

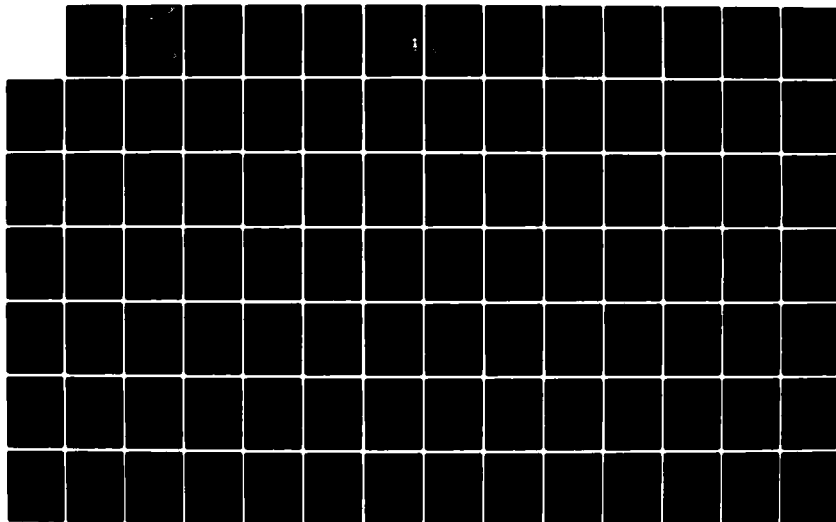
AD-A123 025

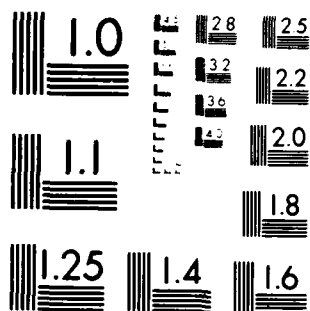
A STUDY TO DEMONSTRATE THE APPLICATION OF A GRAPHICAL  
METHOD TO DETERMINE..(U) AIR FORCE INST OF TECH  
WRIGHT-PATTERSON AFB OH SCHOOL OF SYST..

1/3

UNCLASSIFIED D C BECKWITH ET AL. SEP 82 AFIT-LSSR-60-82 F/G 5/1

NL





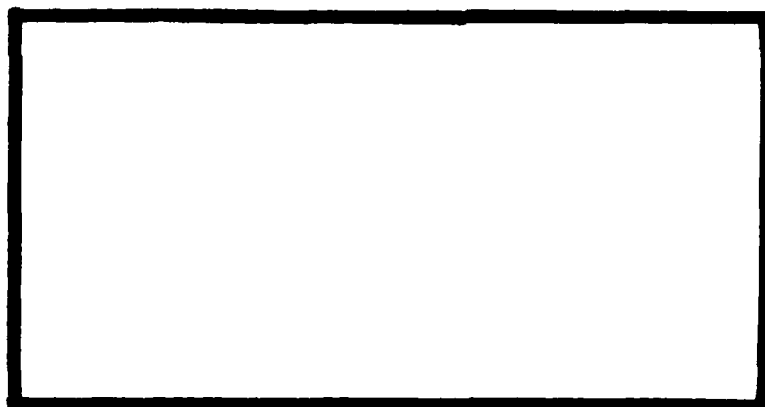
MICROCOPY RESOLUTION TEST CHART  
NATIONAL BUREAU OF STANDARDS-1963-A

AD A 123025

DTIC FILE COPY



2



DTIC  
ELECTE  
JAN 6 1983  
S D D

DEPARTMENT OF THE AIR FORCE  
AIR UNIVERSITY (ATC)  
**AIR FORCE INSTITUTE OF TECHNOLOGY**

Wright-Patterson Air Force Base, Ohio

**DISTRIBUTION STATEMENT A**

Approved for public release  
Distribution Unlimited

83 1 5 058

|                    |                                     |
|--------------------|-------------------------------------|
| Accession For      |                                     |
| NTIS GRA&I         | <input checked="" type="checkbox"/> |
| DTIC TAB           | <input type="checkbox"/>            |
| Unannounced        | <input type="checkbox"/>            |
| Justification      |                                     |
| By                 |                                     |
| Distribution/      |                                     |
| Availability Codes |                                     |
| Dist               | Avail and/or Special                |
| A                  |                                     |



A STUDY TO DEMONSTRATE THE  
APPLICATION OF A GRAPHICAL METHOD  
TO DETERMINE AN OPTIMAL  
MAINTENANCE TASK INTERVAL  
FOR AN ITEM IN AIR FORCE INVENTORY

Douglas C. Beckwith, Captain, USAF  
Anthony R. Roclevitch, Captain, USAF

LSSR 60-82

DTIC TAB  
Approved for public release;  
Distribution Unlimited

The contents of the document are technically accurate, and no sensitive items, detrimental ideas, or deleterious information are contained therein. Furthermore, the views expressed in the document are those of the author(s) and do not necessarily reflect the views of the School of Systems and Logistics, the Air University, the Air Training Command, the United States Air Force, or the Department of Defense.

## AFIT RESEARCH ASSESSMENT

The purpose of this questionnaire is to determine the potential for current and future applications of AFIT thesis research. Please return completed questionnaires to: AFIT/LSH, Wright-Patterson AFB, Ohio 45433.

1. Did this research contribute to a current Air Force project?

- a. Yes                      b. No

2. Do you believe this research topic is significant enough that it would have been researched (or contracted) by your organization or another agency if AFIT had not researched it?

- a. Yes                      b. No

3. The benefits of AFIT research can often be expressed by the equivalent value that your agency received by virtue of AFIT performing the research. Can you estimate what this research would have cost if it had been accomplished under contract or if it had been done in-house in terms of manpower and/or dollars?

a. Man-years \_\_\_\_\_ \$ \_\_\_\_\_ (Contract).

b. Man-years \_\_\_\_\_ \$ \_\_\_\_\_ (In-house).

4. Often it is not possible to attach equivalent dollar values to research, although the results of the research may, in fact, be important. Whether or not you were able to establish an equivalent value for this research (3 above), what is your estimate of its significance?

