLIN 1 NCAL 4
140 1975 B 504 D 0 N 504
150 1976 B 0 D 0 N 504
160 1977 B 0 D 0 N 504
170 1978 B 0 D 0 N 504
180 1979 B 0 D 0 N 504
190 1980 B 0 D 0 N 504
200 1981 B 0 D 0 N 504
210 1982 B 0 D 0 N 504
220 1983 B 0 D 0 N 504
230 1984 B 0 D 504 N 504
240 ISM16
250 L 0 0 1271. X 6.95
260 HSC 7.48 WI 40. XMI 5477. FAIL 1.16
270 FMI 53. AGPP 325. MLIN 1 NCAL 4
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290 1976 B 0 D 0 N 136
300 1977 B 0 D 0 N 136
310 1978 B 0 D 0 N 136
320 1979 B 0 D 0 N 136
330 1980 B 0 D 0 N 136
340 1981 B 0 D 0 N 136
350 1982 B 0 D 0 N 136
360 1983 B 0 D 0 N 136
370 1984 B 0 D 136 N 136
380 URM79
390 LCAL 1 UC0S 1332. XMH 6.68
400 HSC 5.54 WI 40. XMI 6678. FAIL 1.11
410 FMI 45. AGPP 325. MLIN 1 NCAL 2
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430 1976 B 0 D 0 N 14
440 1977 B 0 D 0 N 14
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500 1983 B 0 D 0 N 14
510 1984 B 0 D 14 N 14
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Subject: Data Files; GRP1B1 (Continued)

```
520 USM26
530 LCAL 1 UC0S 3150. XMH 13.27
540 HSC 8.72 WI 40. XMI 6667. FAIL 2.21
550 FMI 83. AGPP 325. MLIN 1 NCAL 4
560 1975 B 3 D 0 N 3
570 1976 B 0 D 0 N 3
580 1977 B 0 D 0 N 3
590 1978 B 0 D 0 N 3
600 1979 B 0 D 0 N 3
610 1980 B 0 D 0 N 3
620 1981 B 0 D 0 N 3
630 1982 B 0 D 0 N 3
640 1983 B 0 D 0 N 3
650 1984 B 0 D 3 N 3
660 USM102
670 LCAL 1 UC0S 3150. XMH 8.59
680 HSC 3.98 WI 14. XMI 4000. FAIL 1.43
690 FMI 48. AGPP 325. MLIN 1 NCAL 2
700 1975 B 7 D 0 N 7
710 1976 B 0 D 0 N 7
720 1977 B 0 D 0 N 7
730 1977 B 0 D 0 N 7
740 1979 B 0 D 0 N 7
750 1980 B 0 D 0 N 7
760 1981 B 0 D 0 N 7
770 1982 B 0 D 0 N 7
780 1983 B 0 D 0 N 7
790 1984 B 0 D 7 N 7
800 USM159
810 LCAL 1 UC0S 694. XMH 6.68
820 HSC 2.23 WI 40. XMI 4829. FAIL 1.11
830 FMI 28. AGPP 325. MLIN 1 NCAL 1
840 1975 B 48 D 0 N 48
850 1976 B 0 D 0 N 48
860 1977 B 0 D 0 N 48
870 1978 B 0 D 0 N 48
880 1979 B 0 D 0 N 48
890 1980 B 0 D 0 N 48
900 1981 B 0 D 0 N 48
910 1982 B 0 D 0 N 48
920 1983 B 0 D 0 N 48
930 1984 B 0 D 48 N 48
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Subject: Data Files; GRP1B1 (Continued)

```
940 USM207
950 LCAL 1 UC0S 3727. XMH 6.68
960 HSC 4.5 WI 40. XMI 5787. FAIL 1.11
970 FMI 89. AGPP 325. MLIN 1 NCAL 2
980 1975 B 194 D 0 N 194
990 1976 B 0 D 0 N 194
1000 1977 B 0 D 0 N 194
1010 1978 B 0 D 0 N 194
1020 1979 B 0 D 0 N 194
1030 1980 B 0 D 0 N 194
1040 1981 B 0 D 0 N 194
1050 1982 B 0 D 0 N 194
1060 1983 B 0 D 0 N 194
1070 1984 B 0 D 194 N 194
1080 CPU1026
1090 LCAL 1 UC0S 1800. XMH 6.68
1100 HSC 3.92 WI 25. XMI 6000. FAIL 1.1
1110 FMI 100. AGPP 325. MLIN 1 NCAL 2
1120 1975 B 1 D 0 N 1
1130 1976 B 0 D 0 N 1
1140 1977 B 0 D 0 N 1
1150 1978 B 0 D 0 N 1
1160 1979 B 0 D 0 N 1
1170 1980 B 0 D 0 N 1
1180 1981 B 0 D 0 N 1
1190 1982 B 0 D 0 N 1
1200 1983 B 0 D 0 N 1
1210 1984 B 0 D 1 N 1
1220 CPU1033
1230 LCAL 1 UC0S 1450. XMH 4.27
1240 HSC 4.42 WI 25. XMI 7000. FAIL .71
1250 FMI 75. AGPP 325. MLIN 1 NCAL 2
1260 1975 B 5 D 0 N 5
1270 1976 B 0 D 0 N 5
1280 1977 B 0 D 0 N 5
1290 1978 B 0 D 0 N 5
1300 1979 B 0 D 0 N 5
1310 1980 B 0 D 0 N 5
1320 1981 B 0 D 0 N 5
1330 1982 B 0 D 0 N 5
1340 1983 B 0 D 0 N 5
1350 1984 B 0 D 5 N 5
```

Subject: Data Files; GRP1B1 (Continued)

```
1360 CPU1049
1370 LCAL 1 UC0S 3150. XMH 1.8
1380 HSC 3.54 WI 40. XMI 2818. FAIL .3
1390 FMI 18. AGPP 325. MLIN 1 NCAL 2
1400 1975 B 11 D 0 N 11
1410 1976 B 0 D 0 N 11
1420 1977 B 0 D 0 N 11
1430 1978 B 0 D 0 N 11
1440 1979 B 0 D 0 N 11
1450 1980 B 0 D 0 N 11
1460 1981 B 0 D 0 N 11
1470 1982 B 0 D 0 N 11
1480 1983 B 0 D 0 N 11
1490 1984 B 0 D 11 N 11
1500 FR67
1510 LCAL 1 UC0S 950. XMH 6.68
1520 HSC 1.96 WI 40. XMI 5750. FAIL 1.1
1530 FMI 77. AGPP 325. MLIN 1 NCAL 2
1540 1975 B 6 D 0 N 6
1550 1976 B 0 D 0 N 6
1560 1977 B 0 D 0 N 6
1570 1978 B 0 D 0 N 6
1580 1979 B 0 D 0 N 6
1590 1980 B 0 D 0 N 6
1600 1981 B 0 D 0 N 6
1610 1982 B 0 D 0 N 6
1620 1983 B 0 D 0 N 6
1630 1984 B 0 D 6 N 6
1640 FR174
1650 LCAL 1 UC0S 1005. XMH 5.78
1660 HSC 3.16 WI 21. XMI 2500. FAIL .96
1670 FMI 10. AGPP 325. MLIN 1 NCAL 2
1680 1975 B 5 D 0 N 5
1690 1976 B 0 D 0 N 5
1700 1977 B 0 D 0 N 5
1710 1978 B 0 D 0 N 5
1720 1979 B 0 D 0 N 5
1730 1980 B 0 D 0 N 5
1740 1981 B 0 D 0 N 5
1750 1982 B 0 D 0 N 5
1760 1983 B 0 D 0 N 5
1770 1984 B 0 D 5 N 5
```

Subject: Data Files; GRP1B1 (Continued)

```
1780 M1020
1790 L 1 0 694. X 7.77
1800 HSC 6. WT 40. XMI 6000. FAIL 1.29
1810 FMI 100. AGPP 325. MLIN 1 NCAL 2
1820 1975 B 1 D 0 N 1
1830 1976 B 0 D 0 N 1
1840 1977 B 0 D 0 N 1
1850 1978 B 0 D 0 N 1
1860 1979 B 0 D 0 N 1
1870 1980 B 0 D 0 N 1
1880 1981 B 0 D 0 N 1
1890 1982 B 0 D 0 N 1
1900 1983 B 0 D 0 N 1
1910 1984 B 0 D 1 N 1
1920 G1150B
1930 LCAL 0 UC0S 1150. XMH 6.68
1940 HSC 2.66 WT 40. XMI 6000. FAIL 1.11
1950 FMII 100. AGPP 325. MLIN 1 NCAL 2
1960 1975 B 1 D 0 N 1
1970 1976 B 0 D 0 N 1
1980 1977 B 0 D 0 N 1
1990 1978 B 0 D 0 N 1
2000 1979 B 0 D 0 N 1
2010 1980 B 0 D 0 N 1
2020 1981 B 0 D 0 N 1
2030 1982 B 0 D 0 N 1
2040 1983 B 0 D 0 N 1
2050 1984 B 0 D 1 N 1
2060 G1191B
2070 LCAL 1 UC0S 1393. XMH 14.5
2080 HSC 9.32 WT 29. XMI 6000. FAIL 2.42
2090 FMI 100. AGPP 325. MLIN 1 NCAL 4
3000 1975 B 1 D 0 N 1
3010 1976 B 0 D 0 N 1
3020 1977 B 0 D 0 N 1
3030 1978 B 0 D 0 N 1
3040 1979 B 0 D 0 N 1
3050 1980 B 0 D 0 N 1
3060 1981 B 0 D 0 N 1
3070 1982 B 0 D 0 N 1
3080 1983 B 0 D 0 N 1
3090 1984 B 0 D 1 N 1
```

Subject: Data Files; GRP1B1 (Continued)

```
3100 C2565A
3110 LCAL 1 UCW0 560. XMH 6.68
3120 HSC 3.26 WI 40. XMI 6000. FAIL 1.11
3130 FMI 100. AGPP 325. MLIN 1 NCAL 2
3140 1975 B 16 D 0 N 16
3150 1976 B 0 D 0 N 16
3160 1977 B 0 D 0 N 16
3170 1978 B 0 D 0 N 16
3180 1979 B 0 D 0 N 16
3190 1980 B 0 D 0 N 16
3200 1981 B 0 D 0 N 16
3210 1982 B 0 D 0 N 16
3220 1983 B 0 D 0 N 16
3230 1984 B 0 D 16 N 16
3240 S3F112A
3250 LCAL 1 UCS0 1400. XMH 6.69
3260 HSC 3.92 WI 40. XMI 6000. FAIL 1.1
3270 FMI 100. AGPP 325. MLIN 1 NCAL 2
3280 1975 B 1 D 0 N 1
3290 1976 B 0 D 0 N 1
3300 1977 B 0 D 0 N 1
3310 1978 B 0 D 0 N 1
3320 1979 B 0 D 0 N 1
3330 1980 B 0 D 0 N 1
3340 1981 B 0 D 0 N 1
3350 1982 B 0 D 0 N 1
3360 1983 B 0 D 0 N 1
3370 1984 B 0 D 1 N 1
3380 H3734A
3390 LCAL 1 UC0S 1100. XMH 3.49
3400 HSC 4.64 WI 40. XMI 7000. FAIL .58
3410 FMI 75. AGPP 325. MLIN 1 NCAL 2
3420 1975 B 2 D 0 N 2
3430 1976 B 0 D 0 N 2
3440 1977 B 0 D 0 N 2
3450 1978 B 0 D 0 N 2
3460 1979 B 0 D 0 N 2
3470 1980 B 0 D 0 N 2
3480 1981 B 0 D 0 N 2
3490 1982 B 0 D 0 N 2
3500 1983 B 0 D 0 N 2
3510 1984 B 0 D 2 N 2
```

Subject: Data Files; GRP1B1 (Continued)

```
3520 M59
3530 L 1 U 420. X .7
3540 HSC 3.1 WI 40. XMI 3667. FAIL .12
3550 FMI 40. AGPP 325. MLIN 1 NCAL 2
3560 1975 B 1 D 0 N 1
3570 1976 B 0 D 0 N 1
3580 1977 B 0 D 0 N 1
3590 1978 B 0 D 0 N 1
3600 1979 B 0 D 0 N 1
3610 1980 B 0 D 0 N 1
3620 1981 B 0 D 0 N 1
3630 1982 B 0 D 0 N 1
3640 1983 B 0 D 0 N 1
3650 1984 B 0 D 1 N 1
3660 H523D
3670 L 1 U 1904. X 7.91
3680 HSC 7.84 WI 40. XMI 4250. FAIL 1.32
3690 FMI 55. AGPP 325. MLIN 1 NCAL 4
3700 1975 B 4 D 0 N 4
3710 1976 B 0 D 0 N 4
3720 1977 B 0 D 0 N 4
3730 1978 B 0 D 0 N 4
3740 1979 B 0 D 0 N 4
3750 1980 B 0 D 0 N 4
3760 1981 B 0 D 0 N 4
3770 1982 B 0 D 0 N 4
3780 1983 B 0 D 0 N 4
3790 1984 B 0 D 4 N 4
3800 H5211A
3810 LCAL 1 UC0S 765. XMH 2.03
3820 HSC 7.1 WI 21. XMI 4000. FAIL .34
3830 FMI 49. AGPP 325. MLIN 1 NCAL 4
3840 1975 B 7 D 0 N 7
3850 1976 B 0 D 0 N 7
3860 1977 B 0 D 0 N 7
3870 1978 B 0 D 0 N 7
3880 1979 B 0 D 0 N 7
3890 1980 B 0 D 0 N 7
3900 1981 B 0 D 0 N 7
3910 1982 B 0 D 0 N 7
3920 1983 B 0 D 0 N 7
3930 1984 B 0 D 7 N 7
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Subject: Data Files; GRP1B1 (Continued)

```
3940 H5212A
3950 LCAL 1 UC0S 1330. XMH 5.86
3960 HSC 3.84 WI 22. XMI 6667. FAIL .98
3970 FMI 83. AGPP 325. MLIN 1 NCAL 2
3980 1975 B 6 D 0 N 6
3990 1976 B 0 D 0 N 6
4000 1977 B 0 D 0 N 6
4100 1978 B 0 D 0 N 6
4110 1979 B 0 D 0 N 6
4120 1980 B 0 D 0 N 6
4130 1981 B 0 D 0 N 6
4140 1982 B 0 D 0 N 6
4150 1983 B 0 D 0 N 6
4160 1984 B 0 D 6 N 6
4170 H5221B
4180 LCAL 1 UC0S 980. XMH 6.91
4190 HSC 3.8 WI 6.5 XMI 6667. FAIL 1.15
4200 FMI 83. AGPP 325. MLIN 1 NCAL 2
4210 1975 B 3 D 0 N 3
4220 1976 B 0 D 0 N 3
4230 1977 B 0 D 0 N 3
4240 1978 B 0 D 0 N 3
4250 1979 B 0 D 0 N 3
4260 1980 B 0 D 0 N 3
4270 1981 B 0 D 0 N 3
4280 1982 B 0 D 0 N 3
4290 1983 B 0 D 0 N 3
4300 1984 B 0 D 3 N 3
4310 H5243L
4320 LCAL 1 UC0S 3150. XMH 10.1
4330 HSC 10.43 WI 40. XMI 6333. FAIL 1.68
4340 FMI 92. AGPP 325. MLIN 1 NCAL 4
4350 1975 B 6 D 0 N 6
4360 1976 B 0 D 0 N 6
4370 1977 B 0 D 0 N 6
4380 1978 B 0 D 0 N 6
4390 1979 B 0 D 0 N 6
4400 1980 B 0 D 0 N 6
4410 1981 B 0 D 0 N 6
4420 1982 B 0 D 0 N 6
4430 1983 B 0 D 0 N 6
4440 1984 B 0 D 6 N 6
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Subject: Data Files; GRP1B1 (Continued)

```
4450 C602A
4460 LCAL 1 UC0S 1475. XMH 6.68
4470 HSC 7.84 WI 40. XMI 6000. FAIL 1.1
4480 FMI 100. AOPP 325. MLIN 1 NCAL 4
4490 1975 B 2 D 0 N 2
4500 1976 B 0 D 0 N 2
4510 1977 B 0 D 0 N 2
4520 1978 B 0 D 0 N 2
4530 1979 B 0 D 0 N 2
4540 1980 B 0 D 0 N 2
4550 1981 B 0 D 0 N 2
4560 1982 B 0 D 0 N 2
4570 1983 B 0 D 0 N 2
4580 1984 B 0 D 2 N 2
4590 A6H86
4600 LCAL 1 UC0S 1680. XMH 6.68
4610 HSC 2.0 WI 40. XMI 7333. FAIL 1.1
4620 FMI 67. AOPP 325. MLIN 1 NCAL 4
4630 1975 B 3 D 0 N 3
4640 1976 B 0 D 0 N 3
4650 1977 B 0 D 0 N 3
4660 1978 B 0 D 0 N 3
4670 1979 B 0 D 0 N 3
4680 1980 B 0 D 0 N 3
4690 1981 B 0 D 0 N 3
4700 1982 B 0 D 0 N 3
4710 1983 B 0 D 0 N 3
4720 1984 B 0 D 3 N 3
4730 S6152
4740 LCAL 1 UC0S 2072. XMH 6.68
4750 HSC 3.84 WI 40. XMI 6000. FAIL 1.1
4760 FMI 100. AOPP 325. MLIN 1 NCAL 2
4770 1975 B 3 D 0 N 3
4780 1976 B 0 D 0 N 3
4790 1977 B 0 D 0 N 3
4800 1978 B 0 D 0 N 3
4810 1979 B 0 D 0 N 3
4820 1980 B 0 D 0 N 3
4830 1981 B 0 D 0 N 3
4840 1982 B 0 D 0 N 3
4850 1983 B 0 D 0 N 3
4860 1984 B 0 D 3 N 3
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Subject: Data Files; GRP1B1 (Continued)

```
4870 S6316A
4880 LCAL 1 UC0S 2590. XMH 6.68
4890 HSC 5.34 WI 40. XMI 5906. FAIL 1.1
4900 FMI 47. AQPP 325. MLIN 1 NCAL 2
4910 1975 B 16 D 0 N 16
4920 1976 B 0 D 0 N 16
4930 1977 B 0 D 0 N 16
4940 1978 B 0 D 0 N 16
4950 1979 B 0 D 0 N 16
4960 1980 B 0 D 0 N 16
4970 1981 B 0 D 0 N 16
4980 1982 B 0 D 0 N 16
4990 1983 B 0 D 0 N 16
5000 1984 B 0 D 16 N 16
5010 C800A
5020 LCAL 1 UC0S 1350. XMH 6.68
5030 HSC 7.0 WI 40. XMI 6000. FAIL 1.1
5040 FMI 100. AQPP 325. MLIN 1 NCAL 4
5050 1975 B 1 D 0 N 1
5060 1976 B 0 D 0 N 1
5070 1977 B 0 D 0 N 1
5080 1978 B 0 D 0 N 1
5090 1979 B 0 D 0 N 1
5100 1980 B 0 D 0 N 1
5110 1981 B 0 D 0 N 1
5120 1982 B 0 D 0 N 1
5130 1983 B 0 D 0 N 1
5140 1984 B 0 D 1 N 1
```

Subject: Data Files; GRP2B1

```
100 CV72002
110 LCAL 1 UCOS 850. XMH 1.59
120 HSC 2.48 WI 9. XMI 5391. FAIL .27
130 FMI 53. AOPP 150. MLIN 1 NCAL 2
140 1975 B 70 D 0 N 70
150 1976 B 0 D 0 N 70
160 1977 B 0 D 0 N 70
170 1978 B 0 D 0 N 70
180 1979 B 0 D 0 N 70
190 1980 B 0 D 0 N 70
200 1981 B 0 D 0 N 70
210 1982 B 0 D 0 N 70
220 1983 B 0 D 0 N 70
230 1984 B 0 D 70 N 70
240 CV19210
250 LCAL 1 UCOS 1062. XMH 2.38
260 HSC 2.48 WI 9. XMI 6526. FAIL .4
270 FMI 83. AOPP 150. MLIN 1 NCAL 2
280 1975 B 40 D 0 N 40
290 1976 B 0 D 0 N 40
300 1977 B 0 D 0 N 40
310 1978 B 0 D 0 N 40
320 1979 B 0 D 0 N 40
330 1980 B 0 D 0 N 40
340 1981 B 0 D 0 N 40
350 1982 B 0 D 0 N 40
360 1983 B 0 D 0 N 40
370 1984 B 0 D 40 N 40
380 MX1637A0
390 LCAL 1 UCOS 850. XMH 4.6
400 HSC 5.2 WI 9. XMI 4600. FAIL .77
410 FMI 64. AOPP 150. MLIN 1 NCAL 4
420 1975 B 10 D 0 N 10
430 1976 B 0 D 0 N 10
440 1977 B 0 D 0 N 10
450 1978 B 0 D 0 N 10
460 1979 B 0 D 0 N 10
470 1980 B 0 D 0 N 10
480 1981 B 0 D 0 N 10
490 1982 B 0 D 0 N 10
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Subject: Data Files; GRP2B1 (Continued)

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500 1983 B 0 D 0 N 10
510 1984 B 0 D 10 N 10
520 CV394
530 LCAL 1 UC0S 1374. XMH 3.22
540 HSC 5.12 WT 9. XMI 4750. FAIL .54
550 FMI 43. AQPP 150. MLIN 1 NCAL 4
560 1975 B 4 D 0 N 4
570 1976 B 0 D 0 N 4
580 1977 B 0 D 0 N 4
590 1978 B 0 D 0 N 4
600 1979 B 0 D 0 N 4
610 1980 B 0 D 0 N 4
620 1981 B 0 D 0 N 4
630 1982 B 0 D 0 N 4
640 1983 B 0 D 0 N 4
650 1984 B 0 D 4 N 4
660 H525C
670 LCAL 1 UC0S 850. XMH 2.84
680 HSC 5.0 WT 10. XMI 3667. FAIL .47
690 FMI 40. AQPP 150. MLIN 1 NCAL 4
700 1975 B 3 D 0 N 3
710 1976 B 0 D 0 N 3
720 1977 B 0 D 0 N 3
730 1978 B 0 D 0 N 3
740 1979 B 0 D 0 N 3
750 1980 B 0 D 0 N 3
760 1981 B 0 D 0 N 3
770 1982 B 0 D 0 N 3
780 1983 B 0 D 0 N 3
790 1984 B 0 D 3 N 3
800 H5251A
810 LCAL 1 UC0S 850. XMH .88
820 HSC 2.48 WT 6. XMI 4444. FAIL .15
830 FMI 60. AQPP 150. MLIN 1 NCAL 2
840 1975 B 9 D 0 N 9
850 1976 B 0 D 0 N 9
860 1977 B 0 D 0 N 9
870 1978 B 0 D 0 N 9
880 1979 B 0 D 0 N 9
890 1980 B 0 D 0 N 9
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Subject: Data Files; GRP2B1 (Continued)

```
900 1981 B 0 D 0 N 9
910 1982 B 0 D 0 N 9
920 1983 B 0 D 0 N 9
930 1984 B 0 D 9 N 9
940 H5253A
950 LCAL 1 UC0S 850. XMH 1.15
960 HSC 2.26 WI 9. XMI 3875. FAIL .19
970 FMI 20. AOPP 150. MLIN 1 NCAL 2
980 1975 B 4 D 0 N 4
990 1976 B 0 D 0 N 4
1000 1977 B 0 D 0 N 4
1010 1978 B 0 D 0 N 4
1020 1979 B 0 D 0 N 4
1030 1980 B 0 D 0 N 4
1040 1981 B 0 D 0 N 4
1050 1982 B 0 D 0 N 4
1060 1983 B 0 D 0 N 4
1070 1984 B 0 D 4 N 4
```

Subject: Data Files; GRP3B1