- a. Highly Significant              b. Significant      c. Slightly Significant      d. Of No Significance

5. Comments:

\_\_\_\_\_  
Name and Grade

\_\_\_\_\_  
Position

\_\_\_\_\_  
Organization

\_\_\_\_\_  
Location

FOLD DOWN ON OUTSIDE - SEAL WITH TAPE

AFIT/LSH  
WRIGHT-PATTERSON AFB OH 45433  
OFFICIAL BUSINESS  
PENALTY FOR PRIVATE USE, \$300



NO POSTAGE  
NECESSARY  
IF MAILED  
IN THE  
UNITED STATES

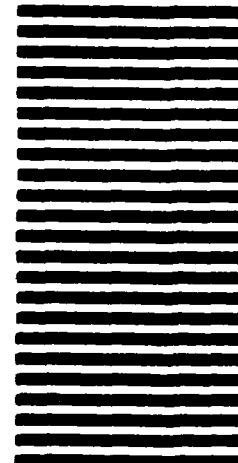
**BUSINESS REPLY MAIL**

FIRST CLASS PERMIT NO. 73236 WASHINGTON D.C.

POSTAGE WILL BE PAID BY ADDRESSEE

AFIT/DAA

Wright-Patterson AFB OH 45433



FOLD IN

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

| REPORT DOCUMENTATION PAGE                                                                                                                                                                                                                                                           |                                  | READ INSTRUCTIONS<br>BEFORE COMPLETING FORM                    |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|----------------------------------------------------------------|
| 1. REPORT NUMBER<br>LSSR 60-82                                                                                                                                                                                                                                                      | 2. GOVT ACCESSION NO.<br>A123025 | 3. RECIPIENT'S CATALOG NUMBER                                  |
| 4. TITLE (and Subtitle)<br>A STUDY TO DEMONSTRATE THE APPLICATION OF<br>A GRAPHICAL METHOD TO DETERMINE AN OPTIMAL<br>MAINTENANCE TASK INTERVAL FOR AN ITEM IN<br>AIR FORCE INVENTORY                                                                                               |                                  | 5. TYPE OF REPORT & PERIOD COVERED<br>Master's Thesis          |
| 7. AUTHOR(s)<br>Douglas C. Beckwith, Captain, USAF<br>Anthony R. Roclevitch, Captain, USAF                                                                                                                                                                                          |                                  | 6. PERFORMING ORG. REPORT NUMBER                               |
| 9. PERFORMING ORGANIZATION NAME AND ADDRESS<br>School of Systems and Logistics<br>Air Force Institute of Technology, WPAFB OH                                                                                                                                                       |                                  | 8. CONTRACT OR GRANT NUMBER(s)                                 |
| 11. CONTROLLING OFFICE NAME AND ADDRESS<br>Department of Communication and<br>Humanities<br>AFIT/LSH, WPAFB OH 45433                                                                                                                                                                |                                  | 10. PROGRAM ELEMENT, PROJECT, TASK<br>AREA & WORK UNIT NUMBERS |
| 14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)                                                                                                                                                                                                         |                                  | 12. REPORT DATE<br>September 1982                              |
|                                                                                                                                                                                                                                                                                     |                                  | 13. NUMBER OF PAGES<br>209                                     |
|                                                                                                                                                                                                                                                                                     |                                  | 15. SECURITY CLASS. (of this report)<br>UNCLASSIFIED           |
|                                                                                                                                                                                                                                                                                     |                                  | 15a. DECLASSIFICATION/DOWNGRADING<br>SCHEDULE                  |
| 16. DISTRIBUTION STATEMENT (of this Report)<br><br>Approved for public release; distribution unlimited                                                                                                                                                                              |                                  |                                                                |
| 17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)                                                                                                                                                                                          |                                  |                                                                |
| 18. SUPPLEMENTARY NOTES<br><i>Lynn E. Wolaver</i><br>LYNN E. WOLAVER<br>Dean for Research and<br>Professional Development<br>APPROVED FOR PUBLIC RELEASE<br>LAW APR 190-17<br>AIR FORCE INSTITUTE OF TECHNOLOGY (ATC)<br>WRIGHT-PATTERSON AFB, OH 45433<br>8 OCT 1982               |                                  |                                                                |
| 19. KEY WORDS (Continue on reverse side if necessary and identify by block number)<br>Scheduled Maintenance<br>Reliability-Centered Maintenance<br>Inertial Measurement Units<br>Optimal Maintenance Policies<br>Age Replacement<br>Interval Determination<br>Failure Data Analysis |                                  |                                                                |
| 20. ABSTRACT (Continue on reverse side if necessary and identify by block number)<br><br>Thesis Chairman: Arthur L. Rastetter, Major, USAF                                                                                                                                          |                                  |                                                                |

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

Determining maintenance task intervals is an important part of any scheduled maintenance program. Criteria for determining optimal intervals is usually based on an objective function designed to minimize average long-term (expected) cost. This study demonstrates a graphical method, developed by Bergman in 1977, for determining a maintenance task interval using the KT-73 Inertial Measurement Unit installed on the A7-D. The method establishes intervals on a "hard time" replacement policy, but can also be used under an "on-condition" maintenance policy. The authors sought to discuss this study within the context of the Reliability-Centered Maintenance Program, but to deviate from the traditional age exploration concept and cost-benefit analyses. Instead, Bergman's simple, but rigorous, method is employed to find a task interval based on a control strategy which balances cost of replacement with cost of failure and results in a minimum total long-run average cost per unit time. Among the advantages of Bergman's method are that the underlying failure distribution need not be known and that a sensitivity analysis can be performed to examine the effects of cost uncertainty with regard to changes in the optimal interval.

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

LSSR 60-82

A STUDY TO DEMONSTRATE THE APPLICATION OF A GRAPHICAL  
METHOD TO DETERMINE AN OPTIMAL MAINTENANCE  
TASK INTERVAL FOR AN ITEM IN  
AIR FORCE INVENTORY

A Thesis

Presented to the Faculty of the School of Systems and Logistics  
of the Air Force Institute of Technology  
Air University

In Partial Fulfillment of the Requirement for the  
Degree of Master of Science in Logistics Management

By

Douglas C. Beckwith, BS  
Captain, USAF

Anthony R. Roclevitch, BS  
Captain, USAF

September 1982

Approved for public release;  
distribution unlimited

This thesis, written by

Captain Douglas C. Beckwith

and

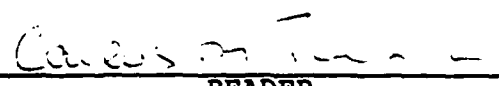
Captain Anthony R. Roclevitch

has been accepted by the undersigned on behalf of the  
faculty of the School of Systems and Logistics in partial  
fulfillment of the requirements for the degree of

MASTER OF SCIENCE IN LOGISTICS MANAGEMENT

DATE: 29 September 1982

  
COMMITTEE CHAIRMAN

  
READER

  
READER

## ACKNOWLEDGEMENTS

We gratefully acknowledge the guidance and cooperation of our advisor, Major Art Rastetter; of our reader, Mr. Ernie Spitzer; and of our technical advisor, Major Carl Talbott, Jr., whose combined efforts made this study possible. We also thank Mr. Jim Hitchcock and Captain John Griffin from the Aerospace Guidance and Metrology Center; Mr. Vern McAlpin and Mr. Bob Newman from the HQ AFLC Engineering Analysis and Support Division; and Ms. Connie Pavliga, our typist.

Captain Beckwith: I wish to express loving gratitude to my wife, Cindy, and daughter, Sarah, for their patience, understanding and selfless cooperation through the graduate program.

Captain Roclevitch: I dedicate my work to my wife, Sylvia, and son, Tony, whose love I could not do without, and for whom, I do everything.

## TABLE OF CONTENTS

|                                          | Page |
|------------------------------------------|------|
| ACKNOWLEDGEMENTS . . . . .               | iii  |
| LIST OF TABLES . . . . .                 | vii  |
| LIST OF FIGURES. . . . .                 | viii |
| <br>CHAPTER                              |      |
| I. INTRODUCTION . . . . .                | 1    |
| Terminology. . . . .                     | 2    |
| Background . . . . .                     | 4    |
| Justification for Research . . . . .     | 9    |
| Problem Statement. . . . .               | 12   |
| Research Objective . . . . .             | 12   |
| Research Question. . . . .               | 12   |
| Scope and Limitations. . . . .           | 13   |
| Methodology. . . . .                     | 18   |
| Research Assumptions . . . . .           | 19   |
| II. LITERATURE REVIEW. . . . .           | 21   |
| Introduction . . . . .                   | 21   |
| Discussion . . . . .                     | 22   |
| Optimal Replacement Policies . . . . .   | 22   |
| Age Exploration. . . . .                 | 28   |
| Computer-Assisted Maintenance Programs . | 29   |
| Summary. . . . .                         | 30   |

| CHAPTER                                                       | Page |
|---------------------------------------------------------------|------|
| III. METHODOLOGY . . . . .                                    | 33   |
| Cost Measurement. . . . .                                     | 34   |
| Total Time on Test-plot: Analysis<br>of Failures . . . . .    | 35   |
| Nonparametric Age Replacement . . . . .                       | 36   |
| Sensitivity Analysis. . . . .                                 | 44   |
| The Sample. . . . .                                           | 46   |
| Data Collection . . . . .                                     | 51   |
| Answering the Research Question . . . . .                     | 55   |
| IV. APPLICATION AND ANALYSIS. . . . .                         | 59   |
| The Failure Data. . . . .                                     | 59   |
| Total Time on Test-plot . . . . .                             | 61   |
| Cost Data . . . . .                                           | 70   |
| Graphical Solution. . . . .                                   | 75   |
| Sensitivity Analysis. . . . .                                 | 83   |
| Summary . . . . .                                             | 87   |
| V. CONCLUSIONS, IMPLICATIONS AND<br>RECOMMENDATIONS . . . . . | 92   |
| Conclusions . . . . .                                         | 92   |
| Research Question . . . . .                                   | 92   |
| Secondary Research Question "a" . . . . .                     | 93   |
| Secondary Research Question "b" . . . . .                     | 93   |
| Implications. . . . .                                         | 95   |
| Managerial Tool . . . . .                                     | 95   |
| Opportunistic Maintenance Policy. . . . .                     | 95   |

| CHAPTER                                                                                                      | Page |
|--------------------------------------------------------------------------------------------------------------|------|
| Recommendations. . . . .                                                                                     | 97   |
| General. . . . .                                                                                             | 97   |
| Recommendations for Future Research. . . . .                                                                 | 98   |
| APPENDICES . . . . .                                                                                         | 100  |
| A. FUNCTIONAL DESCRIPTION AND INSPECTION<br>CHECKLIST--KT-73 IMU . . . . .                                   | 101  |
| B. G078C REPORTS - "AIRCRAFT LISTING" AND<br>"FIELD OPERATING HOURS (FOH) BY CYCLE -<br>QUARTERLY" . . . . . | 131  |
| C. K051 LOGISTIC SUPPORT COST BREAKDOWN . . . . .                                                            | 153  |
| SELECTED BIBLIOGRAPHY. . . . .                                                                               | 193  |
| A. REFERENCES CITED . . . . .                                                                                | 194  |
| B. RELATED SOURCES. . . . .                                                                                  | 197  |
| BIOGRAPHICAL SKETCHES OF THE AUTHORS . . . . .                                                               | 199  |

## LIST OF TABLES

| Table |                                                                        | Page |
|-------|------------------------------------------------------------------------|------|
| 3-1   | Program Output. . . . .                                                | 38   |
| 4-1   | Times to Failure by Serial Number . . . . .                            | 60   |
| 4-2   | Scaled Times to Failure . . . . .                                      | 67   |
| 4-3   | Average Cost to Repair KT-73 IMU. . . . .                              | 71   |
| 4-4   | Trouble-shooting and Transportation<br>Costs Quarterly Totals. . . . . | 73   |