```
100 CV2003BU
110 LCAL 1 UC0S 1150. XMH .73
120 HSC 3.06 WI 9. XMI 6921. FAIL .12
130 FMI 44. AGPP 150. MLIN 1 NCAL 1
140 1975 B 23 D 0 N 23
150 1976 B 0 D 0 N 23
160 1977 B 0 D 0 N 23
170 1978 B 0 D 0 N 23
180 1979 B 0 D 0 N 23
190 1980 B 0 D 0 N 23
200 1981 B 0 D 0 N 23
210 1982 B 0 D 0 N 23
220 1983 B 0 D 0 N 23
230 1984 B 0 D 23 N 23
240 CV2003U
250 LCAL 1 UC0S 827. XMH .42
260 HSC 3.46 WI 9. XMI 3667. FAIL .1
270 FMI 40. AGPP 150. MLIN 1 NCAL 2
280 1975 B 22 D 0 N 22
290 1976 B 0 D 0 N 22
300 1977 B 0 D 0 N 22
310 1978 B 0 D 0 N 22
320 1979 B 0 D 0 N 22
330 1980 B 0 D 0 N 22
340 1981 B 0 D 0 N 22
350 1982 B 0 D 0 N 22
360 1983 B 0 D 0 N 22
370 1984 B 0 D 22 N 22
380 CV2003AU
390 LCAL 1 UC0S 1150. XMH .5
400 HSC 2.66 WI 9. XMI 8000. FAIL .1
410 FMI 50. AGPP 150. MLIN 1 NCAL 2
420 1975 B 1 D 0 N 1
430 1976 B 0 D 0 N 1
440 1977 B 0 D 0 N 1
450 1978 B 0 D 0 N 1
460 1979 B 0 D 0 N 1
470 1980 B 0 D 0 N 1
480 1981 B 0 D 0 N 1
490 1982 B 0 D 0 N 1
500 1983 B 0 D 0 N 1
510 1984 B 0 D 1 N 1
```

Subject: Data Files; GRP4B1

```
100 CV3059
110 LCAL 1 UC0S 2270. XMH 2.29
120 HSC 3.28 WI 12. XMI 7685. FAIL .38
130 FMI 54. AGPP 150. MLIN 1 NCAL 1
140 1975 B 43 D 0 N 43
150 1976 B 0 D 0 N 43
160 1977 B 0 D 0 N 43
170 1978 B 0 D 0 N 43
180 1979 B 0 D 0 N 43
190 1980 B 0 D 0 N 43
200 1981 B 0 D 0 N 43
210 1982 B 0 D 0 N 43
220 1983 B 0 D 0 N 43
230 1984 B 0 D 43 N 43
240 H2590A
250 LCAL 1 UC0S 2313. XMH 4.86
260 HSC 5.22 WI 30. XMI 6000. FAIL .81
270 FMI 100. AGPP 150. MLIN 1 NCAL 2
280 1975 B 1 D 0 N 1
290 1976 B 0 D 0 N 1
300 1977 B 0 D 0 N 1
310 1978 B 0 D 0 N 1
320 1979 B 0 D 0 N 1
330 1980 B 0 D 0 N 1
340 1981 B 0 D 0 N 1
350 1982 B 0 D 0 N 1
360 1983 B 0 D 0 N 1
370 1984 B 0 D 1 N 1
380 H2590B
390 LCAL 1 UC0S 2420. XMH 1.87
400 HSC 6.34 WI 30. XMI 6620 FAIL .31
410 FMI 70. AGPP 150. MLIN 1 NCAL 2
420 1975 B 42 D 0 N 42
430 1976 B 0 D 0 N 42
440 1977 B 0 D 0 N 42
450 1978 B 0 D 0 N 42
460 1979 B 0 D 0 N 42
470 1980 B 0 D 0 N 42
480 1981 B 0 D 0 N 42
490 1982 B 0 D 0 N 42
500 1983 B 0 D 0 N 42
510 1984 B 0 D 42 N 42
```

Subject: Data Files GRPC1

```
GRPC1
100 H432A
110 LCAL 1 UCØS 625. XMH 1.83
120 HSC 3. WT 11.5 XMI 6413. FAIL .61
130 FMI 88. AQPP 150. MLIN 1 NCAL 2
140 1975 NEQB 315 NEQD 0 NDEN 315
150 1976 NEQB 0 NEQD 0 NDEN 315
160 1977 NEQB 0 NEQD 0 NDEN 315
170 1978 NEQB 0 NEQD 0 NDEN 315
180 1979 NEQB 0 NEQD 0 NDEN 315
190 1980 NEQB 0 NEQD 0 NDEN 315
200 1981 NEQB 0 NEQD 0 NDEN 315
210 1982 NEQB 0 NEQD 0 NDEN 315
220 1983 NEQB 0 NEQD 0 NDEN 315
230 1984 NEBB 0 NEQD 315 NDEN 315
240 URM98
250 LCAL 0 UCØS 625. XMH 2.74
260 HSC 7.1 WT 16. XMI 5914. FAIL .91
270 FMI 88. AQPP 150. MLIN 1 NCAL .91
280 1975 B 109 D 0 N 109
290 1976 B 0 D 0 N 109
300 1977 B 0 D 0 N 109
310 1978 B 0 D 0 N 109
320 1979 B 0 D 0 N 109
330 1980 B 0 D 0 N 109
340 1981 B 0 D 0 N 109
350 1982 B 0 D 0 N 109
360 1983 B 0 D 0 N 109
370 1984 B 0 D 109 N 109
380 USM161
390 LCAL 1 UCØS 902. XMH 2.74
400 HSC 6.664 WT 16. XMI 5807. FAIL .0
400 HSC 6.64 WT 16. XMI 5807. FAIL .91
410 FMI 37. AQPP 150. MLIN 1 NCAL 4
420 1975 B 26 D 0 N 26
430 1976 B 0 D 0 N 26
440 1977 B 0 D 0 N 26
450 1978 B 0 D 0 N 26

460 1979 B 0 D 0 N 26
470 1980 B 0 D 0 N 26
480 1981 B 0 D 0 N 26
490 1982 B 0 D 0 N 26
500 1983 B 0 D 0 N 26
510 1984 B 0 D 26 N 26
```

Subject: Data Files GRPC1 (continued)

```
520 USM260
530 LCAL 1 UC0S 625. XMH 2.74
540 HSC 4. WT 12. XMI 6736. FAIL .91
550 FMI 37. AQPP 150. MLIN 1 NCAL 2

560 1975 B 74 D 0 N 74
570 1976 B 0 D 0 N 74
580 1977 B 0 D 0 N 74
590 1978 B 0 D 0 N 74
600 1979 B 0 D 0 N 74
610 1980 B 0 D 0 N 74
620 1981 B 0 D 0 N 74
630 1982 B 0 D 0 N 74
640 1983 B 0 D 0 N 74
650 1984 B 0 D 74 N 74
660 TS125A
670 LCAL 0 UC0S 487. XMH 2.74
680 HSC 1.3 WT 12. XMI 2500. FAIL .91
690 FMI 10. AQPP 150. MLIN 1 NCAL 1.3
700 1975
700 1975 B 2 D 0 N 2
710 1976 B 0 D 0 N 2
720 1977 B 0 D 0 N 2
730 1978 B 0 D 0 N 2
740 1979 B 0 D 0 N 2
750 1980 B 0 D 0 N 2
760 1981 B 0 D 0 N 2
770 1982 B 0 D 0 N 2
780 1983 B 0 D 0 N 2
790 1984 B 0 D 2 N 2
800 H431B
810 LCAL 1 UC0S 618. XMH 2.37
820 HSC 6.56 WT 12. XMI 6518. FAIL .79
830 FMI 58. AQPP 150. MLIN 1 NCAL 4
840 1975 B 55 D 0 N 55
850 1976 B 0 D 0 N 55
860 1977 B 0 D 0 N 55
870 1978 B 0 D 0 N 55
880
880
880 1979 B 0 D 0 N 55
890 1980 B 0 D 0 N 55
900 1981 B 0 D 0 N 55
910 1982 B 0 D 0 N 55
```

Subject: Data Files GRPC1 (continued)

```
920 1983 B 0 D 0 N 55
930 1984 B 0 D 55 N 55
940 G454A
950 LCAL 1 UC0S 6  . XMH 4.31
960 HSC 3.82 WT 12. XMI 5581. FAIL 1.4
970 FMI 85. AQPP 150. MLIN 1 NCAL 2
980 1975 B 49 D 0 N 49
990 1976 B 0 D 0 N 49
1000 1977 B 0 D 0 N 49
1010 1978 B 0 D 0 N 49
1020 1979 B 0 D 0 N 49
1030 1980 B 0 D 0 N 49
1040 1981 B 0 D 0 N 49
1050 1982 B 0 D 0 N 49
1060 1983 B 0 D 0 N 49
1070 1984   0 D 49 N 49
```

Subject: Data Files GRPA4

```
100 GRPA4 DATA FILE
00110 NFIL 11
00120 USM366
00130 LCAL 1 0005 4500. AMH 5.33
00140 HSC 8.06 WI 48. AMI 6056. FAIL .69
00150 FMI 55. AGPP 310. MLIN 1 NCAL 2
160 1975 B 4 D 0 N 4
170 1976 B 5 D 0 N 9
180 1977 B 8 D 0 N 17
190 1978 B 10 D 0 N 27
200 1979 B 8 D 0 N 35
210 1980 B 5 D 0 N 40
215 1981 B 5 D 0 N 45
220 1982 B 4 D 0 N 49
240 1983 B 2 D 0 N 51
250 1984 B 2 D 53 N 53
00260 UPM84
00270 LCAL 1 0005 8624. AMH 5.33
00280 HSC 8.06 WI 50. AMI 5500. FAIL .69
00290 FMI 55. AGPP 310. MLIN 1 NCAL 2
300 1975 B 0 D 0 N 3
310 0976 B 0 D 3 N 3
320 1977 B 0 D 0 N 0
330 1978 B 0 D 0 N 0
340 1979 B 0 D 0 N 0
350 1980 B 0 D 0 N 0
360 1981 B 0 D 0 N 0
370 1982 B 0 D 0 N 0
380 1983 B 0 D 0 N 0
390 1984 B 0 D 0 N 0
00400 D02A
00410 LCAL 1 0005 13785. AMH 8.98
00420 HSC 6.02 WI 135. AMI 8000. FAIL 1.5
00430 FMI 50. AGPP 310. MLIN 1 NCAL 2
435 1975 B 0 D 4 N 4
440 1976 B 0 D 0 N 0
460 1977 B 0 D 0 N 0
470 1978 B 0 D 0 N 0
480 1979 B 0 D 0 N 0
490 1980 B 0 D 0 N 0
500 1981 B 0 D 0 N 0
510 1982 B 0 D 0 N 0
520 1983 B 0 D 0 N 0
530 1984 B 0 D 0 N 0
```

Subject: Data Files GRPA4 (continued)

```
00540 LCA6
00550 LCAL 1 UCL2 8000. AMH 5.33
00560 HSC 8.06 VI 50. AMI 8000. FAIL .69
00570 FMI 50. AGPF 310. MLIN 1 NCAL 2
580 1975 B U L U N U
590 1976 B U L U N U
600 1977 B U L U N U
610 1978 B U L U N U
620 1979 B U L U N U
630 1980 B U L U N U
640 1981 B U L U N U
650 1982 B U L U N U
660 1983 B U L U N U
670 1984 B U L U N U
680 A1A5
685 LCAL 1 UCL2 4675. AMH 5.33
00690 HSC 8. VI 50. AMI 8000. FAIL .69
00710 FMI 50. AGPF 310. MLIN 1 NCAL 4
720 1975 B U L U N U
730 1976 B U L U N U
740 1977 B U L U N U
750 1978 B U L U N U
760 1979 B U L U N U
770 1980 B U L U N U
780 1981 B U L U N U
790 1982 B U L U N U
800 1983 B U L U N U
810 1984 B U L U N U
00820 SA84
00830 LCAL 1 UCL2 8827. AMH 5.33
00840 HSC 23.08 VI 50. AMI 8000. FAIL .69
00850 FMI 50. AGPF 310. MLIN 1 NCAL 4
860 1975 B U L U N U
870 0976 B U L U N U
880 1977 B U L U N U
890 1978 B U L U N U
900 1979 B U L U N U
910 1980 B U L U N U
920 1981 B U L U N U
930 1982 B U L U N U
940 1983 B U L U N U
950 1984 B U L U N U
00960 ISA2
00970 LCAL 1 UCL2 13785. AMH 3.79
00980 HSC 18. VI 50. AMI 8000. FAIL .63
00990 FMI 50. AGPF 310. MLIN 4 NCAL 4
```

Subject: Data Files GRPA4 (continued)

```
1000 1975 B 0 D 0 N 0
1010 1976 B 0 D 0 N 0
1020 1977 B 0 D 0 N 0
1030 1978 B 0 D 0 N 0
1040 1979 B 0 D 0 N 0
1050 1980 B 0 D 0 N 0
1060 1981 B 0 D 0 N 0
1070 1982 B 0 D 0 N 0
1080 1983 B 0 D 0 N 0
1090 1984 B 0 D 0 N 0
1095 L20
01100 LCAL 1 UCCS 4850. AMH 6.2
01110 HSC 19.04 WI 50. AMI 4000. FAIL .97
01120 FMI 30. AGPP 310. MLIN 2 NCAL 4
1130 1975 B 0 D 0 N 2
1140 1976 B 0 D 2 N 2
1150 1977 B 0 D 0 N 0
1160 1978 B 0 D 0 N 0
1170 1979 B 0 D 0 N 0
1180 1980 B 0 D 0 N 0
1190 1981 B 0 D 0 N 0
1195 1982 B 0 D 0 N 0
1200 1983 B 0 D 0 N 0
1210 1984 B 0 D 0 N 0
1215 L30
01220 LCAL 1 UCCS 4850. AMH 11.59
01230 HSC 19.04 WI 50. AMI 2500. FAIL 1.93
01240 FMI 10. AGPP 310. MLIN 1 NCAL 4
1250 1975 B 0 D 1 N 1
1260 1976 B 0 D 0 N 0
1270 1977 B 0 D 0 N 0
1280 1978 B 0 D 0 N 0
1290 1979 B 0 D 0 N 0
1300 1980 B 0 D 0 N 0
1310 1981 B 0 D 0 N 0
1320 0982 B 0 D 0 N 0
1330 1983 B 0 D 0 N 0
1340 1984 B 0 D 0 N 0
01350 L40
01360 LCAL 0 UCCS 4850. AMH 14.13
01370 HSC 10.2 WI 50. AMI 8000. FAIL 2.35
01380 FMI 50. AGPP 310. MLIN 1 NCAL 2
```

Subject: Data Files GRPA4 (continued)

```
1390 1975 B 0 D 0 N 25
1400 1976 B 0 D 0 N 25
1410 1977 B 0 D 0 N 25
1420 1978 B 0 D 7 N 25
1430 1979 B 0 D 5 N 18
1440 0980 B 0 D 4 N 13
1450 1981 B 0 D 4 N 8
1460 1982 B 0 D 2 N 4
1470 1983 B 0 D 2 N 2
1480 1984 B 0 D 0 N 0
01490 M651B
01500 LCAL 1 LCOS 7262. AMH 4.98
1510 HSC 17.24 FI 134. AMI 5000. FAIL .83
01520 FMI 65. ACPP 310. MLIN 1 NCAL 4
1530 1975 B 0 D 0 N 12
1540 1976 B 0 D 1 N 12
1550 1977 B 0 D 10 N 11
1560 1978 B 0 D 1 N 1
1570 1979 B 0 D 0 N 0
1580 1980 B 0 D 0 N 0
1590 1981 B 0 D 0 N 0
1600 1982 B 0 D 0 N 0
1610 1983 B 0 D 0 N 0
1620 1984 B 0 D 0 N 0
01630 M651A
01640 LCAL 1 LCOS 9500. AMH 5.15
01650 HSC 17.64 FI 48. AMI 2500. FAIL .66
01660 FMI 10. ACPP 310. MLIN 1 NCAL 4
1670 1975 B 0 D 0 N 2
1680 1976 B 0 D 2 N 2
1690 1977 B 0 D 0 N 0
1700 1978 B 0 D 0 N 0
1710 1979 B 0 D 0 N 0
1720 1980 B 0 D 0 N 0
1730 1981 B 0 D 0 N 0
1740 1982 B 0 D 0 N 0
1750 1983 B 0 D 0 N 0
1760 1984 B 0 D 0 N 0
```

Subject: Data Files GRPA5

```
100 GRPA5 DATA FILE
00110 NFIL 11
00120 CSM366
00130 LCAL 1 UC05 4500. XMH 5.33
00140 HSC 8.06 WI 46. XMI 6056. FAIL .69
00150 FMI 55. ACPF 310. MLIN 1 NCAL 2
160 1975 B U L U N U
170 1976 B U L U N U
180 1977 B U L U N U
190 1978 B U L U N U
200 1979 B U L U N U
210 1980 B U L U N U
215 1981 B U L U N U
220 1982 B U L U N U
240 1983 B U L U N U
250 1984 B U L U N U
00260 UPM84
00270 LCAL 1 UC05 8624. XMH 5.33
00280 HSC 8.06 WI 50. XMI 5500. FAIL .69
00290 FMI 55. ACPF 310. MLIN 1 NCAL 2
300 1975 B U L U N 3
310 1976 B U L 3 N 3
320 1977 B 3 L U N 3
330 1978 B U L U N 3
340 1979 B U L U N 3
350 1980 B U L U N 3
360 1981 B U L U N 3
370 1982 B U L U N 3
380 1983 B U L U N 3
390 1984 B U L 3 N 3
00400 UC2A
00410 LCAL 1 UC05 13785. XMH 8.98
00420 HSC 8.02 WI 135. XMI 8000. FAIL 1.5
00430 FMI 50. ACPF 310. MLIN 1 NCAL 2
435 1975 B U L 4 N 4
440 1976 B 4 L U N 4
460 1977 B U L U N 4
470 1978 B U L U N 4
480 1979 B U L U N 4
490 1979 B U L U N 4
500 1981 B U L U N 4
510 1982 B U L U N 4
520 1983 B U L U N 4
530 1984 B U L 4 N 4
00540 LCAL
```

Subject: Data Files GRPA5 (continued)

```
00550 LCAL 1 0015 8000. XMH 5.33
00560 HSC 2.06 WI 50. XMI 8000. FAIL .89
00570 FMI 50. ACPF 310. MLIN 1 NCAL 2
580 1975 B 1 D 0 N 1
590 1976 B 0 D 0 N 1
600 1977 B 0 D 0 N 1
610 1978 B 0 D 0 N 1
620 1979 B 0 D 0 N 1
630 1980 B 0 D 0 N 1
640 1981 B 0 D 0 N 1
650 1982 B 0 D 0 N 1
660 1983 B 0 D 0 N 1
670 1984 B 0 D 1 N 1
680 A1A5
685 LCAL 1 0015 4875. XMH 5.33
00690 HSC 8. WI 50. XMI 8000. FAIL .89
00710 FMI 50. ACPF 310. MLIN 1 NCAL 4
720 1975 B 1 D 0 N 1
730 1976 B 0 D 0 N 1
740 1977 B 0 D 0 N 1
750 1978 B 0 D 0 N 1
760 1979 B 0 D 0 N 1
770 1980 B 0 D 0 N 1
780 1981 B 0 D 0 N 1
790 1982 B 0 D 0 N 1
800 1983 B 0 D 0 N 1
810 1984 B 0 D 1 N 1
00820 SA84
00830 LCAL 1 0015 6827. XMH 5.33
00840 HSC 23.08 WI 50. XMI 8000. FAIL .89
00850 FMI 50. ACPF 310. MLIN 1 NCAL 4
860 1975 B 1 D 0 N 1
870 1976 B 0 D 0 N 1
880 1977 B 0 D 0 N 1
890 1978 B 0 D 0 N 1
900 1979 B 0 D 0 N 1
910 1980 B 0 D 0 N 1
920 1981 B 0 D 0 N 1
930 1982 B 0 D 0 N 1
940 1983 B 0 D 0 N 1
950 1984 B 0 D 1 N 1
00960 1SA2
00970 LCAL 1 0015 13785. XMH 3.79
00980 HSC 18. WI 50. XMI 8000. FAIL .63
00990 FMI 50. ACPF 310. MLIN 4 NCAL 4
```

Subject: Data Files GRPA5 (continued)

```
1000 1975 B 1 D 0 N 1
1010 1976 B 0 D 0 N 1
1020 1977 B 0 D 0 N 1
1030 1978 B 0 D 0 N 1
1040 1979 B 0 D 0 N 1
1050 1980 B 0 D 0 N 1
1060 1981 B 0 D 0 N 1
1070 1982 B 0 D 0 N 1
1080 1983 B 0 D 0 N 1
1090 1984 B 0 D 1 N 1
1095 L20
01100 LCAL 1 UCRS 4850. AMH 6.2
01110 HSC 19.04 WI 50. AMI 4000. FAIL .97
01120 FMI 30. AGPP 310. MLIN 2 NCAL 4
1130 1975 B 0 D 0 N 2
1140 1976 B 0 D 2 N 2
1150 1977 B 2 D 0 N 2
1160 1978 B 0 D 0 N 2
1170 1978 B 0 D 0 N 2
1180 1980 B 0 D 0 N 2
1190 1981 B 0 D 0 N 2
1195 1982 B 0 D 0 N 2
1200 1983 B 0 D 0 N 2
1210 1984 B 0 D 2 N 2
1215 L30
01220 LCAL 1 UCRS 4850. AMH 11.59
01230 HSC 19.04 WI 50. AMI 2500. FAIL 1.93
01240 FMI 10. AGPP 310. MLIN 1 NCAL 4
1250 1975 B 0 D 1 N 1
1260 1976 B 1 D 0 N 1
1270 1977 B 0 D 0 N 1
1280 1978 B 0 D 0 N 1
1290 1979 B 0 D 0 N 1
1300 1980 B 0 D 0 N 1
1310 1981 B 0 D 0 N 1
1320 1982 B 0 D 0 N 1
1330 1983 B 0 D 0 N 1
1340 1984 B 0 D 1 N 1
01350 L40
01360 LCAL 0 UCRS 4850. AMH 14.13
01370 HSC 10.2 WI 50. AMI 8000. FAIL 2.35
01380 FMI 50. AGPP 310. MLIN 1 NCAL 2
```

Subject: Data Files GRPA5 (continued)

```
1390 1975 B 0 D 0 N 25
1400 1976 B 0 D 0 N 25
1410 1977 B 0 D 0 N 25
1420 1978 B 0 D 7 N 25
1430 1979 B 7 D 5 N 25
1440 1980 B 5 D 5 N 25
1450 1981 B 5 D 4 N 25
1460 1982 B 4 D 2 N 25
1470 1983 B 2 D 2 N 25
1480 1984 B 2 D 25 N 25
01490 H851B
01500 LCAL 1 UCOS 7262. AMH 4.98
1510 HSC 17.24 WI 134. XMI 5000. FAIL .83
01520 FMI 65. AGPP 310. MLIN 1 NCAL 4
1530 1975 B 0 D 0 N 2
1540 1976 B 0 D 2 N 2
1550 1977 B 2 D 0 N 2
1560 1978 B 0 D 0 N 2
1570 1979 B 0 D 0 N 2
1580 1980 B 0 D 0 N 2
1590 1981 B 0 D 0 N 2
1600 1982 B 0 D 0 N 2
1610 1983 B 0 D 0 N 2
1620 1984 B 0 D 2 N 2
01630 H851A
01640 LCAL 1 UCOS 9500. AMH 5.15
01650 HSC 17.64 WI 48. XMI 2500. FAIL .86
01660 FMI 10. AGPP 310. MLIN 1 NCAL 4
1670 1975 B 0 D 0 N 12
1680 1976 B 0 D 1 N 12
1690 1977 B 1 D 10 N 12
1700 1978 B 10 D 1 N 12
1710 1979 B 1 D 0 N 12
1720 1980 B 0 D 0 N 12
1730 1981 B 0 D 0 N 12
1740 1982 B 0 D 0 N 12
1750 1983 B 0 D 0 N 12
1760 1984 B 0 D 12 N 12
```

Subject: Data Files GRP1B2