## LIST OF FIGURES

| Figure                                                                             | Page |
|------------------------------------------------------------------------------------|------|
| 3-1 Program for Scaling Observed Data . . . . .                                    | 37   |
| 3-2 TTT-plot. . . . .                                                              | 39   |
| 3-3 Examples of Empirical Distributions . . . . .                                  | 40   |
| 3-4 Graphical Solution. . . . .                                                    | 45   |
| 3-5 Sensitivity Analysis. . . . .                                                  | 47   |
| 3-6 Effects of Shape of Failure Curve on<br>Sensitivity . . . . .                  | 48   |
| 4-1 TAPE 11: Raw Failure Data . . . . .                                            | 62   |
| 4-2 Program to Order Failure Data . . . . .                                        | 64   |
| 4-3 TAPE 12: Ordered Failure Data . . . . .                                        | 65   |
| 4-4 Program to Scale Total Time on Test . . . . .                                  | 66   |
| 4-5 TAPE 13: Calculated $U_i$ 's . . . . .                                         | 68   |
| 4-6 Total Time on Test-plot . . . . .                                              | 69   |
| 4-7 Program to Calculate Cost "C" . . . . .                                        | 76   |
| 4-8 TAPE 20: Average Cost to Repair and Total<br>Number of Units Repaired. . . . . | 77   |
| 4-9 TAPE 21: Costs of Trouble-shooting and<br>Transportation. . . . .              | 78   |
| 4-10 TAPE 22: Standardized Cost of Replacement<br>"C" . . . . .                    | 79   |
| 4-11 SPSS Condescriptive Routine and Results . . .                                 | 80   |
| 4-12 Graphical Solution. . . . .                                                   | 81   |
| 4-13 Sensitivity Analysis. . . . .                                                 | 85   |

## CHAPTER I

### INTRODUCTION

Determining maintenance task intervals is an important part of any scheduled maintenance program. Criteria for determining optimal intervals are usually based on an objective function designed to minimize average long-term (expected) cost. Cost can be expressed in terms of dollars, availability, or readiness, to name a few. This study will demonstrate a graphical method developed by Bo Bergman in 1977 to determine an optimal maintenance task interval for an item in Air Force inventory.

A maintenance task is categorized into one of three recognized maintenance processes: hard time replacement, on-condition, or condition monitoring.

A "hard time" maintenance policy consists of establishing interval time periods of constant "T" at the end of which a unit is replaced, regardless of condition, as a means of precluding failure (1:5; 26:A2-3).

An "on-condition" maintenance policy consists of establishing interval time periods to inspect a unit for measurable wear with a decision to replace based on exceeding set limits (1:6; 22:51).

A "condition monitoring" maintenance policy does not require maintenance tasks. Under this policy, units

not safety or economically significant are permitted to fail and are replaced when discovered (1:7; 22:66).

Bergman's method will be used in this study to determine an optimal task interval based on the hard time concept. The chief advantages of Bergman's method are that the method is simple, the underlying failure distribution need not be known, and the method can be used to analyze any maintenance item for which failure and cost data are available.

A great deal of theory exists on the subject of optimal maintenance policies (see Chapter II). This study attempts to apply some of that theory within the context of an existing maintenance program.

### Terminology

Any discussion of maintenance task interval determination in the Air Force is fundamentally tied to Reliability-Centered Maintenance (RCM) concepts. Therefore, the following terms, used throughout this paper, are defined:

Actuarial Analysis: "Statistical analysis of failure data to determine the age-reliability characteristics of an item [22:453]."

Age Exploration: "The process of collecting and analyzing information from in-service equipment to determine the reliability characteristics of each item under actual operating conditions [22:453]."

Age Replacement: Replacement of a unit at failure or some specified age, whichever occurs first (25:139).

Decision Diagram: "In RCM analysis, a graphic display of the decision process in which the answers to an ordered sequence of yes/no questions lead to an identification of the appropriate maintenance action for an item without regard to appropriate level [22:455]."

Failure Modes and Effects Analysis (FMEA): "An analysis, initially performed by the equipment (aircraft) manufacturer, on all the major assemblies, subsystems and systems to demonstrate how the equipment will perform when various items fail [22:80]."

Failure Cycle: The time from renewal to failure of an item.

Item: "Any level of the equipment or its sets of parts isolated as an entity for study [22:459]."

Reliability-Centered Maintenance: "A logical discipline for developing a scheduled maintenance program that will realize the inherent reliability levels of complex equipment at minimum cost [22:463]."

Renewal: Restoring an item to a "good-as-new" condition.

Significant Item: "An item whose functional failures have safety or significant economic consequences [22:464]."

The term "significant" is a subjective value

assignment made through decision processes which are outside the scope of this study.

Task Interval: "The task interval assigned in a maintenance program, subject to adjustment on the basis of findings from actual operating experience through a process called age exploration [22:459]."

AFLC: Air Force Logistics Command

AFSC: Air Force Systems Command

AGMC: Aerospace Guidance and Metrology Center

DOD: Department of Defense

MDS: Mission-Design-Series

WUC: Work Unit Code

### Background

Early aircraft were primitive, and redundancy was practically absent in aircraft design due to weight penalties. Consequently, maintenance programs attempted to preclude the failure of every part. The idea that a direct relationship existed between reliability and safety led to the belief that the more scheduled maintenance, the more reliable the aircraft. Thus, "hard time" replacement policy drove early maintenance programs (1:1-2). Aircraft components were replaced after a specified time which, by best estimates, would be before failure (22:51,65,370).

After World War II, advances in design, materials and manufacturing of aircraft began to erode traditional

beliefs about the relationship between reliability and safety. The airline industry, during the 1950s, introduced new alternatives to "hard time" concepts. Eventually the process of inspecting against measurable standards became a second maintenance process. It would later be referred to as the "on-condition" process (22:383; 1:2).

During the 1960s, studies conducted by the airlines, technological advances, complexity of design, and the need to maintain more efficient and cost-effective maintenance programs eventually led to the recognition that certain items do not benefit from scheduled maintenance. This discovery resulted in the advent of a third maintenance process called "condition monitoring." Under this process, items are permitted to operate until failure. Maintenance tasks do not exist under this process (22:66; 1:7).