```
GRP1B2
50 NPIL 28
100 CP772AU
110 LCAL 1 UC0S 3150. XMH 10.
120 HSC 7.84 WI 40. XMI 6302. FAIL 1.67
130 FMI 56. AGPP 325. MLIN 1 NCAL 4
140 1975 B 53 D 0 N 504
150 1976 B 47 D 0 N 504
160 1977 B 75 D 0 N 504
170 1978 B 103 D 0 N 504
180 1979 B 60 D 0 N 504
190 1980 B 50 D 0 N 504
200 1981 B 50 D 0 N 504
210 1982 B 25 D 0 N 504
220 1983 B 25 D 0 N 504
230 1984 B 16 D 504 N 504
240 ISM16
250 L 0 0 1271. X 6.95
260 HSC 7.48 WI 40. XMI 5477. FAIL 1.16
270 FMI 53. AGPP 325. MLIN 1 NCAL 4
280 1975 B 0 D 27 N 136
290 1976 B 0 D 75 N 109
300 1977 B 0 D 34 N 34
310 1978 B 0 D 0 N 0
320 1979 B 0 D 0 N 0
330 1980 B 0 D 0 N 0
340 1981 B 0 D 0 N 0
350 1982 B 0 D 0 N 0
360 1983 B 0 D 0 N 0
370 1984 B 0 D 0 N 0
380 URM79
390 LCAL 1 UC0S 1332. XMH 6.66
400 HSC 5.54 WI 40. XMI 6678. FAIL 1.11
410 FMI 45. AGPP 325. MLIN 1 NCAL 2
420 1975 B 0 D 14 N 14
430 1976 B 0 D 0 N 0
440 1977 B 0 D 0 N 0
450 1978 B 0 D 0 N 0
460 1979 B 0 D 0 N 0
470 1980 B 0 D 0 N 0
480 1981 B 0 D 0 N 0
490 1982 B 0 D 0 N 0
500 1983 B 0 D 0 N 0
510 1984 B 0 D 0 N 0
```

Subject: Data Files GRP1B2 (continued)

```
520 USM26
530 LCAL 1 UCFS 3150. XMH 13.27
540 HSC 8.72 WI 40. XMI 6667. FAIL 2.21
550 FMI 83. AGPP 325. MLIN 1 NCAL 4
560 1975 B 0 D 0 N 0
570 1976 B 0 D 0 N 0
580 1977 B 0 D 0 N 0
590 1978 B 0 D 0 N 0
600 1979 B 0 D 0 N 0
610 1980 B 0 D 0 N 0
620 1981 B 0 D 0 N 0
630 1982 B 0 D 0 N 0
640 1983 B 0 D 0 N 0
650 1984 B 0 D 0 N 0
660 USM102
670 LCAL 1 UCFS 3150. XMH 8.59
680 HSC 3.98 WI 14. XMI 4000. FAIL 1.43
690 FMI 48. AGPP 325. MLIN 1 NCAL 2
700 1975 B 0 D 1 N 1
710 1976 B 0 D 0 N 0
720 1977 B 0 D 0 N 0
730 1978 B 0 D 0 N 0
740 1979 B 0 D 0 N 0
750 1980 B 0 D 0 N 0
760 1981 B 0 D 0 N 0
770 1982 B 0 D 0 N 0
780 1983 B 0 D 0 N 0
790 1984 B 0 D 0 N 0
800 USM159
810 LCAL 1 UCFS 694. XMH 6.66
820 HSC 2.23 WI 40. XMI 4829. FAIL 1.11
830 FMI 26. AGPP 325. MLIN 1 NCAL 1
840 1975 B 0 D 0 N 48
850 1976 B 0 D 0 N 48
860 1977 B 0 D 48 N 48
870 1978 B 0 D 0 N 0
880 1979 B 0 D 0 N 0
890 1980 B 0 D 0 N 0
900 1981 B 0 D 0 N 0
910 1982 B 0 D 0 N 0
920 1983 B 0 D 0 N 0
930 1984 B 0 D 0 N 0
940 USM207
950 LCAL 1 UCFS 3727. XMH 6.66
960 HSC 4.5 WI 40. XMI 5787. FAIL 1.11
970 FMI 89. AGPP 325. MLIN 1 NCAL 2
```

Subject: Data Files GRP1B2 (continued)

```
980 1975 B 0 D 0 N 194
990 1976 B 0 D 0 N 194
1000 1977 B 0 D 0 N 194
1010 1978 B 0 D 28 N 194
1020 1979 B 0 D 50 N 166
1030 1980 B 0 D 50 N 116
1040 1981 B 0 D 25 N 66
1050 1982 B 0 D 25 N 41
1060 1983 B 0 D 16 N 16
1070 1984 B 0 D 0 N 0
1080 CPU1026
1090 LCAL 1 UCCS 1800. AMH 6.66
1100 HSC 3.92 WI 25. XMI 6000. FAIL 1.1
1110 FMI 100. AGPP 325. MLIN 1 NCAL 2
1120 1975 B 0 D 0 N 0
1130 1976 B 0 D 0 N 0
1140 1977 B 0 D 0 N 0
1150 1978 B 0 D 0 N 0
1160 1979 B 0 D 0 N 0
1170 1980 B 0 D 0 N 0
1180 1981 B 0 D 0 N 0
1190 1982 B 0 D 0 N 0
1200 1983 B 0 D 0 N 0
1210 1984 B 0 D 0 N 0
1220 CPU1033
1230 LCAL 1 UCCS 1450. AMH 4.27
1240 HSC 4.42 WI 25. XMI 7000. FAIL .71
1250 FMI 75. AGPP 325. MLIN 1 NCAL 2
1260 1975 B 0 D 0 N 0
1270 1976 B 0 D 0 N 0
1280 1977 B 0 D 0 N 0
1290 1978 B 0 D 0 N 0
1300 1979 B 0 D 0 N 0
1310 1980 B 0 D 0 N 0
1320 1981 B 0 D 0 N 0
1330 1982 B 0 D 0 N 0
1340 1983 B 0 D 0 N 0
1350 1984 B 0 D 0 N 0
1360 CPU1049
1370 LCAL 1 UCCS 3150. AMH 1.8
1380 HSC 3.54 WI 40. XMI 2818. FAIL .3
1390 FMI 18. AGPP 325. MLIN 1 NCAL 2
```

Subject: Data Files GRP1B2 (continued)

```
1400 1975 B 0 D 0 N 11
1410 1976 B 0 D 0 N 11
1420 1977 B 0 D 11 N 11
1430 1978 B 0 D 0 N 0
1440 1979 B 0 D 0 N 0
1450 1980 B 0 D 0 N 0
1460 1981 B 0 D 0 N 0
1470 1982 B 0 D 0 N 0
1480 1983 B 0 D 0 N 0
1490 1984 B 0 D 0 N 0
1500 FR67
1510 LCAL 1 UC0S 950. XMH 6.68
1520 HSC 1.96 WI 40. XMI 5750. FAIL 1.1
1530 FMI 77. AGPP 325. MLIN 1 NCAL 2
1540 1975 B 0 D 0 N 0
1550 1976 B 0 D 0 N 0
1560 1977 B 0 D 0 N 0
1570 1978 B 0 D 0 N 0
1580 1979 B 0 D 0 N 0
1590 1980 B 0 D 0 N 0
1600 1981 B 0 D 0 N 0
1610 1982 B 0 D 0 N 0
1620 1983 B 0 D 0 N 0
1630 1984 B 0 D 0 N 0
1640 FR174
1650 LCAL 1 UC0S 1005. XMH 5.78
1660 HSC 3.16 WI 21. XMI 2500. FAIL .96
1670 FMI 10. AGPP 325. MLIN 1 NCAL 2
1680 1975 B 0 D 5 N 5
1690 1976 B 0 D 0 N 0
1700 1977 B 0 D 0 N 0
1710 1978 B 0 D 0 N 0
1720 1979 B 0 D 0 N 0
1730 1980 B 0 D 0 N 0
1740 1981 B 0 D 0 N 0
1750 1982 B 0 D 0 N 0
1760 1983 B 0 D 0 N 0
1770 1984 B 0 D 0 N 0
1780 M1020
1790 L 1 U 694. X 7.77
1800 HSC 6. WI 40. XMI 6000. FAIL 1.29
1810 FMI 100. AGPP 325. MLIN 1 NCAL 2
1820 1975 B 0 D 0 N 0
```

Subject: Data Files GRP1B2 (continued)

```
1530 1976 B 0 D 0 N 0
1540 1977 B 0 D 0 N 0
1550 1978 B 0 D 0 N 0
1560 1979 B 0 D 0 N 0
1570 1980 B 0 D 0 N 0
1580 1981 B 0 D 0 N 0
1590 1982 B 0 D 0 N 0
1900 1983 B 0 D 0 N 0
1910 1984 B 0 D 0 N 0
1920 G1150B
1930 LCAL 0 UC0S 1150. XMH 6.66
1940 HSC 2.66 WT 40. XMI 6000. FAIL 1.11
1950 FMII 100. AGPP 325. MLIN 1 NCAL 2
1960 1975 B 0 D 0 N 0
1970 1976 B 0 D 0 N 0
1980 1977 B 0 D 0 N 0
1990 1978 B 0 D 0 N 0
2000 1979 B 0 D 0 N 0
2010 1980 B 0 D 0 N 0
2020 1981 B 0 D 0 N 0
2030 1982 B 0 D 0 N 0
2040 1983 B 0 D 0 N 0
2050 1984 B 0 D 0 N 0
2060 G1191B
2070 LCAL 1 UC0S 1393. XMH 14.5
2080 HSC 9.32 WT 29. XMI 6000. FAIL 2.42
2090 FMI 100. AGPP 325. MLIN 1 NCAL 4
3000 1975 B 0 D 0 N 0
3010 1978 B 0 D 0 N 0
3020 1979 B 0 D 0 N 0
3030 1980 B 0 D 0 N 0
3040 1981 B 0 D 0 N 0
3050 1982 B 0 D 0 N 0
3060 1983 B 0 D 0 N 0
3070 1984 B 0 D 0 N 0
3080 1983 B 0 D 0 N 0
3090 1984 B 0 D 0 N 0
3100 C2565A
3110 LCAL 1 UCW0 560. XMH 6.66
3120 HSC 3.26 WT 40. XMI 6000. FAIL 1.11
3130 FMI 100. AGPP 325. MLIN 1 NCAL 2
```

Subject: Data Files GRP1B2 (continued)

```
3140 1975 B 0 D 0 N 16
3150 1976 B 0 D 0 N 16
3160 1977 B 0 D 0 N 16
3170 1978 B 0 D 16 N 16
3180 1979 B 0 D 0 N 0
3190 1980 B 0 D 0 N 0
3200 1981 B 0 D 0 N 0
3210 1982 B 0 D 0 N 0
3220 1983 B 0 D 0 N 0
3230 1984 B 0 D 0 N 0
3240 S3F112A
3250 LCAL 1 UCS0 1400. XMH 6.69
3260 HSC 3.92 WI 40. XMI 6000. FAIL 1.1
3270 FMI 100. AGPP 325. MLIN 1 NCAL 2
3280 1975 B 0 D 0 N 0
3290 1976 B 0 D 0 N 0
3300 1977 B 0 D 0 N 0
3310 1978 B 0 D 0 N 0
3320 1979 B 0 D 0 N 0
3330 1980 B 0 D 0 N 0
3340 1981 B 0 D 0 N 0
3350 1982 B 0 D 0 N 0
3360 1983 B 0 D 0 N 0
3370 1984 B 0 D 0 N 0
3380 H3734A
3390 LCAL 1 UCS5 1100. XMH 3.49
3400 HSC 4.64 WI 40. XMI 7000. FAIL .58
3410 FMI 75. AGPP 325. MLIN 1 NCAL 2
3420 1975 B 0 D 0 N 0

3430 1976 B 0 D 0 N 0
3440 1977 B 0 D 0 N 0
3450 1978 B 0 D 0 N 0
3460 1979 B 0 D 0 N 0
3470 1980 B 0 D 0 N 0
3480 1981 B 0 D 0 N 0
3490 1982 B 0 D 0 N 0
3500 1983 B 0 D 0 N 0
3510 1984 B 0 D 0 N 0
3520 M59
3530 L 1 C 420. X .7
3540 HSC 3.1 WI 40. XMI 3667. FAIL .12
3550 FMI 40. AGPP 325. MLIN 1 NCAL 2
```

Subject: Data Files GRP1B2 (continued)

```
3560 1975 B 0 D 0 N 0
3570 1976 B 0 D 0 N 0
3580 1977 B 0 D 0 N 0
3590 1978 B 0 D 0 N 0
3600 1979 B 0 D 0 N 0
3610 1980 B 0 D 0 N 0
3620 1981 B 0 D 0 N 0
3630 1982 B 0 D 0 N 0
3640 1983 B 0 D 0 N 0
3650 1984 B 0 D 0 N 0
3660 H523D
3670 L 1 0 1904. X 7.91
3680 HSC 7.84 WI 40. XMI 4250. FAIL 1.32
3690 FMI 55. AGPP 325. MLIN 1 NCAL 4
3700 1975 B 0 D 0 N 0
3710 1976 B 0 D 0 N 0
3720 1977 B 0 D 0 N 0
3730 1978 B 0 D 0 N 0
3740 1979 B 0 D 0 N 0
3750 1980 B 0 D 0 N 0
3760 1981 B 0 D 0 N 0
3770 1982 B 0 D 0 N 0
3780 1983 B 0 D 0 N 0
3790 1984 B 0 D 0 N 0
3800 H5211A
3810 LCAL 1 UC0S 765. XMH 2.03
3820 HSC 7.1 WI 21. XMI 4000. FAIL .34
3830 FMI 49. AGPP 325. MLIN 1 NCAL 4
3840 1975 B 0 D 0 N 7
3850 1976 B 0 D 0 N 7
3860 1977 B 0 D 7 N 7
3870 1978 B 0 D 0 N 0
3880 1979 B 0 D 0 N 0
3890 1980 B 0 D 0 N 0
3900 1981 B 0 D 0 N 0
3910 1982 B 0 D 0 N 0
3920 1983 B 0 D 0 N 0
3930 1984 B 0 D 0 N 0
3940 H5212A
3950 LCAL 1 UC0S 1330. XMH 5.66
3960 HSC 3.84 WI 22. XMI 6667. FAIL .98
3970 FMI 83. AGPP 325. MLIN 1 NCAL 2
```

Subject: Data Files GRP1B2 (continued)

```
3980 1975 B 0 D 0 N 0
3990 1976 B 0 D 0 N 0
4000 1977 B 0 D 0 N 0
4100 1978 B 0 D 0 N 0
4110 1979 B 0 D 0 N 0
4120 1980 B 0 D 0 N 0
4130 1981 B 0 D 0 N 0
4140 1982 B 0 D 0 N 0
4150 1983 B 0 D 0 N 0
4160 1984 B 0 D 0 N 0
4170 H5221B
4180 LCAL 1 UC0S 980. XMH 6.91
4190 HSC 3.8 WI 6.5 XMI 6667. FAIL 1.15
4200 FMI 83. AGPP 325. MLIN 1 NCAL 2
4210 1975 B 0 D 0 N 0
4220 1976 B 0 D 0 N 0
4230 1977 B 0 D 0 N 0
4240 1978 B 0 D 0 N 0
4250 1979 B 0 D 0 N 0
4260 1980 B 0 D 0 N 0
4270 1981 B 0 D 0 N 0
4280 1982 B 0 D 0 N 0
4290 1983 B 0 D 0 N 0
4300 1984 B 0 D 0 N 0
4310 H5243L
4320 LCAL 1 UC0S 3150. XMH 10.1
4330 HSC 10.43 WI 40. XMI 6333. FAIL 1.68
4340 FMI 92. AGPP 325. MLIN 1 NCAL 4
4350 1975 B 0 D 0 N 0
4360 1976 B 0 D 0 N 0
4370 1977 B 0 D 0 N 0
4380 1978 B 0 D 0 N 0
4390 1979 B 0 D 0 N 0
4400 1980 B 0 D 0 N 0
4410 1981 B 0 D 0 N 0
4420 1982 B 0 D 0 N 0
4430 1983 B 0 D 0 N 0
4440 1984 B 0 D 0 N 0
4450 C602A
4460 LCAL 1 UC0S 1475. XMH 6.68
4470 HSC 7.84 WI 40. XMI 6000. FAIL 1.1
4480 FMI 100. AGPP 325. MLIN 1 NCAL 4
```

Subject: Data Files GRP1B2 (continued)

```
4490 1975 B 0 D 0 N 0
4500 1976 B 0 D 0 N 2
4510 1977 B 0 D 0 N 2
4520 1978 B 0 D 0 N 0
4530 1979 B 0 D 0 N 0
4540 1980 B 0 D 0 N 0
4550 1981 B 0 D 0 N 0
4560 1982 B 0 D 0 N 0
4570 1983 B 0 D 0 N 0
4580 1984 B 0 D 0 N 0
4590 A6H86
4600 LCAL 1 UC0S 1680. XMH 6.68
4610 HSC 2.0 WI 40. XMI 7333. FAIL 1.1
4620 FMI 67. AGPP 325. MLIN 1 NCAL 4
4630 1975 B 0 D 0 N 0
4640 1976 B 0 D 0 N 0
4650 1977 B 0 D 0 N 0
4660 1978 B 0 D 0 N 0
4670 1979 B 0 D 0 N 0
4680 1980 B 0 D 0 N 0
4690 1981 B 0 D 0 N 0
4700 1982 B 0 D 0 N 0
4710 1983 B 0 D 0 N 0
4720 1984 B 0 D 0 N 0
4730 S6152
4740 LCAL 1 UC0S 2072. XMH 6.68
4750 HSC 3.84 WI 40. XMI 6000. FAIL 1.1
4760 FMI 100. AGPP 325. MLIN 1 NCAL 2
4770 1975 B 0 D 0 N 0
4780 1976 B 0 D 0 N 0
4790 1977 B 0 D 0 N 0
4800 1978 B 0 D 0 N 0
4810 1979 B 0 D 0 N 0
4820 1980 B 0 D 0 N 0
4830 1981 B 0 D 0 N 0
4840 1982 B 0 D 0 N 0
4850 1983 B 0 D 0 N 0
4860 1984 B 0 D 0 N 0
4870 S6316A
4880 LCAL 1 UC0S 2590. XMH 6.68
4890 HSC 5.34 WI 40. XMI 5906. FAIL 1.1
4900 FMI 47. AGPP 325. MLIN 1 NCAL 2
```

Subject: Data Files GRP1B2 (continued)

```
4910 1975 B 0 D 0 N 16
4920 1976 B 0 D 0 N 16
4930 1977 B 0 D 0 N 16
4940 1978 B 0 D 16 N 16
4950 1979 B 0 D 0 N 0
4960 1980 B 0 D 0 N 0
4970 1981 B 0 D 0 N 0
4980 1982 B 0 D 0 N 0
4990 1983 B 0 D 0 N 0
5000 1984 B 0 D 0 N 0
5010 C800A
5020 LCAL 1 UC0S 1350. XMH 6.68
5030 HSC 7.0 WI 40. XMI 6000. FAIL 1.1
5040 FMI 100. AGPP 325. MLIN 1 NCAL 4
5050 1975 B 0 D 0 N 0
5060 1976 B 0 D 0 N 0
5070 1977 B 0 D 0 N 0
5080 1978 B 0 D 0 N 0
5090 1979 B 0 D 0 N 0
5100 1980 B 0 D 0 N 0
5110 1981 B 0 D 0 N 0
5120 1982 B 0 D 0 N 0
5130 1983 B 0 D 0 N 0
5140 1984 B 0 D 0 N 0
```

Subject: Data Files; GRPC4

```
10 GRPC4 DATA FILE
25 NFIL 6
100 A432A
110 LCAL 1 UCOS 625. XMH 1.83
120 HSC 3. WI 11.5 XMI 6413. FAIL .61
130 FMI 88. AGPP 150. MLIN 1 NCAL 2
140 1975 B 29 D 0 N 29
150 1976 B 30 D 0 N 59
160 1977 B 45 D 0 N 104
170 1978 B 68 D 0 N 172
180 1979 B 45 D 0 N 217
190 1980 B 30 D 0 N 247
200 1981 B 30 D 0 N 277
210 1982 B 30 D 0 N 307
220 1983 B 8 D 0 N 315
230 1984 B 0 D 315 N 315
240 CRM98
250 LCAL 0 UCOS 625. XMH 2.74
260 HSC 7.1 WI 16. XMI 5914. FAIL .91
270 FMI 88. AGPP 150. MLIN 1 NCAL 4
280 1975 B 0 D 30 N 109
290 1976 B 0 D 45 N 79
300 1977 B 0 D 33 N 33
310 1978 B 0 D 0 N 0
320 1979 B 0 D 0 N 0
330 1980 B 0 D 0 N 0
340 1981 B 0 D 0 N 0
350 1982 B 0 D 0 N 0
360 1983 B 0 D 0 N 0
370 1984 B 0 D 0 N 0
380 USM161
390 LCAL 1 UCOS 902. XMH 2.74
400 HSC 6.64 WI 16. XMI 5807. FAIL .91
410 FMI 37. AGPP 150. MLIN 1 NCAL 4
420 1975 B 0 D 0 N 0
430 1976 B 0 D 0 N 0
440 1977 B 0 D 0 N 0
450 1978 B 0 D 0 N 0
460 1979 B 0 D 0 N 0
470 1980 B 0 D 0 N 0
480 1981 B 0 D 0 N 0
490 1982 B 0 D 0 N 0
500 1983 B 0 D 0 N 0
510 1984 B 0 D 0 N 0
```

Subject: Data Files; GRPC4 (Continued)

```
520 USM260
530 LCAL 1 UC05 625. XMH 2.74
540 HSC 4. WI 12. XMI 6736. FAIL .91
550 FMI 37. AUPP 150. MLIN 1 NCAL 2
560 1975 B 0 L 0 N 74
570 1976 B 0 D 0 N 74
580 1977 B 0 D 35 N 74
590 1978 B 0 D 39 N 39
600 1979 B 0 D 0 N 0
610 1980 B 0 D 0 N 0
615 1981 B 0 D 0 N 0
620 1982 B 0 D 0 N 0
630 1983 B 0 D 0 N 0
640 1984 B 0 D 0 N 0
660 IS125A
670 LCAL 0 UC05 487. XMH 2.74
680 HSC 1.3 WI 12. XMI 2500. FAIL .91
690 FMI 10. AUPP 150. MLIN 1 NCAL 1
700 1975 B 0 D 0 N 0
710 1976 B 0 D 0 N 0
720 1977 B 0 D 0 N 0
730 1978 B 0 D 0 N 0
740 1979 B 0 D 0 N 0
750 1980 B 0 D 0 N 0
760 1981 B 0 D 0 N 0
770 1982 B 0 D 0 N 0
780 1983 B 0 D 0 N 0
790 1984 B 0 D 0 N 0
800 H431B
810 LCAL 1 UC05 618. XMH 2.37
820 HSC 6.56 WI 12. XMI 6518. FAIL .79
830 FMI 58. AUPP 150. MLIN 1 NCAL 4
840 1975 B 0 D 0 N 55
850 1976 B 0 D 0 N 55
860 1977 B 0 D 0 N 55
870 1978 B 0 D 6 N 55
880 1979 B 0 D 30 N 49
890 1980 B 0 D 19 N 19
900 1981 B 0 D 0 N 0
910 1982 B 0 D 0 N 0
920 1983 B 0 D 0 N 0
930 1984 B 0 D 0 N 0
940 G454A
```

Subject: Data Files; GRPC4 (Continued)

```
950 LCAL 1 UCCS 625. XMH 4.31
960 HSC 3.82 WI 12. XMI 5581. FAIL 1.4
970 FMI 85. ACPP 150. MLIN 1 NCAL 2
980 1975 B 0 D 0 N 49
990 1976 B 0 D 0 N 49
1000 1977 B 0 D 0 N 49
1010 1978 B 0 D 0 N 49
1020 1979 B 0 D 0 N 49
1030 1980 B 0 D 11 N 49
1040 1981 B 0 D 30 N 38
1050 1982 B 0 D 8 N 8
1060 1983 B 0 D 0 N 0
1070 1984 B 0 D 0 N 0
```

Subject: Data Files GRPC5

```
GRPC5 DATA FILE
20 NPIL 6
100 H432A
110 LCAL 1 UC0S 625. XMH 1.83
120 HSC 3. WT 11.5 XMI 6413. FAIL .61
130 FMI 88. AQPP 150. MLIN 1 NCAL 2
140 1975 B 0 D 0 N 0
150 1976 B 0 D 0 N 0
160 1977 B 0 D 0 N 0
170 1978 B 0 D 0 N 0
180 1979 B 0 D 0 N 0
190 1980 B 0 D 0 N 0
200 1981 B 0 D 0 N 0
210 1982 B 0 D 0 N 0
220 1983 B 0 D 0 N 0
230 1984 B 0 D 0 N 0
240 URM98
250 LCAL 0 UC0S 625. XMH 2.74
260 HSC 7.1 WT 16. XMI 5914. FAIL .91
270 FMI 88. AQPP 150. MLIN 1 NCAL 4
280 1975 B 1 D 1 N 109
290 1976 B 30 D 30 N 109
300 1977 B 45 D 45 N 109
310 1978 B 33 D 33 N 109
320 1979 B 0 D 0 N 109
330 1980 B 0 D 0 N 109
340 1981 B 0 D 0 N 109
350 1982 B 0 D 0 N 109
360 1983 B 0 D 0 N 109
370 1984 B 0 D 109 N 109
380 USM161
390 LCAL 1 UC0S 902. XMH 2.74
400 HSC 6.64 WT 16. XMI 5807. FAIL .91
410 FMI 37. AQPP 150. MLIN 1 NCAL 4
420 1975 B 26 D 26 N 26
430 1976 B 0 D 0 N 26
440 1977 B 0 D 0 N 26
450 1978 B 0 D 0 N 26
460 1979 B 0 D 0 N 26
470 1980 B 0 D 0 N 26
480 1981 B 0 D 0 N 26
490 1982 B 0 D 0 N 26
500 1983 B 0 D 0 N 26
510 1984 B 0 D 26 N 26
520 USM260
```

Subject: Data Files GRPC5 (continued)

```
530 LCAL 1 UC0S 625. XMH 2.74
540 HSC 4. WT 12. XMI 6736. FAIL .91
550 FMI 37. AQPP 150. MLIN 1 NCAL 2
560 1975 B 0 D 0 N 74
570 1976 B 0 D 0 N 74
580 1977 B 0 D 0 N 74
590 1978 B 35 D 35 N 74
600 1979 B 39 D 39 N 74
610 1980 B 0 D 0 N 74
620 1981 B 0 D 0 N 74
630 1982 B 0 D 0 N 74
640 1983 B 0 D 0 N 74
650 1984 B 0 D 74 N 74
660 IS125A
670 LCAL 0 UC0S 487. XMH 2.74
680 HSC 1.3 WT 12. XMI 2500. FAIL .91
690 FMI 10. AQPP 150. MLIN 1 NCAL 1
700 1975 B 2 D 2 N 2
710 1976 B 0 D 0 N 2
720 1977 B 0 D 0 N 2
730 1978 B 0 D 0 N 2
740 1979 B 0 D 0 N 2
750 1980 B 0 D 0 N 2
770 1981 B 0 D 0 N 2
780 1982 B 0 D 0 N 2
790 1983 B 0 D 0 N 2
795 1984 B 0 D 2 N 2
800 H431B
810 LCAL 1 UC0S 618. XMH 2.37
820 HSC 6.56 WT 12. XMI 6518. FAIL .79
830 FMI 58. AQPP 150. MLIN 1 NCAL 4
```

Subject: Data Files GRPC5 (continued)

```
840 1975 B 0 D 0 N 55
850 1976 B 0 D 0 N 55
860 1977 B 0 D 0 N 55
870 1978 B 0 D 0 N 55
875 1979 B 6 D 6 N 55
910 1980 B 30 D 30 N 55
912 1981 B 19 D 19 N 55
915 1982 B 0 D 0 N 55
920 1983 B 0 D 0 N 55
930 1984 B 0 D 55 N 55
940 G454A
950 LCAL 1 UC0S 625. XMH 4.31
960 HSC 3.82 WT 12. XMI 5581. FAIL 1.4
970 FMI 85. AQPP 150. MLIN 1 NCAL 2
980 1975 B 0 D 0 N 49
990 1976 B 0 D 0 N 49
1000 1977 B 0 D 0 N 49
1010 1978 B 0 D 0 N 49
1020 1979 B 0 D 0 N 49
1030 1980 B 0 D 0 N 49
1040 1981 B 11 D 11 N 49
1050 1982 B 30 D 30 N 49
1060 1983 B 8 D 8 N 49
1070 1984 B 0 D 49 N 49
```

Subject: Data Files GRP1B3

```
GRP1B3 DATA FILE
50 NP1L 28
100 CP772AU
110 LCAL 1 UC0S 3150. XMH 10.
120 HSC 7.84 WT 40. XMI 6302. FAIL 1.67
130 FMI 56. AOPP 325. MLIN 1 NCAL 4
140 1975 B 0 D 0 N 0
150 1976 B 0 D 0 N 0
160 1977 B 0 D 0 N 0
170 1978 B 0 D 0 N 0
180 1979 B 0 D 0 N 0
190 1980 B 0 D 0 N 0
200 1981 B 0 D 0 N 0
210 1982 B 0 D 0 N 0
220 1983 B 0 D 0 N 0
230 1984 B 0 D 0 N 0
240 TSM16
250 LCAL 1 UC0S 1271. XMH 6.95
260 HSC 7.48 WT 40. XMI 5477. FAIL 1.16
270 FMI 53. AOPP 325. MLIN 1 NCAL 4
280 1975 B 0 D 27 N 136
290 1976 B 27 D 75 N 136
300 1977 B 75 D 34 N 56
310 1978 B 34 D 0 N 136
320 1979 B 0 D 0 N 136
330 1980 B 0 D 0 N 136
340 1981 B 0 D 0 N 136
350 1982 B 0 D 0 N 136
360 1983 B 0 D 0 N 136
370 1984 B 0 D 136 N 136
380 URM79
390 LCAL 1 UC0S 1332. XMH 6.68
400 HSC 5.54 WT 40. XMI 6678. FAIL 1.11
410 FMI 45. AOPP 325. MLIN 1 NCAL 2
420 1975 B 0 D 14 N 14
430 1976 B 14 D 0 N 14
440 1977 B 0 D 0 N 14
450 1978 B 0 D 0 N 14
460 1979 B 0 D 0 N 14
470 1980 B 0 D 0 N 14
480 1981 B 0 D 0 N 14
490 1982 B 0 D 0 N 14
500 1983 B 0 D 0 N 14
510 1984 B 0 D 14 N 14
```

Subject: Data Files GRP1B3 (continued)

```
520 USM26
530 LCAL 1 UC0S 3150. XMH 13.27
540 HSC 8.72 WT 40. XMI 6667. FAIL 2.21
550 FMI 83. AQPP 325. MLIN 1 NCAL 4
560 1975 B 3 D 0 N 3
570 1976 B 0 D 0 N 3
580 1977 B 0 D 0 N 3
590 1978 B 0 D 0 N 3
600 1979 B 0 D 0 N 3
610 1980 B 0 D 0 N 3
620 1981 B 0 D 0 N 3
630 1982 B 0 D 0 N 3
640 1983 B 0 D 0 N 3
650 1984 B 0 D 3 N 3
660 USM102
670 LCAL 1 UC0S 3150. XMH 8.59
680 HSC 3.98 WT 14. XMI 4000. FAIL 1.43
690 FMI 48. AQPP 325. MLIN 1 NCAL 2
700 1975 B 6 D 1 N 7
710 1976 B 1 D 0 N 7
720 1977 B 0 D 0 N 7
730 1978 B 0 D 0 N 7
740 1979 B 0 D 0 N 7
750 1980 B 0 D 0 N 7
760 1981 B 0 D 0 N 7
770 1982 B 0 D 0 N 7
780 1983 B 0 D 0 N 7
790 1984 B 0 D 7 N 7
800 USM159
810 LCAL 1 UC0S 694. XMH 6.68
820 HSC 2.23 WT 40. XMI 4829. FAIL 1.11
830 FMI 28. AQPP 325. MLIN 1 NCAL 1
840 1975 B 0 D 0 N 48
850 1976 B 0 D 0 N 48
860 1977 B 0 D 48 N 48
870 1978 B 48 D 0 N 48
880 1979 B 0 D 0 N 48
890 1980 B 0 D 0 N 48
900 1981 B 0 D 0 N 48
910 1982 B 0 D 0 N 48
920 1983 B 0 D 0 N 48
930 1984 B 0 D 48 N 48
SM07L  U0S 3727. XMH 6.68
960 HSC 4.5 WT 40. XMI 5787. FAIL 1.11
970 FMI 89. AQPP 325. MLIN 1 NCAL 2
```

Subject: Data Files GRP1B3 (continued)

```
960 1975 B 0 D 0 N 194
990 1976 B 0 D 0 N 194
1000 1977 B 0 D 0 N 194
1010 1978 B 0 D 26 N 194
1020 1979 B 28 D 50 N 194
1030 1980 B 50 D 50 N 194
1040 1981 B 50 D 25 N 194
1050 1982 B 25 D 25 N 194
1060 1983 B 25 D 25 N 194
1070 1984 B 16 D 194 N 194
1080 CPU1026
1090 LCAL 1 UCOS 1800. XMH 6.68
1100 HSC 3.92 WI 25. XMI 6000. FAIL 1.1
1110 FMI 100. AGPP 325. MLIN 1 NCAL 2
1120 1975 B 1 D 0 N 1
1130 1976 B 0 D 0 N 1
1140 1977 B 0 D 0 N 1
1150 1978 B 0 D 0 N 1
1160 1979 B 0 D 0 N 1
1170 1980 B 0 D 0 N 1
1180 1981 B 0 D 0 N 1
1190 1982 B 0 D 0 N 1
1200 1983 B 0 D 0 N 1
1210 1984 B 0 D 1 N 1
1220 CPU1033
1230 LCAL 1 UCOS 1450. XMH 4.27
1240 HSC 4.42 WI 25. XMI 7000. FAIL .71
1250 FMI 75. AGPP 325. MLIN 1 NCAL 2
1260 1975 B 5 D 0 N 5
1270 1976 B 0 D 0 N 5
1280 1977 B 0 D 0 N 5
1290 1978 B 0 D 0 N 5
1300 1979 B 0 D 0 N 5
1310 1980 B 0 D 0 N 5
1320 1981 B 0 D 0 N 5
1330 1982 B 0 D 0 N 5
1340 1983 B 0 D 0 N 5
1350 1984 B 0 D 5 N 5
1360 CPU1049
1370 LCAL 1 UCOS 3150. XMH 1.8
1380 HSC 3.54 WI 40. XMI 2818. FAIL .3
1390 FMI 18. AGPP 325. MLIN 1 NCAL 2
```

Subject: Data Files GRP1B3 (continued)

```
1400 1975 B 0 D 0 N 11
1410 1976 B 0 D 0 N 11
1420 1977 B 0 D 11 N 11
1430 1978 B 11 D 0 N 11
1440 1979 B 0 D 0 N 11
1450 1980 B 0 D 0 N 11
1460 1981 B 0 D 0 N 11
1470 1982 B 0 D 0 N 11
1480 1983 B 0 D 0 N 11
1490 1984 B 0 D 11 N 11
1500 FR67
1510 LCAL 1 UC0S 950. XMH 6.68
1520 HSC 1.96 WT 40.. AI 1 FI 77. AOPP 325. MLIN 1 NCAL 2
1540 1975 B 6 D 0 N 6
1550 1976 B 0 D 0 N 6
1560 1977 B 0 D 0 N 6
1570 1978 B 0 D 0 N 6
1580 1979 B 0 D 0 N 6
1590 1980 B 0 D 0 N 6
1600 1981 B 0 D 0 N 6
1610 1982 B 0 D 0 N 6
1620 1983 B 0 D 0 N 6
1630 1984 B 0 D 6 N 6
1640 FR174
1650 LCAL 1 UC0S 1005. XMH 5.78
1660 HSC 3.16 WT 21. XMI 2500. FAIL .96
1670 FMI 10. AOPP 325. MLIN 1 NCAL 2
1680 1975 B 0 D 5 N 5
1690 1976 B 5 D 0 N 5
1700 1977 B 0 D 0 N 5
1710 1978 B 0 D 0 N 5
1720 1979 B 0 D 0 N 5
1730 1980 B 0 D 0 N 5
1740 1981 B 0 D 0 N 5
1750 1982 B 0 D 0 N 5
1760 1983 B 0 D 0 N 5
1770 1984 B 0 D 5 N 5
1780 M1020
1790 L 1 U 694. X 7.77
1800 HSC 6. WT 40. XMI 6000. FAIL 1.29
1810 FMI 100. AOPP 325. MLIN 1 NCAL 2
```

Subject: Data Files GRP1B3 (continued)

```
1820 1975 B 1 D 0 N 1
1830 1976 B 0 D 0 N 1
1840 1977 B 0 D 0 N 1
1850 1978 B 0 D 0 N 1
1860 1979 B 0 D 0 N 1
1870 1980 B 0 D 0 N 1
1880 1981 B 0 D 0 N 1
1890 1982 B 0 D 0 N 1
1900 1983 B 0 D 0 N 1
1910 1984 B 0 D 1 N 1
1920 G1150B
1930 LCAL 0 UCOS 1150. XMH 6.68
1940 HSC 2.66 WT 40. XMI 6000. FAIL 1.11
1950 FMII 100. AUPP 325. MLIN 1 NCAL 2
1960 1975 B 1 D 0 N 1
1970 1976 B 0 D 0 N 1
1980 1977 B 0 D 0 N 1
1990 1978 B 0 D 0 N 1
2000 1979 B 0 D 0 N 1
2010 1980 B 0 D 0 N 1
2020 1981 B 0 D 0 N 1
2030 1982 B 0 D 0 N 1
2040 1983 B 0 D 0 N 1
2050 1984 B 0 D 1 N 1
2060 G1191B
2070 LCAL 1 UCOS 1393. XMH 14.5
2080 HSC 9.32 WT 29. XMI 6000. FAIL 2.42
2090 FMI 100. AUPP 325. MLIN 1 NCAL 4
3000 1975 B 1 D 0 N 1
3010 1976 B 0 D 0 N 1
3020 1977 B 0 D 0 N 1
3030 1978 B 0 D 0 N 1
3040 1979 B 0 D 0 N 1
3050 1980 B 0 D 0 N 1
3055 1981 B 0 D 0 N 1
3070 1982 B 0 D 0 N 1
3080 1983 B 0 D 0 N 1
3090 1984 B 0 D 1 N 1
3100 C2565A
3110 LCAL 1 UCWO 560. XMH 6.68
3120 HSC 3.26 WT 40. XMI 6000. FAIL 1.11
3130 FMI 100. AUPP 325. MLIN 1 NCAL 2
```

Subject: Data Files GRP1B3 (continued)

```
3140 1975 B 0 D 0 N 16
3150 1976 B 0 D 0 N 16
3160 1977 B 0 D 0 N 16
3170 1978 B 0 D 16 N 16
3180 1979 B 16 D 0 N 16
3190 1980 B 0 D 0 N 16
3200 1981 B 0 D 0 N 16
3210 1982 B 0 D 0 N 16
3220 1983 B 0 D 0 N 16
3230 1984 B 0 D 16 N 16
3240 S3F112A
3250 LCAL 1 UCSC 1400. XMH 6.69
3260 HSC 3.92 WT 40. XMI 6000. FAIL 1.1
3270 FMI 100. AQPP 325. MLIN 1 NCAL 2
3280 1975 B 1 D 0 N 1
3290 1976 B 0 D 0 N 1
3300 1977 B 0 D 0 N 1
3310 1978 B 0 D 0 N 1
3320 1979 B 0 D 0 N 1
3330 1980 B 0 D 0 N 1
3340 1981 B 0 D 0 N 1
3350 1982 B 0 D 0 N 1
3360 1983 B 0 D 0 N 1
3370 1984 B 0 D 1 N 1
3380 H3734A
3390 LCAL 1 UCCS 1100. XMH 3.49
3400 HSC 4.64 WT 40. XMI 7000. FAIL .58
3410 FMI 75. AQPP 325. MLIN 1 NCAL 2
3420 1975 B 2 D 0 N 2
3430 1976 B 0 D 0 N 2
3440 1977 B 0 D 0 N 2
3450 1978 B 0 D 0 N 2
3460 1979 B 0 D 0 N 2
3470 1980 B 0 D 0 N 2
3480 1981 B 0 D 0 N 2
3490 1982 B 0 D 0 N 2
3500 1983 B 0 D 0 N 2
3510 1984 B 0 D 2 N 2
3520 M59
3530 L 1 U 420. X .7
3540 HSC 3.1 WT 40. XMI 3667. FAIL .12
3550 FMI 40. AQPP 325. MLIN 1 NCAL 2
```

Subject: Data Files GRP1B3 (continued)

```
3560 1975 B 1 D 0 N 1
3570 1976 B 0 D 0 N 1
3580 1977 B 0 D 0 N 1
3590 1978 B 0 D 0 N 1
3600 1979 B 0 D 0 N 1
3610 1980 B 0 D 0 N 1
3620 1981 B 0 D 0 N 1
3630 1982 B 0 D 0 N 1
3640 1983 B 0 D 0 N 1
3650 1984 B 0 D 1 N 1
3660 H523D
3670 L 1 U 1904. X 7.91
3680 HSC 7.84 WI 40. XMI 4250. FAIL 1.32
3690 FMI 55. AGPP 325. MLIN 1 NCAL 4
3700 1975 B 4 D 0 N 4
3710 1976 B 0 D 0 N 4
3720 1977 B 0 D 0 N 4
3730 1978 B 0 D 0 N 4
3740 1979 B 0 D 0 N 4
3750 1980 B 0 D 0 N 4
3760 1981 B 0 D 0 N 4
3770 1982 B 0 D 0 N 4
3780 1983 B 0 D 0 N 4
3790 1984 B 0 D 4 N 4
3800 H5211A
3810 LCAL 1 UCOS 765. XMH 2.03
3820 HSC 7.1 WI 21. XMI 4000. FAIL .34
3830 FMI 49. AGPP 325. MLIN 1 NCAL 4
3840 1975 B 0 D 0 N 7
3850 1976 B 0 D 0 N 7
3860 1977 B 0 D 7 N 7
3870 1978 B 7 D 0 N 7
3880 1979 B 0 D 0 N 7
3890 1980 B 0 D 0 N 7
3900 1981 B 0 D 0 N 7
3910 1982 B 0 D 0 N 7
3920 1983 B 0 D 0 N 7
3930 1984 B 0 D 7 N 7
3940 H5212A
3950 LCAL 1 UCOS 1330. XMH 5.86
3960 HSC 3.84 WI 22. XMI 6667. FAIL .98
3970 FMI 83. AGPP 325. MLIN 1 NCAL 2
```

Subject: Data Files GRP1B3 (continued)

```
3980 1975 B 6 D 0 N 6
3990 1976 B 0 D 0 N 6
4000 1977 B 0 D 0 N 6
4100 1978 B 0 D 0 N 6
4110 1979 B 0 D 0 N 6
4120 1980 B 0 D 0 N 6
4130 1981 B 0 D 0 N 6
4140 1982 B 0 D 0 N 6
4150 1983 B 0 D 0 N 6
4160 1984 B 0 D 6 N 6
4170 H5221B
4180 LCAL 1 UC0S 980. XMH 6.91
4190 HSC 3.8 WI 6.5 XMI 6667. FAIL 1.15
4200 FMI 83. AUPP 325. MLIN 1 NCAL 2
4210 1975 B 0 D 0 N 3
4220 1976 B 0 D 0 N 3
4230 1977 B 0 D 3 N 3
4240 1978 B 3 D 0 N 3
4250 1979 B 0 D 0 N 3
4260 1980 B 0 D 0 N 3
4270 1981 B 0 D 0 N 3
4280 1982 B 0 D 0 N 3
4290 1983 B 0 D 0 N 3
4300 1984 B 0 D 3 N 3
4310 H5243L
4320 LCAL 1 UC0S 3150. XMH 10.1
4330 HSC 10.43 WI 40. XMI 6333. FAIL 1.68
4340 FMI 92. AUPP 325. MLIN 1 NCAL 4
4350 1975 B 6 D 0 N 6
4360 1976 B 0 D 0 N 6
4370 1977 B 0 D 0 N 6
4380 1978 B 0 D 0 N 6
4390 1979 B 0 D 0 N 6
4400 1980 B 0 D 0 N 6
4410 1981 B 0 D 0 N 6
4420 1982 B 0 D 0 N 6
4430 1983 B 0 D 0 N 6
4440 1984 B 0 D 6 N 6
4450 C602A
4460 LCAL 1 UC0S 1475. XMH 6.68
4470 HSC 7.84 WI 40. XMI 6000. FAIL 1.1
4480 FMI 100. AUPP 325. MLIN 1 NCAL 4
```

Subject: Data Files GRP1B3 (continued)