The introduction of the Boeing 747 aircraft with all of its complexities reinforced the need for new approaches to maintenance. Major airline operators and Federal Aviation Agency representatives formed a maintenance steering group (MSG-1) which developed a decision tree technique for determining maintenance requirements. The technique was refined, expanded, and published in a universal document called Airline/Manufacturer Maintenance Program Planning Document: MSG-2 in 1970. The fundamental concept behind the program was that maintenance actions can only prevent

deterioration of the inherent design levels of equipment reliability (1:10; 22:Preface).

The objective of MSG-2 was to outline the organization and decision processes for determining scheduled maintenance requirements for new aircraft. In other words, the MSG-2 document would facilitate the development of initial scheduled maintenance programs (1:9).

As new airline programs based on MSG-2 decision logic began to grow, the Department of Defense (DOD) experimented with the program, beginning with the Navy P-3 aircraft. Believing that benefits could be derived from the MSG-2 program, especially in terms of manhour savings and increased equipment availability, the DOD between 1974 and 1978 issued several directives and memorandums to implement the "Reliability-Centered Maintenance Program (RCMP)" across all services (1:22-88).

Initially, the program did not address the problems of establishing task intervals, consolidating tasks into work packages, or making decisions where no information is available. These areas were addressed, but not resolved, later in an authoritative text by Nowlan and Heap entitled, Reliability-Centered Maintenance (22:Preface).

Nowlan and Heap wrote their text (1978) under contract to the Office of Assistant Secretary of Defense for Manpower, Reserve Affairs and Logistics. The text was intended to provide the necessary information to understand,

develop and implement RCM programs (22:DD Form 1473). In general, RCM implementation for a given aircraft system consists of an initial failure modes and effects analysis (FMEA) for significant items, identification of tasks via use of the decision logic diagram, and determination of task intervals (22:7).

The first requirement above is satisfied initially by the builder of the airframe through Government contract. The second requirement is fulfilled on a continuing basis by the armed services (AFSC, AFLC in the Air Force) by modifying task requirements based on engineering analysis. The third requirement is discussed by Nowlan and Heap under the general heading of age exploration, but no method for determining optimal task intervals has been developed and published by the Air Force. Currently, Air Force engineers are using the Mean Time Between Failure (MTBF) and Incipency methods. The MTBF method is

. . . based on a 70 to 90 percent probability of detecting a pending failure. This is equivalent to inspection at 10 to 30 percent of the MTBF. An alternative method called the Incipency Concept holds that the inspection interval should be a function of the time between first discernible degradation in performance and loss of the function [28:12].

There are also two computerized programs available (discussed in Chapter II), but they are designed primarily as program management tools.

The Army has published an Appendix C to DARCOM-P 750-16, DARCOM Guide to Logistic Support Analysis,

which defines a general methodology for determining maintenance task intervals based on replacement cost, safety and readiness criteria, and equipment failure rates. The method uses age exploration and seeks to minimize cost, but it involves subjective trade-off considerations (33:C1-C44).

Frick and Sasser (1979) investigated a method to improve the preventive maintenance checks and services program for the M60A1 main battle tank. In the study, Frick and Sasser developed a questionnaire sent to operating units. Each question represented a variable, such as technician skill level, which was analyzed using multiple regression to establish correlations between type and time interval estimates for individual maintenance tasks. The results were subjected to network analysis to produce a preventive maintenance checks and services schedule (14:72-73). The research was extremely subjective since it sought opinions rather than substantive data.

Thus far, the Air Force has successfully integrated the majority, but not all, of its aircraft inventory into the RCM program through contract with the airframe builders. System Managers monitor and update programs using the decision logic criteria outlined in MIL-M-5096D and AFLCP 66-35. (A proposed AFSC/AFLC combined regulation is being drafted which will greatly expand AFLCP 66-35.) However, maintenance

task interval determination remains an area without a proven applicable analytical technique.

Although RCM is a DOD program, each service is pursuing the program objectives individually. There is no apparent consistency of effort. The major problem seems to be lack of guidance from DOD which can best be characterized by the fact that DOD, despite its emphasis on implementing the RCMP within the services, has yet to define the program (1:84-85).

#### Justification for Research

The Air Force recently experienced a large incidence of failure of the fifth stage compressor disc for the J-85 engine (20:3). Attention to the problem was brought about by an aircraft accident. The aircraft accident board attributed the accident to failure of the disc and also discovered that the replacement interval for the disc had been changed by AFLC from the 3200 hours recommended by General Electric to 4000 hours. The disc failed less than 100 hours from replacement and resulted in the loss of the aircraft. Consequently, the replacement interval has been changed to 3600 hours (20:1-3). The board findings illustrate the need to develop a methodology for determining optimal maintenance intervals.

An excerpt from a HQ USAF Reliability-Centered Maintenance Program Status Report dated 29 May 1981, identifies an Air Force Logistics Management Center (AFLMC)

tasking to pursue a means of improving the analytical process for determining scheduled maintenance task intervals during FY 82 and the outyears (19:4).

The latest effort by AFLMC was a contract study which resulted in a report authored by Singpurwalla and Talbott and published in January 1981. The report reviewed key ideas in the area of preventive maintenance replacement policies, and concluded that sufficient theory exists for practical applications (26:A2-16,17).

There is, indeed, much theory (see Chapter II) concerning optimal maintenance policies used to determine task intervals. The policies are typically based on the objective of finding the interval which minimizes cost. Bergman's method, the subject of this study, also seeks to minimize cost. However, as these methods are presented in theoretical form, application of the theory needs to be explored.

The MSG-2 maintenance concept did not address the problem of establishing task intervals (22:Preface). Any maintenance task can be made effective in terms of failure prevention if the intervals are made short enough, but this ignores, among other things, the opportunity cost of being unable to operate the equipment during maintenance (22:91,95).

Nowlan and Heap discuss maintenance task interval determination in terms of age exploration and actuarial analysis. Basically, intervals are established at an age when a large number of failures begin to occur, but before

which very few failures occur (22:390). Approaching the problem of cost-effectiveness, they employ a decision logic technique. Specifically, they recommend at least four proposed intervals be examined to determine whether a cost-effective interval does exist, based on the most favorable cost-benefit ratio (22:102).