```
4490 1975 B 2 D 0 N 2
4500 1976 B 0 D 0 N 2
4510 1977 B 0 D 0 N 2
4520 1978 B 0 D 0 N 2
4530 1979 B 0 D 0 N 2
4540 1980 B 0 D 0 N 2
4550 1981 B 0 D 0 N 2
4560 1982 B 0 D 0 N 2
4570 1983 B 0 D 0 N 2
4580 1984 B 0 D 2 N 2
4590 A6H86
4600 LCAL 1 UC0S 1680. XMH 6.68
4610 HSC 2.0 WT 40. XMI 7333. FAIL 1.1
4620 FMI 67. AQPP 325. MLIN 1 NCAL 4
4630 1975 B 3 D 0 N 3
4640 1976 B 0 D 0 N 3
4650 1977 B 0 D 0 N 3
4660 1978 B 0 D 0 N 3
4670 1979 B 0 D 0 N 3
4680 1980 B 0 D 0 N 3
4690 1981 B 0 D 0 N 3
4700 1982 B 0 D 0 N 3
4710 1983 B 0 D 0 N 3
4720 1984 B 0 D 3 N 3
4730 S6152
4740 LCAL 1 UC0S 2072. XMH 6.68
4750 HSC 3.84 WT 40. XMI 6000. FAIL 1.1
4760 FMI 100. AQPP 325. MLIN 1 NCAL 2
4770 1975 B 3 D 0 N 3
4780 1976 B 0 D 0 N 3
4790 1977 B 0 D 0 N 3
4800 1978 B 0 D 0 N 3
4810 1979 B 0 D 0 N 3
4820 1980 B 0 D 0 N 3
4830 1981 B 0 D 0 N 3
4840 1982 B 0 D 0 N 3
4850 1983 B 0 D 0 N 3
4860 1984 B 0 D 3 N 3
4870 S6316A
4880 LCAL 1 UC0S 2590. XMH 6.68
4890 HSC 5.34 WT 40. XMI 5906. FAIL 1.1
4900 FMI 47. AQPP 325. MLIN 1 NCAL 2
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Subject: Data Files GRP1B3 (continued)

```
4910 1975 B 0 D 0 N 16
4920 1976 B 0 D 0 N 16
4930 1977 B 0 D 0 N 16
4940 1978 B 0 D 16 N 16
4950 1979 B 16 D 0 N 16
4960 1980 B 0 D 0 N 16
4970 1981 B 0 D 0 N 16
4980 1982 B 0 D 0 N 16
4990 1983 B 0 D 0 N 16
5000 1984 B 0 D 16 N 16
5010 C800A
5020 LCAL 1 UC0S 1350. XMH 6.68
5030 HSC 7.0 WT 40. XMI 6000. FAIL 1.1
5040 FMI 100. AGPP 325. MLIN 1 NCAL 4
5050 1975 B 1 D 0 N 1
5060 1976 B 0 D 0 N 1
5070 1977 B 0 D 0 N 1
5080 1978 B 0 D 0 N 1
5090 1979 B 0 D 0 N 1
5100 1980 B 0 D 0 N 1
5110 1981 B 0 D 0 N 1
5120 1982 B 0 D 0 N 1
5130 1983 B 0 D 0 N 1
5140 1984 B 0 D 1 N 1
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Subject: Data Files GRPA8

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GRPA8 DATA FILE
00110 NFIL 11
00120 USM366
00130 LCAL 1 UCOS 4500. AMH 5.33
00140 HSC 8.06 WI 48. AMI 6056. FAIL .89
00150 FMI 55. AGPP 310. MLIN 1 NCAL 2
160 1975 B 4 D 0 N 4
170 1976 B 5 D 0 N 9
180 1977 B 8 D 0 N 17
190 1978 B 10 D 0 N 27
200 1979 B 1 D 0 N 28
210 1980 B 0 D 0 N 28
220 1981 B 0 D 0 N 28
230 1982 B 0 D 0 N 28
240 1983 B 0 D 0 N 28
250 1984 B 0 D 0 N 28
00260 UPM84
00270 LCAL 1 UCOS 8624. AMH 5.33
00280 HSC 8.06 WI 50. AMI 5500. FAIL .89
00290 FMI 55. AGPP 310. MLIN 1 NCAL 2
300 1975 B 0 D 0 N 3
310 1976 B 0 D 3 N 3
320 1977 B 0 D 0 N 0
330 1978 B 0 D 0 N 0
340 1979 B 0 D 0 N 0
350 1980 B 0 D 0 N 0
360 1981 B 0 D 0 N 0
370 1982 B 0 D 0 N 0
380 1983 B 0 D 0 N 0
390 1984 B 0 D 0 N 0
00400 UU2A
00410 LCAL 1 UCOS 13785. AMH 8.98
00420 HSC 6.02 WI 135. AMI 8000. FAIL 1.5
00430 FMI 50. AGPP 310. MLIN 1 NCAL 2
440 1975 B 0 D 4 N 4
450 1976 B 0 D 0 N 0
460 1977 B 0 D 0 N 0
470 1978 B 0 D 0 N 0
480 1979 B 0 D 0 N 0
490 1980 B 0 D 0 N 0
500 1981 B 0 D 0 N 0
510 1982 B 0 D 0 N 0
520 1983 B 0 D 0 N 0
530 1984 B 0 D 0 N 0
00540 LCA6
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Subject: Data Files GRPA8 (continued)

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00550 LCAL 1 UCOS 8000. XMH 5.33
00560 HSC 8.08 WI 50. XMI 8000. FAIL .89
00570 FMI 50. AGPP 310. MLIN 1 NCAL 2
580 1975 B O D O N O
590 1976 B O D O N O
600 1977 B O D O N O
610 1978 B O D O N O
620 1979 B O D O N O
630 1980 B O D O N O
640 1981 B O D O N O
650 1982 B O D O N O
660 1983 B O D  N O
670 1984 B O D O N O
00680 A1A5
685 LCAL 1 UCOS 4675. XMH 5.33
00690 HSC 8. WI 50. XMI 8000. FAIL .89
00710 FMI 50. APPP 310. MLIN 1 NCAL 4
720 1975 B O D O N O
730 1976 B O D O N O
740 1977 B O D O N O
750 1978 B O D O N O
760 1979 B O D O N O
770 1980 B O D O N O
780 1981 B O D O N O
790 1982 B O D O N O
800 1983 B O D O N O
810 1984 B O D O N O
00820 SA64
00830 LCAL 1 UCOS 8827. XMH 5.33
00840 HSC 23.08 WI 50. XMI 8000. FAIL .89
00850 FMI 50. AGPP 310. MLIN 1 NCAL 4
860 1975 B O D O N O
870 1976 B O D O N O
880 1977 B O D O N O
890 1978 B O D O N O
900 1979 B O D O N O
910 1980 B O D O N O
920 1981 B O D O N O
930 1982 B O D O N O
940 1983 B O D O N O
950 1984 B O D O N O
00960 TSAW2
00970 LCAL 1 UCOS 13785. XMH 3.79
00980 HSC 18. WI 50. XMI 8000. FAIL .63
00990 FMI 50. AGPP 310. MLIN 4 NCAL 4
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Subject: Data Files GRPA8 (continued)

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1000 1975 B 0 D 0 N 0
1010 1976 B 0 D 0 N 0
1020 1977 B 0 D 0 N 0
1030 1978 B 0 D 0 N 0
1040 1979 B 0 D 0 N 0
1050 1980 B 0 D 0 N 0
1060 1981 B 0 D 0 N 0
1070 1982 B 0 D 0 N 0
1080 1983 B 0 D 0 N 0
1090 1984 B 0 D 0 N 0
1095 L20
01100 LOAL 1 LOCS 4650. AMR 6.2
01110 MSC 19.04 VI 50. AMI 4000. FAIL .97
01120 FMI 30. AUPT 310. MLIN 2 AOAL 4
1130 1975 B 0 D 0 N 2
1140 1976 B 0 D 2 N 2
1150 1977 B 0 D 0 N 0
1160 1978 B 0 D 0 N 0
1170 1979 B 0 D 0 N 0
1180 1980 B 0 D 0 N 0
1190 1981 B 0 D 0 N 0
1195 1982 B 0 D 0 N 0
1200 1983 B 0 D 0 N 0
1210 1984 B 0 D 0 N 0
1215 L30
01220 LOAL 1 LOCS 4650. AMR 11.59
01230 MSC 19.04 VI 50. AMI 2500. FAIL 1.93
01240 FMI 10. AUPT 310. MLIN 1 AOAL 4
1250 1975 B 0 D 1 N 1
1260 1976 B 0 D 0 N 0
1270 1977 B 0 D 0 N 0
1280 1978 B 0 D 0 N 0
1290 1979 B 0 D 0 N 0
1300 1980 B 0 D 0 N 0
1310 1981 B 0 D 0 N 0
1320 1982 B 0 D 0 N 0
1330 1983 B 0 D 0 N 0
1340 1984 B 0 D 0 N 0
01350 L40
01360 LOAL 0 LOCS 4650. AMR 14.13
01370 MSC 10.2 VI 50. AMI 6000. FAIL 2.35
01380 FMI 50. AUPT 310. MLIN 1 AOAL 4
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Subject: Data Files GRPA8 (continued)

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1390 1975 B 0 D 0 N 25
1400 1976 B 0 D 0 N 25
1410 1977 B 0 D 0 N 25
1420 1978 B 0 D 7 N 25
1430 1979 B 7 D 5 N 25
1440 1980 B 5 D 5 N 25
1450 1981 B 5 D 4 N 25
1460 1982 B 4 D 2 N 25
1470 1983 B 2 D 2 N 25
1480 1984 B 2 D 25 N 25
01490 H651B
01500 LCAL 1 UCOS 7262. XMH 4.98
1510 HSC 17.24 WI 134. XMI 5000. FAIL .83
01520 FMI 65. AOPP 310. MLIN 1 MCAL 4
1530 1975 B 0 D 0 N 2
1540 1976 B 0 D 2 N 2
1550 1977 B 0 D 0 N 0
1560 1978 B 0 D 0 N 0
1570 1979 B 0 D 0 N 0
1580 1980 B 0 D 0 N 0
1590 1981 B 0 D 0 N 0
1600 1982 B 0 D 0 N 0
1610 1983 B 0 D 0 N 0
1620 1984 B 0 D 0 N 0
01630 H651A
01640 LCAL 1 UCOS 9500. XMH 5.15
01650 HSC 17.64 WI 48. XMI 2500. FAIL .86
01660 FMI 10. AOPP 310. MLIN 1 MCAL 4
1670 1975 B 0 D 0 N 12
1680 1976 B 0 D 1 N 11
1690 1977 B 0 D 10 N 10
1700 1978 B 0 D 1 N 1
1710 1979 B 0 D 0 N 0
1720 1980 B 0 D 0 N 0
1730 1981 B 0 D 0 N 0
1740 1982 B 0 D 0 N 0
1750 1983 B 0 D 0 N 0
1760 1984 B 0 D 0 N 0
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APPENDIX A-3

LCC COMPUTATIONS

Scenario	Option	Case	TMDE Group	Description	Page No.
1	-	-	A	LCC of PIL TMDE and non-PIL TMDE	A.3-3
1	-	-	B	LCC of PIL TMDE and non-PIL TMDE	A.3-4 to A.3-7
1	-	-	C	LCC of PIL TMDE and non-PIL TMDE	A.3-8
3	1	-	A	PIL Phased-in to Replace non-PIL TMDE; USACC Plan	A.3-9
3	2	-	A	Non-PIL Phased-in to Replace non-PIL TMDE; USACC Plan	A.3-10
3	3	-	A	Phase-in of PIL and non-PIL mix to replace non-PIL TMDE; USACC Plan	A.3-11
3	1	-	B	PIL Phased-in to Replace non-PIL TMDE; USACC Plan	A.3-12 to A.3-15
3	2	-	B	Non-PIL Phased-in to Replace non-PIL TMDE; USACC Plan	A.3-16 to A.3-19
2	1	-	A	PIL Phased-in to replace non-PIL TMDE (10%)	A.3-20
2	2	-	A	Non-PIL Phased-in to replace non-PIL TMDE (10%)	A.3-21
2	3	-	A	Phase-in of PIL and non-PIL mix to replace non-PIL TMDE (10%)	A.3-22
3	1	-	C	PIL TMDE Phased-in to Replace non-PIL TMDE; USACC Plan	A.3-23
3	2	-	C	Non-PIL TMDE Phased-in to Replace non-PIL TMDE; USACC Plan	A.3-24
1	-	1	A	Initial Consumables Stockage for PIL TMDE	A.3-25
1	-	2	A	LCC of PIL TMDE and non-PIL TMDE with 0% Inflation	A.3-26

CASE EXERCISES

PHASE III ECONOMIC ANALYSIS OF TMDE

Subject: Computer Run; Group A, Scenario 1 - Total life cycle costs of PIL (USM366) and non-PIL TMDE

PIL NO.	YEAR	COST	CUMCOST
USM366	1		
	1975	499778.53	499778.53
	1976	229067.53	728846.12
	1977	226838.33	955684.45
	1978	224809.97	1180494.42
	1979	215124.16	1395618.57
	1980	203953.62	1599572.19
	1981	194302.01	1793861.20
	1982	184719.66	1978580.86
	1983	175273.19	2153854.07
	1984	150881.24	2304735.31

NON-PIL GROUP COSTS

YEAR	COST	CUMCOST
1975	1206966.63	1206966.63
1976	325084.48	1532051.10
1977	321918.07	1853969.17
1978	319039.52	2173008.69
1979	305300.98	2478309.67
1980	289441.16	2767750.83
1981	275744.09	3043494.93
1982	262145.30	3305640.23
1983	248740.15	3554380.40
1984	212789.17	3767169.57

NPIL LIFE CYCLE TOTALS		PIL LIFE CYCLE TOTALS	
TRAINING	99644.31	TRAINING	10829.80
PURCHASE	326639.09	PURCHASE	217781.22
PERSONNEL	1563338.22	PERSONNEL	1285199.25
FIRST DEST	3925.41	FIRST DEST	2367.77
TRANSPORT	1172.05	TRANSPORT	347.99
CONSUMBLES	543528.52	CONSUMBLES	219366.11
INTRODUCT	24596.49	INTRODUCT	2077.37
HOLDING	681218.90	HOLDING	453520.95
DOCUMENTS	542500.00	DOCUMENTS	49316.18
INSTALL	4577.27	INSTALL	4577.27
DISPOSAL	-24170.66	DISPOSAL	-16091.61

PHASE III ECONOMIC ANALYSIS OF TMDE

Subject: Computer Run ; Group 1 B, Scenario 1 - Total life cycle costs of PIL (CP772AU) and non-PIL TMDE

ITEM NO.	YEAR	COST	CUMCOST
CP772AU	1		
	1975	3654768.22	3654768.22
	1976	2124768.55	5779536.77
	1977	2104072.75	7883609.52
	1978	2082258.39	9965867.91
	1979	1995462.57	11964330.48
	1980	1691802.18	13656132.66
	1981	1602277.29	15258409.95
	1982	1713394.93	17371804.88
	1983	1625778.15	18997583.03
	1984	1441666.08	20439249.11

NON-PIL GROUP COSTS

YEAR	COST	CUMCOST
1975	4671908.94	4671908.94
1976	2126462.79	6798371.73
1977	2105750.49	8904122.23
1978	2086921.13	10991043.36
1979	1997053.71	12988097.07
1980	1693310.66	14681407.74
1981	1603714.39	16285122.13
1982	1714761.16	18399883.29
1983	1627074.51	20026957.79
1984	1472440.60	21499398.39

NPIL LIFE CYCLE TOTALS		PIL LIFE CYCLE TOTALS	
TRAINING	975438.57	TRAINING	1010765.36
PURCHASE	1054420.91	PURCHASE	1452436.36
PERSONNEL	14466911.54	PERSONNEL	12202168.27
FIRST DEST	16615.97	FIRST DEST	19519.24
TRANSPORT	7376.43	TRANSPORT	5268.57
CONSUMBLES	1320414.08	CONSUMBLES	2739968.32
INTRODUCE	58166.26	INTRODUCE	2077.37
HOLDING	2186376.03	HOLDING	3018909.29
DOCUMENTS	1447727.27	DOCUMENTS	51704.55
INSTALL	43527.27	INSTALL	43527.27
DISPOSAL	-77575.95	DISPOSAL	-107115.49

Subject: Computer Run; Group 2 B, Scenario 1 - Total life cycle costs of PIL (CV2002) and non-PIL TMDE

LIFE NO.	YEAR	COST	CUMCOST
CV72002	1		
	1975	294677.27	294677.27
	1976	211912.34	506589.61
	1977	209848.26	716437.87
	1978	207971.82	924409.69
	1979	199016.10	1123425.79
	1980	188677.60	1312103.39
	1981	179748.90	1491852.29
	1982	170884.28	1662736.57
	1983	162145.88	1824882.44
	1984	150452.21	1975334.65

NON-PIL GROUP COSTS

YEAR	COST	CUMCOST
1975	470871.25	470871.25
1976	256187.27	727058.53
1977	253691.94	980750.47
1978	251423.46	1232173.93
1979	240596.61	1472770.54
1980	228098.09	1700868.63
1981	217303.91	1918172.54
1982	206587.20	2124759.73
1983	196023.08	2320782.81
1984	182011.43	2502794.24

NPIL LIFE CYCLE TOTALS		PIL LIFE CYCLE TOTALS	
TRAINING	140384.08	TRAINING	140384.08
PURCHASE	64976.16	PURCHASE	55383.64
PERSONNEL	1976154.04	PERSONNEL	1621322.91
FIRST TEST	526.03	FIRST TEST	521.60
TRANSPORT	51.45	TRANSPORT	25.19
CONSUMBLES	30483.63	CONSUMBLES	16602.44
INTRODUCE	12464.20	INTRODUCE	2077.37
HOLDING	133253.39	HOLDING	113142.54
DOCUMENTS	143181.82	DOCUMENTS	23883.64
INSTALL	6045.45	INSTALL	6045.45
DISPOSAL	-4728.03	DISPOSAL	-4014.47

PHASE III ECONOMIC ANALYSIS OF TMDE

Subject: Computer Run; Group 3 B, Scenario 1 - Total life cycle costs of PIL (CV2003BU) and non-PIL TMDE

LIFE NO.	YEAR	COST	CUMCOST
CV2003BU	1		
	1975	120919.99	120919.99
	1976	70897.74	191817.73
	1977	70207.17	262024.90
	1978	69579.39	331604.29
	1979	66583.15	398187.44
	1980	63124.28	461311.73
	1981	60137.08	521448.81
	1982	57171.32	578620.13
	1983	54247.79	632867.92
	1984	49894.04	682761.95

NON-PIL GROUP COSTS

YEAR	COST	CUMCOST
1975	150032.46	150032.46
1976	82150.46	232182.91
1977	81350.29	313533.20
1978	80622.86	394156.07
1979	77151.07	471307.13
1980	73143.22	544450.35
1981	69681.90	614132.25
1982	66245.41	680377.66
1983	62857.86	743235.52
1984	58575.79	801811.31

NPIL LIFE CYCLE TOTALS		PIL LIFE CYCLE TOTALS	
TRAINING	46126.20	TRAINING	46126.20
PURCHASE	18003.64	PURCHASE	24463.64
PERSONNEL	646210.50	PERSONNEL	532229.85
FIRST DEST	122.61	FIRST DEST	220.11
TRANSPORT	2.34	TRANSPORT	3.05
CONSUMBLES	1999.11	CONSUMBLES	3280.18
INTRODUCE	4154.73	INTRODUCE	2077.37
HOLDING	36783.69	HOLDING	50296.14
DOCUMENTS	41727.27	DOCUMENTS	23863.64
INSTALL	1986.36	INSTALL	1986.36
DISPOSAL	-1305.14	DISPOSAL	-1784.58

PHASE III ECONOMIC ANALYSIS OF TMDE

Subject: Computer Run; Group 4 B, Scenario 1 - Total life cycle costs of PIL (CV3059) and non-PIL TMDE

ITEM	NO.	YEAR	COST	CUMCOST
CV3059	1			
		1975	262767.95	262767.95
		1976	146932.51	409700.47
		1977	145501.35	555201.82
		1978	144200.29	699402.11
		1979	137990.71	837392.82
		1980	130822.36	968215.19
		1981	124631.52	1092846.70
		1982	118485.10	1211331.81
		1983	112426.21	1323758.01
		1984	100515.97	1424273.98

NON-PIL GROUP COSTS

YEAR	COST	CUMCOST
1975	319285.19	319285.19
1976	172827.68	492112.87
1977	171144.30	663257.16
1978	169613.94	832871.11
1979	162309.99	995181.10
1980	153878.31	1149059.41
1981	146596.39	1295655.80
1982	139366.74	1435022.55
1983	132240.04	1567262.58
1984	118963.45	1686226.04

NPIL LIFE CYCLE TOTALS		PIL LIFE CYCLE TOTALS	
TRAINING	86235.93	TRAINING	86235.93
PURCHASE	95284.55	PURCHASE	89516.18
PERSONNEL	1222560.20	PERSONNEL	1000568.66
FIRST DEST	1309.17	FIRST DEST	809.24
TRANSPORT	83.20	TRANSPORT	[illegible]
CONSUMBLES	34498.69	CONSUMBLES	30352.67
INTRODUCE	4154.73	INTRODUCE	2077.37
HOLDING	197672.38	HOLDING	185610.82
DOCUMENTS	47727.27	DOCUMENTS	23863.64
INSTALL	3713.64	INSTALL	3713.64
DISPOSAL	-7013.72	DISPOSAL	-6585.75

PHASE III ECONOMIC ANALYSIS OF TMDE

Subject: Computer Run ; Group C, Scenario 1 - Total life cycle costs of PIL (H432A) and non-PIL TMDE

ITEM NO.	YEAR	COST	COMCOST
H432A	1		
	1975	1166829.28	1166829.28
	1976	945618.92	2114448.19
	1977	936408.34	3050856.54
	1978	926035.09	3976891.63
	1979	868071.86	4844963.49
	1980	841938.26	5686901.74
	1981	802095.60	6488997.34
	1982	762538.89	7251536.24
	1983	723545.43	7975081.66
	1984	675995.27	8651076.94
NON-PIL GROUP COSTS			
	YEAR	COST	COMCOST
	1975	1467612.26	1467612.26
	1976	1158325.90	2625938.16
	1977	1127238.31	3753176.47
	1978	1117158.69	4870335.16
	1979	1069051.37	5939386.53
	1980	1013516.24	6952902.77
	1981	965554.07	7918456.84
	1982	917936.14	8836392.98
	1983	870996.22	9707389.20
	1984	816021.50	10523410.70

NPIL LIFE CYCLE TOTALS		PIL LIFE CYCLE TOTALS	
TRAINING	603105.91	TRAINING	631728.35
PURCHASE	190650.91	PURCHASE	184704.55
PERSONNEL	8964568.00	PERSONNEL	7314189.05
FIRST DEST	4049.06	FIRST DEST	3569.14
TRANSPORT	2509.77	TRANSPORT	543.40
CONSUMBLES	202594.20	CONSUMBLES	124111.37
INTRODUCE	12464.20	INTRODUCE	2077.37
HOLDING	386806.78	HOLDING	374368.71
DOCUMENTS	143181.82	DOCUMENTS	23863.64
INSTALL	27204.55	INSTALL	27204.55
DISPOSAL	-13724.49	DISPOSAL	-13283.17

PHASE III ECONOMIC ANALYSIS OF TMDE

Subject: Computer Run ; Group A, Scenario 3, Option 1 - PIL phased-in to replace non-PIL TMDE.

ITEM NO.	YEAR	COST	CUMCOST
ESM30E	1		
	1975	84147.27	84147.27
	1976	60607.66	144754.93
	1977	107060.46	251815.39
	1978	156966.57	408781.96
	1979	174549.60	583331.56
	1980	173178.94	756510.50
	1981	183302.20	939812.71
	1982	184713.07	1124525.78
	1983	175270.65	1299796.43
	1984	157175.04	1456971.47

NON-PIL GROUP COSTS

YEAR	COST	CUMCOST
1975	288946.76	288946.76
1976	252837.05	541783.81
1977	201849.08	743632.89
1978	146246.31	889879.20
1979	97269.97	987149.17
1980	66482.34	1053631.51
1981	38438.63	1092070.14
1982	18331.19	1110401.33
1983	8410.06	1118811.39
1984	0.	1118811.39

NPIL LIFE CYCLE TOTALS		PIL LIFE CYCLE TOTALS	
TRAINING	39395.03	TRAINING	6200.62
PURCHASE	0.	PURCHASE	205359.63
PERSONNEL	640360.66	PERSONNEL	746553.52
FIRST DEST	0.	FIRST DEST	2232.72
TRANSPORT	572.74	TRANSPORT	205.69
CONSUMABLES	229642.69	CONSUMABLES	12767.66
INTRODUCE	2971.99	INTRODUCE	2077.37
HOLDING	234086.32	HOLDING	26632.09
DOCUMENTS	0.	DOCUMENTS	4316.16
INSTALL	0.	INSTALL	4316.19
DISPOSAL	-20216.24	DISPOSAL	-1691.61

PHASE III ECONOMIC ANALYSIS OF TMDE

Subject: Computer Run; Group A, Scenario 3, Option 2 - Non-PIL used to replace non-PIL TMDE.

NON-PIL GROUP COSTS

YEAR	COST	CUMCOST
1975	555309.61	555309.61
1976	485560.72	1040870.53
1977	578681.61	1619552.14
1978	409755.72	2029307.87
1979	396901.12	2426208.98
1980	314653.89	2740862.88
1981	300144.46	3041007.34
1982	282309.96	3323317.30
1983	260745.04	3584062.34
1984	223370.00	3807432.34

NPIL LIFE CYCLE TOTALS

TRAINING	99644.31
PURCHASE	334130.62
PERSONNEL	1563772.40
FIRST DEST	2903.01
TRANSPORT	961.57
CONSUMBLES	565670.69
INTRODUCE	24619.44
HOLDING	723775.71
DOCUMENTS	543764.53
INSTALL	4316.19
DISPOSAL	-56346.11

Subject: Computer Run ; Group A, Scenario 3, Option 3 - Mixture of PIL and non-PIL to replace non-PIL TMDE.

ITEM	NO.	YEAR	COST	CUMCOST
USM366	1			
		1975	84147.27	84147.27
		1976	60607.66	144754.93
		1977	107060.46	251815.39
		1978	156966.57	408781.96
		1979	117773.24	526555.20
		1980	107811.28	634366.48
		1981	102709.38	737075.85
		1982	97644.09	834719.94
		1983	92650.92	927370.87
		1984	88262.99	1015633.86

NON-PIL GROUP COSTS

YEAR	COST	CUMCOST
1975	296087.71	296087.71
1976	253815.48	549903.19
1977	201281.48	751184.67
1978	146756.57	897941.24
1979	214366.88	1112308.12
1980	149542.70	1261850.82
1981	142846.75	1404697.56
1982	132769.64	1537467.21
1983	118851.68	1656318.89
1984	105696.60	1762015.49

NPIL LIFE CYCLE TOTALS		PIL LIFE CYCLE TOTALS	
TRAINING	55468.41	TRAINING	43929.03
PURCHASE	96829.64	PURCHASE	115489.00
PERSONNEL	914271.88	PERSONNEL	522695.39
FIRST DEST	1344.08	FIRST DEST	1255.62
TRANSPORT	792.16	TRANSPORT	143.62
CONSUMBLES	346963.26	CONSUMBLES	90662.03
INTRODUCE	3801.46	INTRODUCE	2077.37
HOLDING	332342.94	HOLDING	167435.10
DOCUMENTS	47158.97	DOCUMENTS	49316.16
INSTALL	1888.87	INSTALL	2427.31
DISPOSAL	-33646.20	DISPOSAL	0.

PHASE III ECONOMIC ANALYSIS OF TMDE

Subject: Computer Run ; Group 1 B, Scenario 3, Option 1 - PIL phased-in to replace non-PIL TMDE. Total cost equals cumcost of PIL and non-PIL TMDE

ITEM NO.	YEAR	COST	CUMCOST
CP772AU 1			
	1975	431403.50	431403.50
	1976	565594.11	996997.61
	1977	958058.62	1955056.24
	1978	1459746.31	3414802.55
	1979	1510788.56	4925591.11
	1980	1592712.74	6518303.85
	1981	1696126.42	8214430.27
	1982	1635742.15	9850172.42
	1983	1616606.75	11466779.17
	1984	1477372.34	12944151.51

NON-PIL GROUP COSTS

YEAR	COST	CUMCOST
1975	1853358.12	1853358.12
1976	1708207.28	3561565.40
1977	1401752.86	4963318.26
1978	1006971.28	5970289.54
1979	717587.63	6687877.17
1980	470811.50	7158688.67
1981	256262.13	7414950.80
1982	148753.15	7563703.95
1983	53502.49	7617206.43
1984	0.	7617206.43

NPIL LIFE CYCLE TOTALS		PIL LIFE CYCLE TOTALS	
TRAINING	384965.43	TRAINING	615857.66
PURCHASE	0.	PURCHASE	1375080.61
PERSONNEL	5617200.76	PERSONNEL	7434760.98
FIRST DEST	0.	FIRST DEST	18479.66
TRANSPORT	2542.81	TRANSPORT	3210.13
CONSUMBLES	633292.23	CONSUMBLES	1669470.36
INTRODUCE	4583.19	INTRODUCE	2077.37
HOLDING	1063793.58	HOLDING	1839416.44
DOCUMENTS	0.	DOCUMENTS	51704.55
INSTALL	0.	INSTALL	41209.05
DISPOSAL	-89171.56	DISPOSAL	-107115.49

PHASE III ECONOMIC ANALYSIS OF TMDE

Subject: Computer Run; Group B, Scenario 3, Option 1 - (2 B)

ITEM NØ.	YEAR	COST	CUMCØST
CV72002 1			
	1975	63322.73	63322.73
	1976	57882.25	121204.98
	1977	109390.63	230595.60
	1978	172211.98	402807.78
	1979	214243.97	617051.75
	1980	188677.60	805729.35
	1981	179748.90	985478.24
	1982	170884.28	1156362.52
	1983	162145.88	1318508.40
	1984	154466.67	1472975.07

NON-PIL GRØUP CØSTS

YEAR	COST	CUMCØST
1975	214368.38	214368.38
1976	191450.47	405818.85
1977	134822.15	540640.99
1978	62337.90	602978.89
1979	0.	602978.89
1980	0.	602978.89
1981	0.	602978.89
1982	0.	602978.89
1983	0.	602978.89
1984	0.	602978.89

NPIL LIFE CYCLE TOTALS		PIL LIFE CYCLE TOTALS	
TRAINING	37546.48	TRAINING	102837.60
PURCHASE	0.	PURCHASE	54927.18
PERSØNNEL	527093.02	PERSONNEL	1187691.37
FIRST DEST	0.	FIRST DEST	517.69
TRANSPØRT	11.91	TRANSPØRT	18.45
CØNSUMBLES	6695.99	CONSUMBLES	12162.03
INTRØDUCE	1902.12	INTRODUCE	2077.37
HOLDING	35177.82	HOLDING	82661.96
DOCUMENTS	0.	DOCUMENTS	23863.74
INSTALL	0.	INSTALL	5997.79
DISPØSAL	-5448.44	DISPOSAL	0.

PHASE III ECONOMIC ANALYSIS OF TMDE

Subject: Computer Run ; Group B, Scenario 3, Option 1 - (3 B)

ITEM NO.	YEAR	COST	CUMCOST
CV2003BU 1			
	1975	74932.17	74932.17
	1976	83684.92	158617.09
	1977	70207.17	229024.26
	1978	69579.39	298603.65
	1979	66583.15	365186.80
	1980	63124.28	428311.09
	1981	60137.08	488448.17
	1982	57171.32	545619.49
	1983	54247.79	599867.28
	1984	49894.04	649761.31

NON-PIL GROUP COSTS

YEAR	COST	CUMCOST
1975	37917.17	37917.17
1976	0.	37917.17
1977	0.	37917.17
1978	0.	37917.17
1979	0.	37917.17
1980	0.	37917.17
1981	0.	37917.17
1982	0.	37917.17
1983	0.	37917.17
1984	0.	37917.17

NPIL LIFE CYCLE TOTALS

TRAINING	2425.71
PURCHASE	0.
PERSONNEL	33980.11
FIRST DEST	0.
TRANSPORT	.12
CONSUMBLES	107.05
INTRODUCE	290.91
HOLDING	1969.64
DOCUMENTS	0.
INSTALL	0.
DISPOSAL	-856.36

PIL LIFE CYCLE TOTALS

TRAINING	43700.49
PURCHASE	24676.36
PERSONNEL	504240.67
FIRST DEST	222.02
TRANSPORT	2.89
CONSUMBLES	3107.68
INTRODUCE	2077.37
HOLDING	47651.14
DOCUMENTS	23863.64
INSTALL	2003.64
DISPOSAL	-1784.58

PHASE III ECONOMIC ANALYSIS OF TMDE

Subject: Computer Run ; Group B, Scenario 3, Option 1 - (4 B)

ITEM	NO.	YEAR	COST	CUMCOST
CV3059	1			
		1975	102253.41	102253.41
		1976	132472.68	234726.09
		1977	176306.76	411032.85
		1978	144200.29	555233.14
		1979	137990.71	693223.85
		1980	130822.36	824046.22
		1981	124631.52	948677.73
		1982	118485.10	1067162.84
		1983	112426.21	1179589.04
		1984	100515.97	1280105.01

NON-PIL GROUP COSTS

YEAR	COST	CUMCOST
1975	111044.13	111044.13
1976	53144.87	164189.00
1977	0.	164189.00
1978	0.	164189.00
1979	0.	164189.00
1980	0.	164189.00
1981	0.	164189.00
1982	0.	164189.00
1983	0.	164189.00
1984	0.	164189.00

NPIL LIFE CYCLE TOTALS		PIL LIFE CYCLE TOTALS	
TRAINING	9538.45	TRAINING	76697.48
PURCHASE	0.	PURCHASE	90326.82
PERSONNEL	135210.10	PERSONNEL	890163.83
FIRST DEST	0.	FIRST DEST	614.74
TRANSPORT	8.65	TRANSPORT	26.32
CONSUMBLES	3687.45	CONSUMBLES	34092.74
INTRODUCE	293.55	INTRODUCE	2077.37
HOLDING	21886.80	HOLDING	165060.64
DOCUMENTS	0.	DOCUMENTS	23863.64
INSTALL	0.	INSTALL	3747.18
DISPOSAL	-6436.00	DISPOSAL	-6585.75

PHASE III ECONOMIC ANALYSIS OF TMDE

Subject: Computer Run; Group 1 B, Scenario 3, Option 2 - Non-PIL used to replace non-PIL TMDE.

NØN-PIL GRØUP CØSTS

YEAR	CØST	CUMCØST
1975	3129138.83	3129138.83
1976	2344598.90	5473737.73
1977	2196156.66	7669894.39
1978	2408196.79	10078091.18
1979	2277287.57	12355378.75
1980	2041055.20	14396433.95
1981	1951782.75	16348216.69
1982	1783104.42	18131321.11
1983	1691922.94	19823244.06
1984	1540504.35	21363748.40

NPIL LIFE CYCLE TOTALS

TRAINING	1010507.50
PURCHASE	985390.87
PERSØNNEL	14466911.54
FIRST DEST	15894.35
TRANSPØRT	4153.64
CØNSUMBLES	1320414.08
INTRØDUCE	58106.05
HØLDING	2186376.03
DØCUMENTS	1443601.08
INSTALL	41785.92
DISPØSAL	-169392.64

PHASE III ECONOMIC ANALYSIS OF TMDE

Subject: Computer Run; Group B, Scenario 3, Option 2 - (2 B)

NON-PIL GROUP COSTS

YEAR	COST	CUMCOST
1975	335666.57	335666.57
1976	261010.66	596677.23
1977	292885.83	889563.06
1978	271501.56	1161064.63
1979	303797.25	1464861.88
1980	228098.09	1692959.97
1981	217303.91	1910263.87
1982	206567.20	2116831.07
1983	164995.58	2301826.65
1984	171735.59	2473562.24

NPIL LIFE CYCLE TOTALS

TRAINING	139042.23
PURCHASE	64520.53
PERSONNEL	1957377.63
FIRST DEST	523.29
TRANSPORT	51.38
CONSUMBLES	30371.95
INTRODUCE	12183.09
HOLDING	132171.93
DOCUMENTS	141289.48
INSTALL	5997.79
DISPOSAL	-9947.08

PHASE III ECONOMIC ANALYSIS OF TMDE

Subject: Computer Run ; Group B, Scenario 3, Option 2 - (3 B)

NON-PIL GROUP COSTS

YEAR	COST	CUMCOST
1975	114782.51	114782.51
1976	117169.38	231951.89
1977	81350.29	313302.18
1978	80622.86	393925.04
1979	77151.07	471076.11
1980	73143.22	544219.32
1981	69681.90	613901.22
1982	66245.41	680146.63
1983	62857.86	743004.50
1984	58575.79	801580.29

NPIL LIFE CYCLE TOTALS

TRAINING	46126.20
PURCHASE	18162.98
PERSONNEL	646210.50
FIRST DEST	123.73
TRANSPORT	2.34
CONSUMBLES	1999.11
INTRODUCE	4168.45
HOLDING	36783.69
DOCUMENTS	48161.16
INSTALL	2003.64
DISPOSAL	-2161.50

PHASE III ECONOMIC ANALYSIS OF TMDE

Subject: Computer Run; Group B, Scenario 3, Option 2 - (4 B)

NON-PIL GRØUP CØSTS

YEAR	CØST	CUMCØST
1975	248268.51	248268.51
1976	205354.38	453622.89
1977	204105.27	657726.17
1978	169613.94	827342.11
1979	162309.99	989652.11
1980	153878.31	1143530.41
1981	146596.39	1290126.81
1982	139366.74	1429493.55
1983	132240.04	1561733.59
1984	118963.45	1680697.04

NPIL LIFE CYCLE TØTALS

TRAINING	86235.93
PURCHASE	96146.15
PERSONNEL	1222560.20
FIRST DEST	1321.02
TRANSPØRT	83.20
CONSUMBLES	34498.69
INTRØDUCE	4154.73
HØLDING	197672.38
DCCUMENTS	47727.27
INSTALL	3747.18
DISPØSAL	-13449.72

PHASE III ECONOMIC ANALYSIS OF TMDE

Subject: Computer Run; Group A, Scenario 2, Option 1 - PIL phased-in to replace non-PIL TMDE (10%).

ITEM NO.	YEAR	COST	CUMCOST
USM366 1			
	1975	92629.54	92629.54
	1976	64926.94	157556.48
	1977	94232.91	251789.39
	1978	110348.12	362137.51
	1979	125878.37	488015.88
	1980	146257.27	634273.15
	1981	153992.56	788265.71
	1982	163813.27	952078.98
	1983	171961.03	1124040.02
	1984	169762.64	1293802.66

NON-PIL GROUP COSTS

YEAR	COST	CUMCOST
1975	286338.98	286338.98
1976	256660.99	542999.97
1977	219786.43	762786.40
1978	186898.54	949684.94
1979	149276.68	1098961.62
1980	109263.70	1208225.32
1981	78128.43	1286353.75
1982	49938.32	1336292.07
1983	24316.56	1360608.63
1984	-654.46	1359954.17

NPIL LIFE CYCLE TOTALS		PIL LIFE CYCLE TOTALS	
TRAINING	47100.01	TRAINING	54612.14
PURCHASE	0.	PURCHASE	197766.26
PERSONNEL	760161.51	PERSONNEL	652439.10
FIRST DEST	0.	FIRST DEST	2150.16
TRANSPORT	544.51	TRANSPORT	179.45
CONSUMBLES	273420.48	CONSUMBLES	113122.92
INTRODUCE	4072.45	INTRODUCE	2077.37
HOLDING	307916.65	HOLDING	233872.10
DOCUMENTS	0.	DOCUMENTS	49318.18
INSTALL	0.	INSTALL	4156.59
DISPOSAL	-33261.44	DISPOSAL	-16091.61

PHASE III ECONOMIC ANALYSIS OF TMDE

Subject: Computer Run; Group A, Scenario 2, Option 2 - Non-PIL used to replace non-PIL TMDE (10%).

NON-PIL GROUP COSTS

YEAR	COST	CUMCOST
1975	523594.46	523594.46
1976	460809.73	984404.18
1977	567159.60	1551563.78
1978	445111.33	1996675.11
1979	328920.33	2325595.44
1980	317408.01	2643003.45
1981	297076.80	2940080.25
1982	282425.96	3222506.20
1983	266413.95	3488920.15
1984	233162.17	3722082.32

NPIL LIFE CYCLE TOTALS

TRAINING	99844.31
PURCHASE	302797.46
PERSONNEL	1563338.22
FIRST DEST	3576.53
TRANSPORT	1172.05
CONSUMBLES	543526.52
INTRODUCE	24662.16
HOLDING	681218.90
DOCUMENTS	545849.63
INSTALL	4155.02
DISPOSAL	-48060.46

PHASE III ECONOMIC ANALYSIS OF TMDE

Subject: Computer Run; Group A, Scenario 2, Option 3 - Mixture of PIL and non-PIL to replace non-PIL TMDE.

ITEM NO.	YEAR	COST	CUMCOST
US*366	1		
	1975	75665.00	75665.00
	1976	39015.40	114680.40
	1977	51466.98	166147.38
	1978	63723.64	229871.02
	1979	73148.81	303019.83
	1980	80885.95	383905.78
	1981	88049.34	471955.12
	1982	94156.11	566111.23
	1983	92647.79	658759.01
	1984	86055.56	744814.58

NON-PIL GROUP COSTS

YEAR	COST	CUMCOST
1975	362088.57	362088.57
1976	299730.81	661819.38
1977	277289.39	939108.76
1978	255615.82	1194724.59
1979	227061.58	1421786.17
1980	172612.34	1594398.51
1981	149754.95	1744153.46
1982	133601.88	1877755.34
1983	127456.97	2005212.31
1984	105696.60	2110908.91

NPIL LIFE CYCLE TOTALS		PIL LIFE CYCLE TOTALS	
TRAINING	67501.54	TRAINING	30809.57
PURCHASE	102583.03	PURCHASE	105858.18
PERSONNEL	1090294.90	PERSONNEL	366732.04
FIRST DEST	1423.95	FIRST DEST	1150.91
TRANSPORT	985.08	TRANSPORT	100.87
CONSUMBLES	402043.10	CONSUMBLES	63565.70
INTRODUCE	6215.53	INTRODUCE	2077.37
HOLDING	423340.89	HOLDING	131458.08
DOCUMENTS	49318.18	DOCUMENTS	49318.18
INSTALL	2001.11	INSTALL	2224.90
DISPOSAL	-34798.39	DISPOSAL	-8501.23

PHASE III ECONOMIC ANALYSIS OF TMDE

Subject: Computer Run ; Group C, Scenario 3, Option 1 - PIL phased-in to replace non-PIL TMDE.

ITEM NO.	YEAR	COST	CUMCOST
M432A 1			
	1975	130090.31	130090.31
	1976	198131.14	328221.46
	1977	340298.63	668520.09
	1978	553283.59	1221803.68
	1979	641261.01	1863064.70
	1980	678818.85	2541883.55
	1981	723073.51	3264957.06
	1982	760025.29	4024982.35
	1983	727808.84	4752791.20
	1984	675995.27	5428786.47

NON-PIL GROUP COSTS

YEAR	COST	CUMCOST
1975	1014537.21	1014537.21
1976	924315.44	1938852.65
1977	750311.21	2689163.86
1978	504949.41	3194113.26
1979	331974.63	3526087.90
1980	218520.30	3744608.20
1981	116022.94	3860631.14
1982	23236.99	3883868.13
1983	0.	3883868.13
1984	0.	3883868.13

NPIL LIFE CYCLE TOTALS		PIL LIFE CYCLE TOTALS	
TRAINING	236046.89	TRAINING	369811.88
PURCHASE	0.	PURCHASE	175830.49
PERSONNEL	3436845.43	PERSONNEL	4513265.57
FIRST DEST	0.	FIRST DEST	3397.66
TRANSPORT	697.86	TRANSPORT	335.31
CONSUMBLES	79831.85	CONSUMBLES	76583.69
INTRODUCE	2983.82	INTRODUCE	2077.37
HOLDING	143208.07	HOLDING	231006.53
DOCUMENTS	0.	DOCUMENTS	23863.64
INSTALL	0.	INSTALL	25897.51
DISPOSAL	-15745.78	DISPOSAL	-13283.17

PHASE III ECONOMIC ANALYSIS OF TMDE

Subject: Computer Run; Group C, Scenario 3, Option 2 - Non-PIL used to replace non-PIL TMDE.

NON-PIL GROUP COSTS

YEAR	COST	CUMCOST
1975	1216349.01	1216349.01
1976	1156715.42	2373064.42
1977	1156530.33	3529594.76
1978	1186396.03	4715990.79
1979	1119593.43	5835584.21
1980	1030437.77	6866021.99
1981	1002974.21	7868996.20
1982	933360.40	8802356.60
1983	874899.03	9677255.62
1984	816021.50	10493277.12

NPIL LIFE CYCLE TOTALS

TRAINING	603105.91
PURCHASE	181812.85
PERSONNEL	8964568.00
FIRST DEST	3883.66
TRANSPORT	2509.77
CONSUMBLES	202594.20
INTRODUCE	12327.71
HOLDING	386806.78
DOCUMENTS	138865.19
INSTALL	25897.51
DISPOSAL	-29094.47

PHASE III ECONOMIC ANALYSIS OF TMDE

Subject: Computer Run; Group A, Case I

ITEM	NO.	YEAR	COST	CUMCOST
USM366	1			
		1975	474673.54	474673.54
		1876	209834.50	684508.04
		1977	207790.65	892298.69
		1978	205932.62	1098231.31
		1979	197064.70	1295296.01
		1980	186827.58	1482123.59
		1981	177986.42	1660110.01
		1982	169208.72	1829318.72
		1983	160556.00	1989874.72
		1984	137255.18	2127129.91

NON-PIL GROUP COSTS

YEAR	COST	CUMCOST
1975	1206966.63	1206966.63
1876	325084.48	1532051.10
1977	321918.07	1853969.17
1978	319039.52	2173008.69
1979	305300.98	2478309.67
1980	289441.18	2767750.85
1981	275744.09	3043494.95
1982	262145.30	3305640.25
1983	248740.15	3554380.40
1984	212789.17	3767169.57

NPIL LIFE CYCLE TOTALS		PIL LIFE CYCLE TOTALS	
TRAINING	99844.31	TRAINING	94257.88
PURCHASE	326639.09	PURCHASE	212354.55
PERSONNEL	1563338.22	PERSONNEL	1121969.14
FIRST DEST	3925.41	FIRST DEST	2099.72
TRANSPORT	1172.05	TRANSPORT	308.60
CONSUMBLES	543528.52	CONSUMBLES	213985.43
INTRODUCE	24596.49	INTRODUCE	2077.37
HOLDING	681218.90	HOLDING	442396.85
DOCUMENTS	542500.00	DOCUMENTS	49318.18
INSTALL	4577.27	INSTALL	4059.09
DISPOSAL	-24170.68	DISPOSAL	-15696.91

PHASE III ECONOMIC ANALYSIS OF TMDE

Subject: Computer Run; Group A, Case 2

ITEM	NO.	YEAR	COST	CUMCOST
USM366	1			
		1975	499778.59	499778.59
		1976	204526.36	704304.95
		1977	185933.06	890238.01
		1978	169030.05	1059268.06
		1979	153663.68	1212931.75
		1980	139694.26	1352626.01
		1981	126994.78	1479620.79
		1982	115449.80	1595070.58
		1983	104954.36	1700024.95
		1984	86217.85	1786242.80

NON-PIL GROUP COSTS

YEAR	COST	CUMCOST
1975	1206966.63	1206966.63
1976	290254.00	1497220.62
1977	263867.27	1761087.90
1978	239879.34	2000967.23
1979	218072.13	2219039.36
1980	198247.39	2417286.74
1981	180224.90	2597511.64
1982	163840.82	2761352.46
1983	148946.20	2910298.65
1984	121593.81	3031892.47

NPIL LIFE CYCLE TOTALS

TRAINING	74205.05
PURCHASE	326639.09
PERSONNEL	1161864.88
FIRST DEST	3925.41
TRANSPORT	871.08
CONSUMBLES	403954.54
INTRODUCE	20859.89
HOLDING	506287.08
DOCUMENTS	542500.00
INSTALL	4577.27
DISPOSAL	-13811.82

PIL LIFE CYCLE TOTALS

TRAINING	78996.13
PURCHASE	217761.82
PERSONNEL	940303.72
FIRST DEST	2367.77
TRANSPORT	250.63
CONSUMBLES	163034.57
INTRODUCE	1737.66
HOLDING	337060.25
DOCUMENTS	49316.18
INSTALL	4577.27
DISPOSAL	-9195.21

PHASE III ECONOMIC ANALYSIS OF TMDE

Subject: Computer Run ; Group A, Case 2

ITEM NO.	YEAR	COST	CUMCOST
US 366	1		
	1975	549756.45	549756.45
	1976	247476.90	797233.35
	1977	247476.90	1044710.25
	1978	247476.90	1292187.15
	1979	247476.90	1539664.05
	1980	247476.90	1787140.95
	1981	247476.90	2034617.85
	1982	247476.90	2282094.74
	1983	247476.90	2529571.64
	1984	223626.90	2753198.54

NON-PIL GROUP COSTS

YEAR	COST	CUMCOST
1975	1327663.29	1327663.29
1976	351207.34	1678870.63
1977	351207.34	2030077.96
1978	351207.34	2381285.30
1979	351207.34	2732492.64
1980	351207.34	3083699.98
1981	351207.34	3434907.32
1982	351207.34	3786114.66
1983	351207.34	4137321.99
1984	315383.04	4452705.03

NPIL LIFE CYCLE TOTALS

TRAINING	120765.30
PURCHASE	359303.00
PERSONNEL	1890914.13
FIRST DEST	4317.95
TRANSPORT	1417.64
CONSUMBLES	657417.41
INTRODUCE	28650.00
HOLDING	823958.90
DOCUMENTS	596750.00
INSTALL	5035.00
DISPOSAL	-35824.30

PIL LIFE CYCLE TOTALS

TRAINING	126562.57
PURCHASE	239560.00
PERSONNEL	1530304.26
FIRST DEST	2604.55
TRANSPORT	420.91
CONSUMELES	265331.25
INTRODUCE	2430.00
HOLDING	548550.00
DOCUMENTS	54250.00
INSTALL	5035.00
DISPOSAL	-23850.00

PHASE III ECONOMIC ANALYSIS OF TMDE

Subject: Computer Run; Group A, Case 2

ITEM NO.	YEAR	COST	CUMCOST
USM366 1			
	1975	549756.45	549756.45
	1976	277174.13	826930.58
	1977	301921.82	1128852.39
	1978	329144.28	1457996.67
	1979	346467.66	1804464.33
	1980	361316.27	2165780.60
	1981	378639.66	2544420.26
	1982	395963.04	2940383.30
	1983	413286.42	3353669.72
	1984	391347.07	3745016.79

NON-PIL GROUP COSTS

YEAR	COST	CUMCOST
1975	1327663.29	1327663.29
1976	393352.22	1721015.51
1977	428472.95	2149488.46
1978	467105.76	2616594.22
1979	491690.27	3108284.49
1980	512762.71	3621047.21
1981	537347.23	4158394.43
1982	561931.74	4720326.17
1983	586516.25	5306842.43
1984	551920.32	5858762.75

NPIL LIFE CYCLE TOTALS

TRAINING	170037.54
PURCHASE	359303.00
PERSONNEL	2662407.09
FIRST DEST	4317.95
TRANSPORT	1996.04
CONSUMBLES	925643.72
INTRODUCE	35830.80
HOLDING	1160134.13
DOCUMENTS	596750.00
INSTALL	5035.00
DISPOSAL	-62692.52

PIL LIFE CYCLE TOTALS

TRAINING	151016.10
PURCHASE	239560.00
PERSONNEL	2154066.40
FIRST DEST	2604.55
TRANSPORT	592.64
CONSUMBLES	373566.40
INTRODUCE	3082.60
HOLDING	772356.40
DOCUMENTS	54250.00
INSTALL	5035.00
DISPOSAL	-41737.50

PHASE III ECONOMIC ANALYSIS OF TMDE

Subject: Computer Run; Group B, Case 3

ITEM NO.	YEAR	COST	CUMCOST
CP772AC 1			
	1975	3239466.49	3239466.49
	1976	1995818.69	5235285.18
	1977	1976378.90	7211664.08
	1978	1958706.36	9170370.44
	1979	1874360.15	11044730.59
	1980	1776990.79	12821721.38
	1981	1692899.07	14514620.46
	1982	1609410.88	16124031.34
	1983	1527111.46	17651142.80
	1984	1369095.34	19020238.14
NON-PIL GROUP COSTS			
YEAR		COST	CUMCOST
	1975	4671908.94	4671908.94
	1976	2126462.79	6798371.73
	1977	2105750.49	8904122.23
	1978	2086921.13	10991043.36
	1979	1997053.71	12988097.07
	1980	1693310.66	14681407.74
	1981	1803714.39	16685122.13
	1982	1714761.16	18399883.29
	1983	1627074.51	20026957.79
	1984	1472440.60	21499398.39

PHASE III ECONOMIC ANALYSIS OF TMDE

Subject: Computer Run; Group B, Case 3

ITEM NO.	YEAR	COST	CUMCOST
CV72002	1		
	1975	287841.53	287841.53
	1976	210459.76	498301.28
	1977	208409.82	706711.11
	1978	206546.25	913257.35
	1979	197651.91	1110909.27
	1980	187384.28	1298293.55
	1981	178516.78	1476810.33
	1982	169712.92	1646523.25
	1983	161034.42	1807557.67
	1984	149794.84	1957352.50
NON-PIL GROUP COSTS			
	YEAR	COST	CUMCOST
	1975	470871.25	470871.25
	1976	256187.27	727058.53
	1977	253691.94	980750.47
	1978	251423.46	1232173.93
	1979	240596.61	1472770.54
	1980	228096.09	1700866.63
	1981	217303.91	1918172.54
	1982	206587.20	2124759.73
	1983	196023.08	2320782.81
	1984	182011.43	2502794.24

PHASE III ECONOMIC ANALYSIS OF TMDE

Subject: Computer Run; Group B, Case 3

ITEM NO.	YEAR	COST	CUMCOST
CV2003BU 1			
	1975	117926.33	117926.33
	1976	70297.91	188224.25
	1977	69613.19	257837.44
	1978	68990.72	326828.16
	1979	66019.83	392847.98
	1980	62590.23	455438.21
	1981	59628.30	515066.51
	1982	56687.63	571754.13
	1983	53788.83	625542.96
	1984	49635.27	675178.23
NON-PIL GROUP COSTS			
	YEAR	COST	CUMCOST
	1975	150032.46	150032.46
	1976	82150.46	232182.91
	1977	81350.29	313533.20
	1978	80622.86	394156.07
	1979	77151.07	471307.13
	1980	73143.22	544450.35
	1981	69681.90	614132.25
	1982	66245.41	680377.66
	1983	62857.86	743235.52
	1984	58575.79	801811.31

PHASE III ECONOMIC ANALYSIS OF TMDE

Subject: Computer Run; Group B, Case 3

ITEM NO.	YEAR	COST	CUMCOST
CV3059	1		
	1975	251431.88	251431.88
	1976	144425.31	395857.19
	1977	143018.57	538875.75
	1978	141739.71	680615.47
	1979	135636.09	816251.55
	1980	128590.06	944841.61
	1981	122504.85	1067346.46
	1982	116463.31	1183809.77
	1983	110507.80	1294317.57
	1984	99346.99	1393664.57
NON-PIL GROUP COSTS			
	YEAR	COST	CUMCOST
	1975	319285.19	319285.19
	1976	172827.68	492112.87
	1977	171144.30	663257.16
	1978	169613.94	832871.11
	1979	162309.99	995181.10
	1980	153878.31	1149059.41
	1981	146596.39	1295655.80
	1982	139366.74	1435022.55
	1983	132240.04	1567262.58
	1984	118963.45	1686226.04

PHASE III ECONOMIC ANALYSIS OF TMDE

Subject: Computer Run; Group C, Case 3

ITEM	NO.	YEAR	COST	CUMCOST
H432A	1			
		1975	1133760.92	1133760.92
		1976	937247.66	2071008.58
		1977	928118.63	2999127.20
		1978	919819.50	3918946.71
		1979	880210.05	4799156.75
		1980	834484.85	5633641.61
		1981	794994.91	6428636.52
		1982	755788.39	7184424.90
		1983	717140.12	7901565.02
		1984	671885.79	8573450.81
NON-PIL GROUP COSTS				
		YEAR	COST	CUMCOST
		1975	1487612.26	1487612.26
		1976	1138325.90	2625938.16
		1977	1127238.31	3753176.47
		1978	1117158.69	4870335.16
		1979	1069051.37	5939386.53
		1980	1013516.24	6952902.77
		1981	965554.07	7918456.84
		1982	917936.14	8836392.98
		1983	870996.22	9707389.20
		1984	816021.50	10523410.70

Subject: Computer Run; Group A, Sensitivity Analysis - MTBF decreased by 50% of original value

ITEM NO.	YEAR	COST	CUMCOST
65366 1			
	1975	511856.24	511856.24
	1976	241368.80	753227.04
	1977	239017.80	992244.84
	1978	236880.54	1229125.38
	1979	226679.94	1455805.32
	1980	214904.36	1670709.68
	1981	204734.54	1875444.21
	1982	194637.71	2070081.92
	1983	184684.64	2254766.56
	1984	159646.40	2414412.96

NON-PIL BASIC COSTS

YEAR	COST	CUMCOST
1975	1236894.47	1236894.47
1976	355556.46	1592450.93
1977	352093.25	1944544.18
1978	348944.88	2293489.06
1979	333916.54	2627407.60
1980	316572.12	2943979.73
1981	301591.13	3245570.86
1982	286717.65	3532288.51
1983	272055.95	3804344.46
1984	235000.75	4039345.20

NPIL LIFE CYCLE TOTALS		PIL LIFE CYCLE TOTALS	
TRAINING	99844.31	TRAINING	106290.60
PURCHASE	326639.09	PURCHASE	217761.02
PERSONNEL	1563338.22	PERSONNEL	1265199.25
FIRST DEST	3925.41	FIRST DEST	2367.77
TRANSPORT	1583.42	TRANSPORT	521.99
CONSUMBLES	815292.79	CONSUMBLES	329049.17
INTRODUCE	24596.49	INTRODUCE	2077.37
HOLDING	681216.90	HOLDING	453520.95
DOCUMENTS	542500.00	DOCUMENTS	49316.16
INSTALL	4577.27	INSTALL	4577.27
DISPOSAL	-24170.68	DISPOSAL	-16091.61

PHASE III ECONOMIC ANALYSIS OF TMDE

Subject: Computer Run: Group B, Sensitivity Analysis - (1 B)

ITEM NO.	YEAR	COST	CUMCOST
OPTICAL 1			
	1975	3805699.47	3805699.47
	1976	2278444.00	6084143.47
	1977	2256251.37	8340394.84
	1978	2236076.24	10576471.08
	1979	2139785.88	12716256.96
	1980	2028628.17	14744885.13
	1981	1932628.33	16677513.46
	1982	1837317.49	18514830.95
	1983	1743363.75	20258194.70
	1984	1553682.86	21811877.56

NON-PIL GROUP COSTS

YEAR	COST	CUMCOST
1975	4744731.01	4744731.01
1976	2200608.90	6945339.91
1977	2179174.40	9124514.31
1978	2159686.49	11284200.80
1979	2066667.55	13350890.35
1980	1959327.16	15310217.50
1981	1866606.82	17176824.32
1982	1774551.94	18951376.26
1983	1683807.80	20635184.06
1984	1526487.01	22161671.07

NPIL LIFE CYCLE TOTALS		PIL LIFE CYCLE TOTALS	
TRAINING	975438.57	TRAINING	1010765.38
PURCHASE	1054420.91	PURCHASE	1452436.36
PERSONNEL	14466911.54	PERSONNEL	12202168.27
FIRST DEST	16615.97	FIRST DEST	19519.24
TRANSPORT	9442.07	TRANSPORT	7902.66
CONSUMBLES	1980621.12	CONSUMBLES	4109982.46
INTRODUCE	58166.26	INTRODUCE	2077.37
HOLDING	2186376.03	HOLDING	3018909.29
DOCUMENTS	1447727.27	DOCUMENTS	51704.55
INSTALL	43527.27	INSTALL	43527.27
DISPOSAL	-77575.95	DISPOSAL	-107115.49

PHASE III ECONOMIC ANALYSIS OF TMDE

Subject: Computer Run; Group B, Sensitivity Analysis - (2 B)

ITEM NO.	YEAR	COST	CUMCOST
CV72002	1		
	1975	295591.44	295591.44
	1976	212843.13	508434.57
	1977	210769.99	719204.55
	1978	206865.31	926069.86
	1979	199690.25	1125760.11
	1980	189506.34	1317466.44
	1981	180538.41	1498024.86
	1982	171634.86	1669659.71
	1983	162858.07	1832517.79
	1984	151130.67	1983648.46
NON-PIL GROUP COSTS			
	YEAR	COST	CUMCOST
	1975	472550.04	472550.04
	1976	257896.58	730446.62
	1977	255384.60	985831.22
	1978	253100.98	1238932.21
	1979	242201.90	1481134.11
	1980	229619.98	1710754.09
	1981	218753.78	1929507.87
	1982	207965.57	2137473.44
	1983	197330.96	2334804.40
	1984	183257.37	2518061.77

PHASE III ECONOMIC ANALYSIS OF TMDE

Subject: Computer Run; Group B, Sensitivity Analysis - MTBF decreased by 50% of original value (3B)

ITEM NO.	YEAR	COST	CUMCOST
CV2003BC	1		
	1975	121100.50	121100.50
	1976	71061.53	192162.03
	1977	70389.17	262571.21
	1978	69759.76	332330.97
	1979	66755.75	399086.72
	1980	63287.92	462374.65
	1981	60292.98	522667.62
	1982	57319.53	579987.15
	1983	54388.42	634375.57
	1984	50028.01	684403.57
NON-PIL GROUP COSTS			
	YEAR	COST	CUMCOST
	1975	150142.50	150142.50
	1976	82262.49	232404.99
	1977	81461.24	313866.22
	1978	80732.82	394599.04
	1979	77256.29	471855.33
	1980	73242.97	545098.30
	1981	69776.93	614875.23
	1982	66335.76	681210.99
	1983	62943.59	744154.58
	1984	58657.45	802812.04

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ECONOMIC ANALYSIS OF SELECTED TEST MEASUREMENT AND DIAGNOSTIC E--ETC(U)
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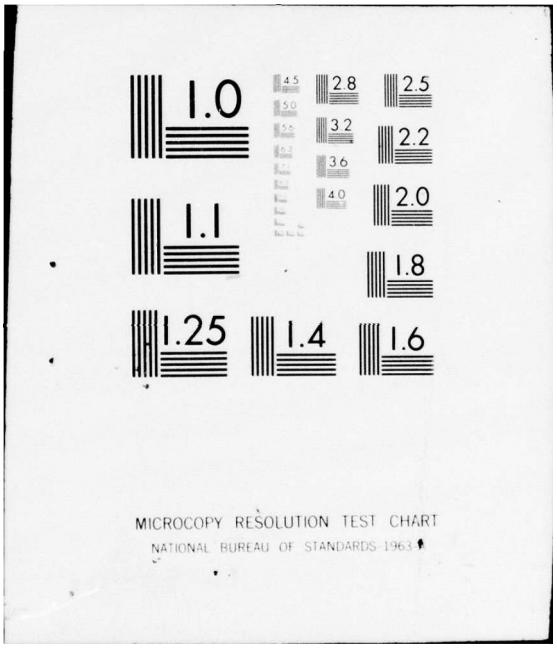
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PHASE III ECONOMIC ANALYSIS OF TMDE

Subject: Computer Run; Group B, Sensitivity Analysis - (4 B)

ITEM	NO.	YEAR	COST	CUMCOST
CV3059	1			
		1975	264877.07	264877.07
		1976	149079.97	413957.04
		1977	147627.90	561584.94
		1978	146307.83	707892.77
		1979	140007.49	847900.25
		1980	132734.37	980634.63
		1981	126453.04	1107087.67
		1982	120216.80	1227304.47
		1983	114069.35	1341373.82
		1984	102081.29	1443455.11
NON-PIL GROUP COSTS				
		YEAR	COST	CUMCOST
		1975	321186.46	321186.46
		1976	174763.53	495949.99
		1977	173061.28	669011.27
		1978	171513.79	840525.06
		1979	164128.03	1004653.09
		1980	155601.90	1160254.99
		1981	148238.42	1308493.41
		1982	140927.79	1449421.20
		1983	133721.26	1583142.46
		1984	120374.52	1703516.98

PHASE III ECONOMIC ANALYSIS OF TMDE

Subject: Computer Run; Group C, Sensitivity Analysis - MTBF decreased by 50% of original value

ITEM	NO.	YEAR	COST	CUMCOST
H432A	1			
		1975	1175682.66	1175682.66
		1976	952596.91	2128279.57
		1977	943316.37	3071597.93
		1978	934883.33	4006481.26
		1979	894625.19	4901106.46
		1980	848151.16	5749257.61
		1981	808014.49	6557272.10
		1982	768165.89	7325437.99
		1983	728884.68	8054322.67
		1984	681081.65	8735404.32
NON-PIL GROUP COSTS				
		YEAR	COST	CUMCOST
		1975	1498794.30	1498794.30
		1976	1149711.25	2648505.55
		1977	1138512.77	3787018.32
		1978	1128332.33	4915350.65
		1979	1079743.85	5995094.50
		1980	1023653.26	7018747.76
		1981	975211.39	7993959.15
		1982	927117.19	8921076.34
		1983	879707.78	9800784.13
		1984	824320.48	10625104.61

PHASE III ECONOMIC ANALYSIS OF TMDE

Subject: Computer Run; Group A, Sensitivity Analysis - Cost of consumables two times original value

ITEM	NO.	YEAR	COST	CUMCOST
USM366	1			
		1975	523899.61	523899.61
		1976	253629.11	777528.73
		1977	251158.70	1028687.43
		1978	248912.87	1277600.30
		1979	238194.13	1515794.43
		1980	225820.41	1741614.84
		1981	215134.02	1956748.86
		1982	204524.32	2161273.18
		1983	194065.69	2355338.86
		1984	168783.16	2524122.02
NON-PIL GROUP COSTS				
		YEAR	COST	CUMCOST
		1975	1266731.84	1266731.84
		1976	385936.34	1652668.18
		1977	382177.22	2034845.40
		1978	378759.84	2413605.24
		1979	362449.60	2776054.84
		1980	343621.05	3119675.89
		1981	327360.03	3447035.92
		1982	311215.72	3758251.64
		1983	295301.28	4053552.92
		1984	257145.18	4310698.09

PHASE III ECONOMIC ANALYSIS OF TMDE

Subject: Computer Run ; Group B, Sensitivity Analysis - (1 B, 2 B, 3 B)

GROUP? GRP1B1

ITEM	NO.	YEAR	COST	CUMCOST
CP772AU	1			
		1975	3956051.40	3956051.40
		1976	2431529.60	6387581.01
		1977	2407845.87	8795426.88
		1978	2386315.21	11181742.09
		1979	2283555.23	13465297.32
		1980	2164928.98	15630226.30
		1981	2062479.04	17692705.34
		1982	1960764.39	19653469.73
		1983	1860498.03	21513967.76
		1984	1665269.67	23179237.43

GROUP? GRP2B1

ITEM	NO.	YEAR	COST	CUMCOST
CV72002	1			
		1975	296502.83	296502.83
		1976	213771.10	510273.94
		1977	211688.92	721962.85
		1978	209796.02	931758.87
		1979	200761.74	1132520.62
		1980	190332.56	1322853.18
		1981	181325.54	1504178.72
		1982	172383.16	1676561.88
		1983	163568.12	1840130.00
		1984	151807.09	1991937.09

GROUP? GRP3B1

ITEM	NO.	YEAR	COST	CUMCOST
CV2003BU	1			
		1975	121280.68	121280.68
		1976	71264.98	192545.65
		1977	70570.84	263116.49
		1978	69939.80	333056.29
		1979	66928.04	399984.33
		1980	63451.26	463435.59
		1981	60448.58	523884.17
		1982	57467.46	581351.63
		1983	54528.78	635880.41
		1984	50161.72	686042.14

Subject: Computer Run ; Group B, Sensitivity Analysis - (4 B)

GROUP? GRP4B1

ITEM	NO.	YEAR	COST	CUMCOST
CV3059	1			
		1975	266982.93	266982.93
		1976	151224.12	418207.06
		1977	149751.16	567958.22
		1978	148412.11	716370.32
		1979	142021.15	858391.48
		1980	134643.43	993034.91
		1981	128271.76	1121306.67
		1982	121945.82	1243252.49
		1983	115709.96	1358962.45
		1984	103644.20	1462606.65

GROUP? GRPC1

ITEM	NO.	YEAR	COST	CUMCOST
H432A	1			
		1975	1182476.29	1182476.29
		1976	959514.06	2141990.35
		1977	950168.14	3092158.50
		1978	941671.86	4033830.36
		1979	901121.39	4934951.75
		1980	854309.89	5789261.64
		1981	813881.78	6603143.42
		1982	773743.82	7376887.24
		1983	734177.37	8111064.61
		1984	686123.69	8797188.30

PHASE III ECONOMIC ANALYSIS OF TMDE

Subject: Computer Run; Group A, Sensitivity Analysis - NHO equal to two times original value

ITEM	NO.	YEAR	COST	CUMCOST
USM366	1			
		1975	632953.14	632953.14
		1976	364665.43	997618.56
		1977	361113.49	1358732.06
		1978	357684.46	1716616.51
		1979	342473.17	2059089.68
		1980	324682.35	2383772.03
		1981	309317.56	2693089.59
		1982	294063.04	2987152.63
		1983	279025.72	3266178.35
		1984	249719.50	3515897.85
NON-PIL GROUP COSTS				
		YEAR	COST	CUMCOST
		1975	1368995.66	1368995.66
		1976	490059.49	1859055.15
		1977	485286.18	2344341.33
		1978	480946.81	2825288.15
		1979	460236.19	3285524.33
		1980	436327.81	3721852.14
		1981	415679.67	4137531.82
		1982	395179.72	4532711.54
		1983	374971.67	4907683.21
		1984	333042.39	5240725.61

Subject: Computer Run; Group B, Sensitivity Analysis - continued;
Group C, NHO two times original value

GROUP? GRP4B1

ITEM	NO.	YEAR	COST	CUMCOST
CV3059	1			
		1975	370815.23	370815.23
		1976	256944.28	627759.51
		1977	254441.58	882201.08
		1978	252166.39	1134367.47
		1979	241307.55	1375675.02
		1980	228772.09	1604447.11
		1981	217946.02	1822393.13
		1982	207197.64	2029590.77
		1983	196602.30	2226193.07
		1984	180705.50	2406898.57

GROUP? GRPC1

ITEM	NO.	YEAR	COST	CUMCOST
H432A	1			
		1975	1960338.37	1960338.37
		1976	1751519.08	3711857.45
		1977	1734458.83	5446316.28
		1978	1718949.51	7165265.79
		1979	1644927.76	8810193.55
		1980	1559476.97	10369670.52
		1981	1485678.56	11855349.08
		1982	1412409.80	13267758.88
		1983	1340184.30	14607943.18
		1984	1263430.23	15871373.41

PHASE III ECONOMIC ANALYSIS OF TMDE

Subject: Computer Run; Group B, Sensitivity Analysis - (1 B, 2 B, 3 B)

NHO equal to two times original value

GROUP? GRP1B1

ITEM NO.	YEAR	COST	CUMCOST
CP772AU 1			
	1975	4921182.77	4921182.77
	1976	3414208.81	8335391.58
	1977	3380953.53	11716345.11
	1978	3350721.46	15067066.57
	1979	3206432.02	18273498.58
	1980	3039864.12	21313362.70
	1981	2896010.03	24209372.73
	1982	2753188.38	26962561.11
	1983	2612400.34	29574961.45
	1984	2381562.02	31956523.47

NON-PIL GROUP C

GROUP? GRP2B1

ITEM NO.	YEAR	COST	CUMCOST
CV72002 1			
	1975	470568.18	470568.18
	1976	391001.27	861569.44
	1977	387192.81	1248762.26
	1978	383730.38	1632492.64
	1979	367206.30	1999699.14
	1980	348130.65	2347829.79
	1981	331656.22	2679486.01
	1982	315300.03	2994786.04
	1983	299176.74	3293962.78
	1984	280993.31	3574956.08

NON-PIL GROUP COSTS

GROUP? GRP3B1

ITEM NO.	YEAR	COST	CUMCOST
CV2003BU 1			
	1975	178712.72	178712.72
	1976	129741.24	308453.96
	1977	128477.53	436931.49
	1978	127328.70	564260.19
	1979	121845.64	686105.83
	1980	115516.00	801621.83
	1981	110049.49	911671.32
	1982	104622.21	1016293.53
	1983	99272.21	1115565.74
	1984	92786.11	1208351.85

APPENDIX A-4

TMDE AND TMDE-1 COMPUTER PROGRAMS

1. Computer Program "TMDE"