Their approach tends to suboptimize the last of the four objectives of an operator's maintenance program. Those objectives are

- To ensure realization of the inherent safety and reliability levels of the equipment.
- To restore safety and reliability to their inherent levels when deterioration has occurred.
- To obtain the information necessary for design improvement of those items whose inherent reliability proves inadequate.
- To accomplish these goals at a minimum total cost, including maintenance costs and the costs of residual failures [22:Preface].

Nowlan and Heap do not approach the problem of determining "optimal" intervals by balancing the cost of replacement and the cost of failure.

Perhaps a key word is "costs." Concerted efforts to assess benefits derived from implementation of RCM programs in DOD have generated controversy because of the difficulty in delineating cost-savings directly attributable to RCM and in quantifying benefits such as increased equipment availability (1:68-69).

An unending cycle exists in which appropriate cost data is not available to fully test new methods for determining maintenance task intervals, while on the other hand,

the adoption of an acceptable methodology might warrant changes in data systems to facilitate collection of needed cost information.

Nevertheless, a need exists to begin bridging the gap between theoretical and practical application of methodology to determine maintenance task intervals.

#### Problem Statement

DODD 4151.16, AFR 66-14, AFR 66-30, AFLCP 66-35 and MIL-M-5096D provide definitions, outline responsibilities and explain the use of reliability data as applied to equipment maintenance, but the Air Force does not present a standard analytical approach for determining maintenance task intervals in published form.

#### Research Objective

The objective of this study is to demonstrate the feasibility of applying a new and simple graphical method for determining optimal maintenance task intervals using actual field data for equipment used on aircraft. The method is based on a control strategy which balances cost of replacement with the cost of failure resulting in a minimum total long-run average cost per unit time.

#### Research Question

Can Bergman's graphical method be applied in determining an optimal maintenance task interval based on the

objective of minimizing total long-run average cost per unit time using actual field data?

Since the research question involves application of actual field data for an existing item in Air Force inventory, two questions secondary to the research question are

1. How does the calculated optimal interval for the units tested compare with the current interval for that item?
2. How sensitive is the calculated optimal interval to the uncertainty of cost?

#### Scope and Limitations

The Reliability-Centered Maintenance Program is a DOD program and applies to all military services. There are three basic steps for incorporating a major equipment end item into the program: (1) a failure modes and effects analysis (FMEA) for all significant items, (2) identification of maintenance tasks based on the decision logic, and (3) determination of maintenance task intervals. This study is concerned with the third requirement and is limited to its application in the Air Force, though results could be generalized to any equipment maintenance program. Bergman's graphical technique was chosen among the many available theoretical models because it is a simple, but rigorous method.

The units selected for the study were taken from the Air Force aircraft inventory of equipment primarily to facilitate data collection.

The unit selected for study was by no means an ideal one. The KT-73 Inertial Measurement Unit (IMU) is used on the A7-D and AC-130A aircraft. This study collected data for only those units installed on the A7-D. A complete description of the unit is contained in Appendix A. As an electronic component, the KT-73 IMU currently does not have a maintenance task interval assigned to it. Like other electronic units, the KT-73 is assumed to have an exponential failure distribution (16). Thus, the item is maintained under a condition monitoring or "fly-to-failure" policy. A hard time replacement policy is appropriate for those items which exhibit wearout characteristics for which an economic life-limit can be identified. A unit which is already maintained under a hard time replacement policy would better illustrate the application of Bergman's graphical method.

Availability of failure data dictated the choice of unit for study. Bergman's method requires the use of observational data. The KT-73 is repaired by the Aerospace Guidance and Metrology Center (AGMC) and tracked by serial number and field operating hours on the G078C Maintenance Data Collection System. Since no other data collection system could be found which provided the same type of

nonaggregated data, the C078C was the logical choice. The KT-73 was selected among other IMUs because of early acquisition.

The greatest limitation on this study centers around the availability of appropriate cost data. In order to find an optimal replacement interval which minimizes cost, the cost to replace an item (scheduled maintenance) as well as the cost of an in-service failure (unscheduled maintenance) must be known. These costs are actually random variables, not constants. Since Bergman's method treats these costs as constants, an expected value for each cost will be used in lieu of a probability distribution description. Furthermore, since the cost data covers several years, it is assumed that these historical costs are representative of actual costs.

The cost of in-service failure can be obtained from data collected by the Resources Division at AGMC and is expressed in terms of the actual dollar amount required to repair each failed unit. Adding to this, the cost of transporting units to and from depot and the cost of labor to trouble-shoot failed units gives the total cost of failure.

Replacement cost is the cost of transporting units to and from depot plus the cost that would be incurred to renew a nonfailed unit which is removed after a specified interval of time, presumably before failure. This entails repair or replacement of unit subcomponents which are

approaching failure, thus, restoring the unit to a "good-as-new" condition (renewal) (24:53). Since the KT-73 IMU is a hermetically-sealed unit, any unit received by AGMC, whether failed or nonfailed, is subjected to the same test and repair procedures (Appendix A contains a checklist used for testing units) (16). Consequently, the same cost is incurred to repair a nonfailed unit as a failed unit.

The difference between cost of replacement and cost of failure is the cost of trouble-shooting. Other costs which could be considered are the loss of equipment availability or readiness. But these costs are much too difficult to quantify.

Actual cost to repair a failed unit is documented as an annual average for each fiscal year. Transportation costs are documented quarterly by WUC 73FAO in the K051 system. By adding the repair cost, transportation cost and trouble-shooting cost, a total cost of in-service failure can be assigned to each unit in the sample. The range of these values can be evaluated for parameters and used for sensitivity analysis under Bergman's method. A limitation exists in that individual trouble-shooting costs cannot be linked to individual unit failures by serial number. Cost data provided by AGMC and the K051 data collection system is presented in aggregated form from which averages (expected costs) must be derived.

It should be noted that a unit might have failed in a quarter previous to the one in which it arrived at and was repaired by AGMC. In cases where this is true, the costs of transportation and trouble-shooting for a unit may be included in a different quarter than the quarter in which the repair cost for the same unit is recorded. However, since expected per unit costs in this study are computed based on annual averages, the problem is limited to when the discrepancy occurs between the last quarter of a given year and the first quarter of the following year. Hence, the use of annual averages tends to smooth or reduce the scope of the mismatch problem.