```
100 PROGRAM TMDE (INPUT,OUTPUT,TAPE2)
200 DIMENSION NYR(10),ECOS(29,10,11),NEGB(29,10),NEGD(29,10),NAME(29),
210+NCAT(11),XINF(10),NDEN(29,10),IR(7),CIOP(5),CTC(2),NPERC(2),
220+NPERO(5),LCAL(29),UCOS(29),XMH(29),DLH(7),PROD(7),
230+HSC(29),WI(29),XMI(29),FAIL(29),FMI(29),AOPP(29),
240+NCAL(29),MLIN(29)
300 1 PRINT,* ------------TMDE LIFE CYCLE COST EVALUATION----------
400 PRINT,* GROUP*,
500 READ,GFILE
600 CALL GET (5HTAPE2,GFILE,0,0)
700 READ (2,)L,L,L,L
800 READ (2,)L,L,NPIL$ NPIL=NPIL+1
900 DO 2 I=1,NPIL
1000 READ (2,) L,NAME(I)
1100 READ (2,) L,L,LCAL(I),L,UCOS(I),L,XMH(I)
1200 READ (2,) L,L,HSC(I),L,WI(I),L,XMI(I),L,FAIL(I)
1300 READ (2,) L,L,FMI(I),L,AOPP(I),L,MLIN(I),L,NCAL(I)
1400 READ (2,) (L,NYR(J),L,NEGB(I,J),L,NEGD(I,J),L,NDEN(I,J),J=1,10)
1600 2 CONTINUE
1700 DATA (NCAT(I),I=1,11)/8HTRAINING,8HPURCHASE,9HPERSONNEL,
1710+10HFIRST DEST,9HTRANSPORT,10HCONSUMBLES,9HINTRODUCE,
1720+7HHOLDING,9HDOCUMENTS,7HINSTALL,8HDISPOSAL/
1800 DATA (XINF(I),I=1,10)/1.,1.12,1.22,1.33,1.40,1.46,
1810+1.53,1.60,1.67,1.75/
1900 DATA DIS,NIDEN,CTR,CTC(1),CTC(2),SHC,CPP,NPERR
1910+/.1,32411,22080.,25024.,41226.,.000169,175.,42/
2000 DATA (IR(I),I=1,7)/.41,.36,.46,.33,.35,.5,.59/
2100 DATA (CIOP(I),I=1,5)/31630.,25083.,31233.,21127.,17360./
2200 DATA (DLH(I),I=1,7)/7*6.91/
2300 DATA (PROD(I),I=1,7)/.75,.75,.75,.75,.75,.75,.75/
2310 DATA NPERC(1),NPERC(2)/143,32/
2320 DATA (NPERO(I),I=1,5)/1616,2326,445,251,848/
2330 DATA CPC,NHO/95.,365/
2400 DO 3 I=1,NPIL
2410 ML=0
2450 LL=LLL=0
2455 IF((NDEN(I,1).GT.0).AND.(NEGB(I,1).EQ.0))ML=LL=1
2500 DO 4 J=1,10
2510 IF((ML.EQ.1).AND.(NEGB(I,J).GT.0))ML=LL=0
2520 IF(NDEN(I,J).EQ.0)LL=0
2550 NLIN=NN=0
2600 XDUM=0.
2700 DO 5 K=1,5
2800 5 XDUM=XDUM+IR(K)*NPERO(K)*CIOP(K)
2900 ECOS(I,J,1)=NDEN(I,J)*(LCAL(I)*IR(6)*NPERC(1)*CTC(1)+
2910+(1-LCAL(I))*IR(7)*NPERC(2)*CTC(2)+IR(7)*NPERR*CTR+
2920+.1*XDUM)*XINF(J)/((1+DIS)**J)/NIDEN
3000 ECOS(I,J,2)=NEGB(I,J)*(UCOS(I)+20.)*XINF(J)/((1+DIS)**J)
3100 XDUM=0.
3200 DO 6 K=1,5
3300 6 XDUM=XDUM+DLH(K)/PROD(K)
3350 XDUM=XDUM/5.
```

1. Computer Program "TMDE" (Cont)

```
3400 EC0S(I,J,3)=NDEN(I,J)*(XMH(I)*DLH(7)/PR0D(7)+LCAL(I)*HSC(I)
3410+*DLH(6)/PR0D(6)+(1-LCAL(I))*HSC(I)*DLH(7)/PR0D(7)+NH0
3420+*XDUM)*XINF(J)/((1+DIS)**J)
3500 EC0S(I,J,4)=NEGB(I,J)*WI(I)*XMI(I)*SHC*XINF(J)/((1+DIS)**J)
3600 EC0S(I,J,5)=NDEN(I,J)*WI(I)*2*FMI(I)*SHC*(FAIL(I)+(1-LCAL(I))
3610+*NCAL(I))*XINF(J)/((1+DIS)**J)
3650 IF((NEGB(I,J).GT.0).AND.(LL.EQ.0))NLIN=1
3700 EC0S(I,J,6)=NDEN(I,J)*.125*FAIL(I)*UC0S(I)*XINF(J)/((1+DIS)**J)
3800 EC0S(I,J,7)=(NLIN*(480.*MLIN(I)+510.)+LL*160.)*XINF(J)
3810+/((1+DIS)**J)
3850 IF(NLIN.EQ.1)LL=1
3900 EC0S(I,J,8)=.23*NDEN(I,J)*UC0S(I)*LL*XINF(J)/((1+DIS)**J)
3910 IF((NEGB(I,J).GT.0).AND.(LLL.EQ.0))NN=1
4000 EC0S(I,J,9)=NN*AGPP(I)*CPP*XINF(J)/((1+DIS)**J)
4010 IF(NN.EQ.1)LLL=1
4100 EC0S(I,J,10)=NEGB(I,J)*CPC*XINF(J)/((1+DIS)**J)
4200 EC0S(I,J,11)=-.1*NEGB(I,J)*UC0S(I)*XINF(J)/((1+DIS)**J)
4300 4 CONTINUE
4400 3 CONTINUE
4500 PRINT,*  ITEM  NO.  YEAR          C0ST        CUMC0ST*
4600 D0 7 I=1,NPIL
4700 PRINT 400,NAME(I),I
4750 400 F0RMAT (A8,I3)
4800 CUMC0S=0.
4900 D0 8 J=1,10
5000 XDUM=0.
5100 D0 9 K=1,11
5200 9 XDUM=XDUM+EC0S(I,J,K)
5300 CUMC0S=CUMC0S+XDUM
5400 8 PRINT 100, NYR(J), XDUM, CUMC0S
5500 100 FORMAT (I17,2F14.2)
5600 7 CONTINUE
5700 PRINT,* NON-PIL GR0UP C0STS*
5800 PRINT,*          YEAR          C0ST        CUMC0ST*
5900 CUMC0S=0.
6000 D0 10 I=1,10
6100 XDUM=0.
6200 D0 11 J=2,NPIL
6300 D0 12 K=1,11
6350 12 XDUM=XDUM+EC0S(J,I,K)
6400 11 CONTINUE
6600 CUMC0S=CUMC0S+XDUM
6700 10 PRINT 100, NYR(I), XDUM, CUMC0S
6800 PRINT,* D0 Y0U WANT GR0UP BREAK0UT BY C0ST ELEMENT,YES 0R NO*,
6900 READ,AA
7000 IF(AA.NE.3HYES)G0T0 13
7100 PRINT,* YEAR   ELEMENT          C0ST*
7200 D0 14 I=1,10
7300 PRINT 200,NYR(I)
7400 D0 15 J=1,11
7500 XDUM=0.
7600 D0 16 K=2,NPIL
```

1. Computer Program "TMDE" (Cont)