Since in-service failure of the KT-73 will not cause a mission abort or damage to other components in the system, an attempt will not be made here to quantify the effects of aircraft Not-Mission-Capable (NMC) time generated by failure of the KT-73 unit. This kind of opportunity cost (the cost of being unable to operate the aircraft) is contingent on too many variables to attempt an adequate measure. To illustrate this difficulty, a Government Accounting Office (GAO) study in November 1976, an Air Force Audit Agency (AFAA) audit in April 1977, and an Air Force study in November 1977 sought to measure benefits derived from RCM using the same kind of variables. General comments from these reports concluded that ". . . RCM appeared to have had an effect that could not be quantified [1:68]."

The validity of the findings of this study is dependent on the accuracy of the data contained in the G078C and K051 systems. Inaccuracies in the data are probably the most often cited shortcoming of the entire range of maintenance data collection systems (3:12). Badalamente and Clark (1978) discuss these and other problems in their technical report. The advantage in using data collected from the G078C is that operating hours are tracked by a mechanical time indicator as opposed to being tracked by manual observation.

#### Methodology

The objective of this study is to demonstrate the application of Bergman's graphical method for determining optimal maintenance task intervals. To accomplish this, field data for the KT-73 Inertial Measurement Unit representing operating time to failure, replacement cost, and cost of in-service failure will be collected from the G078C and K051 Maintenance Data Collection Systems. The failure data will be scaled and used to construct a Total Time on Test (TTT)-plot representing a transform of the empirical failure distribution for the unit. The cost data will be scaled and used to plot a point, which represents the cost of replacement, through which a line can be drawn tangent to the TTT-plot. The abscissa of the tangent point denotes the index for the optimal replacement interval.

The function that Bergman's method performs is to minimize total long-run average cost per unit time,  $C(T)$ , by maximizing the reciprocal of the objective function,  $[C(T)]^{-1}$ .

The calculated interval can be compared to the existing interval, which is infinite (fly-to-failure), and a sensitivity analysis performed using a range of values for cost of replacement to observe their effect on changes in the optimal interval.

#### Research Assumptions

1. Units upon which data are collected are subjected to identical and constant maintenance policy.
2. Field data was accurately entered into the G078C and K051 Maintenance Data Collection Systems.
3. The replacement cost provided by AGMC is a valid estimate of long-run average cost to replace.
4. The item used in this study is not safety-critical.
5. Organizations operating the units under study consider the effect of a unit's failure on mission in the same way. Essentially, the effect which the unit has on aircraft status in the Mission Essential Subsystems List (MESL) is the same. For example, if the anti-skid system on a T-39 aircraft is not operational, all units would record the aircraft status as Partial-Mission-Capable (PMC). This

assumption is necessary since the priority given to failure of a KT-73 unit could affect base labor costs.

## CHAPTER II

### LITERATURE REVIEW

#### Introduction

For over two decades, there has been a large and continuing interest in the field of reliability and maintainability concerning maintenance models for items with stochastic failures. This interest has its roots in many military and industrial applications [23:353].

As Pierskalla and Voelker point out in their survey paper, there are a number of maintenance models. This review is concerned with those models which pertain to the maintenance of simple (i.e., single component) equipment and which involve an optimal decision to replace a unit in service (scheduled, hard time maintenance). These types of maintenance policies are known as "Replacement Policies" and involve the single uncertainty of when a failure will occur (26:A2-1).

The maintenance models presented here address objective of minimizing total cost or maximizing availability. In addition to the optimal concepts presented, the U.S. Army's use of age exploration (in determining hard time replacement intervals) as well as two computer-assisted maintenance programs are discussed. The literature has been divided into the three sections indicated in Figure 2-1.

- I. Optimal Replacement Policies
  - A. Age replacement
  - B. Block replacement
  - C. Periodic replacement with minimum repair at failure
  - D. Sequential replacement over a finite time span
  - E. Optimal replacement under damage accumulation model
- II. Age Exploration
- III. Computer Assisted Maintenance Programs

Fig. 2-1. Summary of Preventive Maintenance Literature

### Discussion

#### Optimal Replacement Policies

This section considers policies pertaining to scheduled maintenance actions on a hard time replacement basis so as to preclude failure during operation. These policies specify a replacement interval,  $T$ , which minimizes total long-run average cost per unit of time,  $C(T)$ .

Age Replacement. In general, an age replacement policy is in effect when a part is replaced at failure or at some specified age, whichever occurs first (6:85; 18:213; 7:751). This policy makes intuitive sense only if the cost of replacement is less than the cost of an in-service failure and only if all costs are nonnegative (6:85; 18:213; 7:751).

According to Barlow and Proschan, the specified decision variable, age of replacement (i.e.,  $T$ ), can be random (for a finite time span) or fixed (for an infinite time

span) (6:72,86). Most of the age replacement literature is for an infinite time span, whereby, the underlying failure distribution is assumed to be known and continuous, the optimum age replacement interval is a constant, a replacement restores the system to a good-as-new condition, and the restoration process goes on indefinitely (6:86).

Ingram and Scheaffer assert that if the underlying failure distribution is completely known, then finding the optimum replacement interval is simply an analysis problem (18:213). However, if the underlying distribution is not completely known, they show that an estimate of the optimum interval,  $T$ , can be found by minimizing a consistent estimator,  $C_n(T)$ , of the objective function  $C(T)$ . The consistent estimator,  $C_n(T)$ , assumes a form or property of the failure distribution. They treat four cases: (1) a Weibull distribution with unknown scale parameter, (2) a gamma distribution with unknown scale parameter, (3) an empirical distribution, and (4) a distribution specified only as having an increasing failure rate (18:213). They conclude that the empirical estimator of the optimum replacement interval is close to the estimators of the cases in which the distribution is known (18:219).

Berg notes that previous authors have assumed that an age replacement policy is appropriate for a replacement scenario. In his paper (7:751-759), he proves that an age replacement policy is the optimal procedure among a range of replacement policies for which a replacement time can be

well-defined (7:752). He accomplishes this by showing that the expected long-run cost per unit time for an optimal age replacement policy is less than or equal to the expected cost associated with other common replacement policies (7:758).