```
7700 200 FORMAT (I5)
7800 16 XDUM=XDUM+ECOS(K,I,J)
7900 15 PRINT 300,NCAT(J),XDUM
8000 14 CONTINUE
8100 300 FORMAT (A15,F14.2)
8200 13 PRINT,* DO YOU WANT BREAKOUT BY ITEM, YES OR NO*,
8300 READ,AA
8400 IF(AA.NE.3HYES)GOTO 17
8500 18 PRINT,* TYPE ITEM NAME, NO.*,
8600 READ, BB,I
9000 PRINT,* YEAR   ELEMENT          COST*
9100 DO 21 J=1,10
9200 PRINT 200,NYR(J)
9300 DO 22 K=1,11
9400 22 PRINT 300,NCAT(K),ECOS(I,J,K)
9500 21 CONTINUE
9600 PRINT,* MORE ITEMS, YES OR NO*,
9700 READ, AA
9800 IF(AA.EQ.3HYES)GOTO 18
9900 17 PRINT,* DO YOU WANT TO RUN ANOTHER CASE, YES OR NO*,
10000 READ,AA
10100 IF(AA.NE.3HYES)GOTO 99
10200 REWIND 2 $ GOTO 1
10300 99 STOP
10400 END
READY.
6700
FORT,OLD,TMDE
READY.
6700 PRINT,*NPIL LIFE CYCLE TOTALS*
6710 DO 327 I=1,11
6720 XCOS=0.
6730 DO 328 J=2,NPIL
6740 DO 329 K=1,10
6750 329 XCOS=XCOS(J,K,I)
6760 328 CONTINUE
6770 327 PRINT 300,NCAT(I),XCOS
9810 17PRINT,*PIL LIFE CYCLE TOTALS*
9820 DO 331 J=1,11
9830 XCOS=0
9840 DO 332 K=1,10
9850 332 XCOS=XCOS+ECOS(I,K,J)
9860 331 PRINT 300,NCAT(J),XCOS
9900 PRINT,*DO YOU WANT TO RUN ANOTHER CASE, YES OR NO*,
```

2. Computer Program "TMDE 1"

```
100 PROGRAM TMDE1(INPUT,OUTPUT,TAPE2)
200 DIMENSION NYR(10),EC0S(29,10,11),NEQB(29,10),NEQD(29,10),NAME(29),
210+NCAT(11),XINF(10),NDEN(29,10),TR(7),CT0P(5),CTC(2),NPERC(2),
220+NPER0(5),LCAL(29),UC0S(29),XMH(29),DLH(7),PR0D(7),
230+HSC(29),WI(29),XMI(29),FAIL(29),FMI(29),AQPP(29),
240+NCAL(29),MLIN(29)
300 1 PRINT,* ------------IMDE LIFE CYCLE C0ST EVALUATI0N----------*
400 PRINT,* GR0UP*,
500 READ,GFILE
600 CALL GET (5HTAPE2,GFILE,0,0)
700 READ (2,)L,L,L,L
800 READ (2,)L,L,NPIL$ NPIL=NPIL+1
900 D0 2 I=1,NPIL
1000 READ (2,) L,NAME(I)
1100 READ (2,) L,L,LCAL(I),L,UC0S(I),L,XMH(I)
1200 READ (2,) L,L,HSC(I),L,WI(I),L,XMI(I),L,FAIL(I)
1300 READ (2,) L,L,FMI(I),L,AQPP(I),L,MLIN(I),L,NCAL(I)
1400 READ (2,) (L,NYR(J),L,NEQB(I,J),L,NEQD(I,J),L,NDEN(I,J),J=1,10)
1600 2 CONTINUE
1700 DATA (NCAT(I),I=1,11)/8HTRAINING,8HPURCHASE,9HPERS0NNEL,
1710+10HFIRST DEST,9HTRANSP0RT,10HC0NSUMBLES,9HINTR0DUCE,
1720+7HH0LDING,9HD0CUMENTS,7HINSTALL,8HDISP0SAL/
1800 DATA (XINF(I),I=1,10)/1.,1.12,1.22,1.33,1.40,1.46,
1810+1.53,1.60,1.67,1.75/
1900 DATA DIS,NIDEN,CTR,CTC(1),CTC(2),SHC,CPP,NPERR
1910+/.1,32411,22080.,25024.,41226.,.000169,175.,42/
2000 DATA (TR(I),I=1,7)/.41,.36,.46,.33,.35,.5,.59/
2100 DATA (CT0P(I),I=1,5)/31630.,25083.,31233.,21127.,17360./
2200 DATA (DLH(I),I=1,7)/7*6.91/
2300 DATA (PR0D(I),I=1,7)/.75,.75,.75,.75,.75,.75,.75/
2310 DATA NPERC(1),NPERC(2)/143,32/
2320 DATA (NPE[illegible](I),I=1,5)/1616,2326,445,251,848/
2330 DATA CPC[illegible]95.,365/
2400 D0 3 I=1,NPIL
2410 ML=0
2450 LL=LLL=0
2455 IF((NDEN(I,1).GT.0).AND.(NEQB(I,1).EQ.0))ML=LL=1
2500 D0 4 J=1,10
2510 IF((ML.EQ.1).AND.(NEQB(I,J).GT.0))ML=LL=0
2520 IF(NDEN(I,J).EQ.0)LL=0
2550 NLIN=NN=0
2600 XDUM=0.
2700 D0 5 K=1,5
2800 5 XDUM=XDUM+TR(K)*NPER0(K)*CT0P(K)
2900 EC0S(I,J,1)=NDEN(I,J)*(LCAL(I)*TR(6)*NPERC(1)*CTC(1)+
2910+(1-LCAL(I))*TR(7)*NPERC(2)*CTC(2)+TR(7)*NPERR*CTR+
2920+.1*XDUM)*XINF(J)/((1+DIS)**J)/NIDEN
3000 EC0S(I,J,2)=NEQB(I,J)*(UC0S(I)+20.)*XINF(J)/((1+DIS)**J)
3100 XDUM=0.
3200 D0 6 K=1,5
3300 6 XDUM=XDUM+DLH(K)/PR0D(K)
3350 XDUM=XDUM/5.
```

2. Computer Program "TMDE 1" (Cont)

```
3400 ECOS(I,J,3)=NDEN(I,J)*(XMH(I)*DLH(7)/PROD(7)+LCAL(I)*HSC(I)
3410+*DLH(6)/PROD(6)+(1-LCAL(I))*HSC(I)*DLH(7)/PROD(7)+NHO
3420+*XDUM)*XINF(J)/((1+DIS)**J)
3500 ECOS(I,J,4)=NEOB(I,J)*WI(I)*XMI(I)*SHC*XINF(J)/((1+DIS)**J)
3600 ECOS(I,J,5)=NDEN(I,J)*WT(I)*2*FMI(I)*SHC*(FAIL(I)+(1-LCAL(I))
3610+*NCAL(I))*XINF(J)/((1+DIS)**J)
3650 IF((NEOB(I,J).GT.0).AND.(LL.EQ.0))NLIN=1
3700 ECOS(I,J,6)=NDEN(I,J)*.125*FAIL(I)*UCOS(I)*XINF(J)/((1+DIS)**J)
3800 ECOS(I,J,7)=(NLIN*(480.*MLIN(I)+510.)+LL*160.)*XINF(J)
3810+/((1+DIS)**J)
3850 IF(MLIN.EQ.1)LL=1
3900 ECOS(I,J,8)=.23*NDEN(I,J)*UCOS(I)*LL*XINF(J)/((1+DIS)**J)
3910 IF((NEOB(I,J).GT.0).AND.(LLL.EQ.0))NN=1
4000 ECOS(I,J,9)=NN*AOPP(I)*OPP*XINF(J)/((1+DIS)**J)
4010 IF(NN.EQ.1)LLL=1
4100 ECOS(I,J,10)=NEOB(I,J)*OPC*XINF(J)/((1+DIS)**J)
4200 ECOS(I,J,11)=-.1*NEOB(I,J)*UCOS(I)*XINF(J)/((1+DIS)**J)
4300 4 CONTINUE
4400 3 CONTINUE
4500 PRINT,*  ITEM  NO.  YEAR          COST        CUMCOST*
4600 DO 7 I=1,NPIL
4700 PRINT 400,NAME(I),I
4750 400 FORMAT (A8,I3)
4800 CUMCOS=0.
4900 DO 8 J=1,10
5000 XDUM=0.
5100 DO 9 K=1,11
5200 9 XDUM=XDUM+ECOS(I,J,K)
5300 CUMCOS=CUMCOS+XDUM
5400 8 PRINT 100, NYR(J), XDUM, CUMCOS
5500 100 FORMAT (I17,2F14.2)
5600 7 CONTINUE
5700 PRINT,* NON-PIL GROUP COSTS*
5800 PRINT,*          YEAR          COST        CUMCOST*
5900 CUMCOS=0.
6000 DO 10 I=1,10
6100 XDUM=0.
6200 DO 11 J=2,NPIL
6300 DO 12 K=1,11
6350 12 XDUM=XDUM+ECOS(J,I,K)
6400 11 CONTINUE
6600 CUMCOS=CUMCOS+XDUM
6700 PRINT,*NPIL LIFE CYCLE TOTALS*
6710 DO 327 I=1,11
6720 XCOS=0.
6730 DO 328 J=2,NPIL
6740 DO 329 K=1,10
6750 329 XCOS=XCOS(J,K,I)
```

2. Computer Program "TMDE 1" (Cont)

```
6760 328 CONTINUE
6770 327 PRINT 300,NCAT(I),XCOS
6800 PRINT,* DO YOU WANT GROUP BREAKOUT BY COST ELEMENT,YES OR NO*,
6900 READ,AA
7000 IF(AA.NE.3HYES)GOTO 13
7100 PRINT,* YEAR   ELEMENT          COST*
7200 DO 14 I=1,10
7300 PRINT 200,NYR(I)
7400 DO 15 J=1,11
7500 XDUM=0.
7600 DO 16 K=2,NPIL
7700 200 FORMAT (I5)
7800 16 XDUM=XDUM+ECOS(K,I,J)
7900 15 PRINT 300,NCAT(J),XDUM
8000 14 CONTINUE
8100 300 FORMAT (A15,F14.2)
8200 13 PRINT,* DO YOU WANT BREAKOUT BY ITEM, YES OR NO*,
8300 READ,AA
8400 IF(AA.NE.3HYES)GOTO 17
8500 18 PRINT,* TYPE ITEM NAME, NO.*,
8600 READ, BB,I
9000 PRINT,* YEAR   ELEMENT          COST*
9100 DO 21 J=1,10
9200 PRINT 200,NYR(J)
9300 DO 22 K=1,11
9400 22 PRINT 300,NCAT(K),ECOS(I,J,K)
9500 21 CONTINUE
9600 PRINT,* MORE ITEMS, YES OR NO*,
9700 READ, AA
9800 IF(AA.EQ.3HYES)GOTO 18
9810 17PRINT,*PIL LIFE CYCLE TOTALS*
9820 DO 331 J=1,11
9830 XCOS=0
9840 DO 332 K=1,10
9850 332 XCOS=XCOS+ECOS(I,K,J)
9860 331 PRINT 300,NCAT(J),XCOS
9900 PRINT,*DO YOU WANT TO RUN ANOTHER CASE, YES OR NO*,
10000 READ,AA
10100 IF(AA.NE.3HYES)GOTO 99
10200 REWIND 2 $ GOTO 1
10300 99 STOP
10400 END
```

APPENDIX A-5

TECHNICAL DESCRIPTION OF PIL TMDE

1. GROUP A PIL TMDE

The AN/USM-366(V)1 is a wideband spectrum analyzer with a frequency range of 10 MHz to 40 GHz, consisting of eight individual band selections: 10 to 275 MHz; 275 to 900 MHz; 800 to 2000 MHz; 1.5 to 4 GHz; 3.8 to 8.2 GHz; 8.2 to 12.4 GHz; 12.4 to 18.0 GHz; and 18.0 to 40 GHz. The AN/USM366(V)1 has oscilloscope-type time base and trigger circuits, and is operable from 90 to 136 Vac or 180 to 272 Vac, 48 to 446 Hz. The input impedance is approximately 50 ohms.

The CRT display plots frequency against calibrated output. The CRT has 8 x 10 divisions (each division = 0.8 cm) and an internal graticule. Overall dimensions of the AN/USM-366(V)1 are 12.4 in. long x 19.7 in. wide x 7.2 in. high. Standard accessories include BNC cables, coaxial cables, waveguide mixers, alternators, various fittings and adapters, light filters, fuses, dust and rain covers, and a power cord. The electronic circuitry comprising the AN/USM-366(V)1 is all solid state. The commercial model number of this PIL item manufactured by Tektronic, Inc., is the 491C.

2. GROUP B PIL TMDE

2.1 Group 1B: CP-772A/U

The CP-772A/U is an electronic digital counter that measures frequency, period, multiple period average, time interval, ratio, and multiples of ratio. This unit is a main frame with a frequency range from dc to 50 MHz; with the three plug-ins described below, it has a frequency range up to 12.4 GHz. An additional plug-in not described below extends the frequency range up to 18 GHz. The CP-772A/U has a gate time of 1 microsecond to 10 seconds in decade steps. The signal input

sensitivity is 100 mVrms, and the impedance is 1 MΩ in parallel with approximately 25 pf for all ranges.

The CP-772A/U has an eight-digit numeric readout tube type display with positioned decimal point. The unit is approximately 18-3/8 in. long x 16-3/4 in. wide by 5-7/32 in. high. This PIL item is manufactured by Hewlett Packard as model number 5245L.

2.2 Group 2B: CV-2002/U

The CV-2002/U is a plug-in frequency converter used with the CP-772A/U main frame to measure frequency from 20 to 512 MHz. The unit has a 50 mV sensitivity over the entire frequency range. The CV-2002/U is all solid-state circuit design, and is manufactured by Hewlett-Packard as model number 5243B.

2.3 Group 3B: CV-2003B/U

The CV-2003B/U is a plug-in frequency converter used with the CP-772A/U main frame to measure frequency from 150 MHz to 3 GHz in 50 MHz steps. The model number of this plug-in is 5245C.

2.4 Group 4B: CV-3059/U

The CV-3059/U is a plug-in frequency converter used with the CP-772A/U to measure frequency from 3 to 12.4 GHz in 200 MHz steps. The unit model number is 5255A.

3. GROUP C PIL TMDE

The 432A (ME-441/U) is a power meter that measures microwave power from 10 to 40 GHz. The 432A is used with an external temperature-compensated thermistor mount (a standard accessory). The unit has seven power ranges with full-scale readings of 10, 30, 100, and 300 uW, and 1, 3, and 10 mW. The instrument is also calibrated in dBm to read from -20 to +10 dBm in 5 dBm steps. The accuracy is 1% of full scale on all ranges.

The 432A is manufactured by Hewlett-Packard. It is approximately 5-1/8 in. wide x 6-3/32 in. high x 11 in. deep.

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