Scheaffer introduces an optimal age replacement policy with an increasing cost factor for an infinite time horizon. Specifically, he addresses the exponential life distribution with an exponential cost factor (25:142), i.e., the cost of replacing a unit increases with age. For example, the trade-in value of a rubber tire may decrease with wear. This has the effect of increasing the cost of replacement with age. Using numerical illustrations, he shows that when the objective function includes an increasing cost factor, the optimum replacement interval yields a smaller average cost per unit time than the interval found under a replacement policy whose objective function does not include an increasing cost factor (25:144).

According to Glasser, the analytical solution for finding the optimal age replacement interval is generally known (15:83). In his paper, he asserts that the optimal interval depends upon: (1) the ratio of cost of failure to cost of replacement, and (2) the average service life in standard deviation units (15:86). For the truncated normal, the gamma and the Weibull distributions, he charts cost ratio versus service life for each case to obtain a graphical

means for locating the optimal replacement interval based on changing values for the two variables (15:87-89).

Fox considers a discounted cost criterion when determining an optimal age for replacement. Assuming a continuous IFR failure distribution, he shows that for each stage (replacement to replacement) on an infinite time span, there is an optimal replacement interval which minimizes loss (12:534). For example, if a replacement interval is fixed at age  $T$  and a failure occurs before age  $T$ , then a loss is incurred. Fox seeks to find an optimal interval which minimizes this loss (12:534-535).

Block Replacement. Barlow and Proschan define a block replacement policy as one in which an item is replaced at equal time intervals independent of age and at failure (6:67). This policy has the practical advantage of not having to maintain records of failure times or age. When compared to an age replacement policy, block replacement results in a greater number of total removals. However, the expected number of failures is fewer under block replacement, provided failure increases with age (6:67). The objective is to minimize average cost per unit of time.

Berg and Epstein acknowledge that block replacement policies (BRPs) result in the replacement of fairly new items. Some modifications to the BRP have been made to avoid this drawback. One model allows minimal repair of a failed

item which is equivalent to replacing the item with a working one of the same age (8:15). Another model permits a failed item to remain idle until scheduled block replacement occurs (8:16). They propose a third model called a Modified BRP.

In Berg and Epstein's Modified BRP, failed items are still replaced immediately, but items of age "b" or less are permitted to remain in service when a scheduled block replacement point arrives. Within the interval  $(0, t)$ , there is an age b such that  $0 < b < t$ . The objective function,  $C(b, t)$ , is then minimized for values of b and t (8:16-17).

Singpurwalla and Talbott point out that, although the problem of replacing relatively new items is overcome, an additional problem is created by requiring knowledge of an item's age (26:A2-13).

#### Periodic Replacement with Minimum Repair at Failure.

Barlow and Hunter developed Policy II, a variation of the block replacement concept. Under this policy, system replacement occurs at a fixed time, regardless of the number of previous failures. For failures which occur prior to planned replacement, only minimal repairs are made so that the system failure rate is unchanged (5:92). "This repair action is mathematically equivalent to replacing the failed item by another working item of the same age [8:15]." Under this policy, complex systems appear to be single units aging over time.

Sequential Replacement Over a Finite Time Span. In a sequential replacement policy where an item has a finite life, replacements are scheduled only for the next interval such that the next planned replacement time is found which minimizes expected cost over the remaining life of the system (6:98). Hence, a new optimal replacement time is computed after each replacement rather than at fixed time intervals. Barlow and Proschan compared the results of a sequential policy versus an age replacement policy and found that the difference was quite small (about one percent of expected cost) (6:105). Their work was reviewed by Singpurwalla and Talbott who stated, "Only in cases of very high maintenance costs should sequential replacement policies be considered [26:A2-15]."

Optimal Replacement Under Damage Accumulation Model. Taylor presents an optimal replacement policy based on additive damage which seeks to balance the cost of replacement with the cost of failure, and which results in minimum total long-run average cost per unit time (29:1). The damage accumulation model uses a shock failure model in which shocks to the system occur in a Poisson fashion and accumulate additively. The total accumulated damage dictates the probability of system failure (29:4). Assuming that the accumulated damage can be continually observed by a controller, a decision to replace can be made based on the current

value of total damage (29:2). Taylor shows that an optimal policy exists which enables the controller to replace the system upon reaching a critical damage threshold. Replacement also occurs upon failure, regardless of the amount of damage, and a penalty cost is incurred (29:5).

Singpurwalla and Talbott conclude that models of this type have limited usefulness because they are highly structured and require a great deal of user information (26:A2-15).

#### Age Exploration

Nowlan and Heap's concept of age exploration (discussed in Chapter I) considers cost measurement subjectively without giving a truly optimal method for determining maintenance task intervals. Although the U.S. Army uses this concept for determining hard time replacement intervals, the procedure below must be considered outside the context of "optimal" age replacement policies.

Essentially, the Army establishes two types of hard time limits: safety and readiness. In each case, a cumulative failure distribution is first established (or assumed) for the item under study. For safety limits, replacement intervals are established based on extremely low probabilities of failure. Readiness hard time intervals are established for items which affect mission success. The readiness interval is identified through a trade-off process involving the cost of replacement, the cost of failure and the

readiness requirement of the equipment under consideration (33:C6-C19). Although an objective function is formulated, the trade-off process actually represents a "search" process for an acceptable, rather than an optimal, solution.

#### Computer-Assisted Maintenance Programs

The Computer Monitored Inspection Program (CMIP) developed by Lockheed, and the Vought RCM Update System developed by LTV Corporation are designed to help managers keep scheduled maintenance programs current and cost-effective while maintaining design levels of safety and reliability. They are similar in that both programs use a series of computer routines to reduce data collected by the Air Force. These programs are currently in limited use by the Air Force for determining intervals for scheduled maintenance programs and are projected for widespread use on many MDS aircraft.

Essentially, the program outputs are designed to provide analysts and decision makers with the information necessary to evaluate maintenance task requirements. Decisions can be made whether to add or drop certain maintenance tasks and whether or not to change task intervals. Additionally, information is provided concerning the effects of these changes on associated manhours (17:29; 19:4).

The programs differ primarily in output. The CMIP output is more condensed than the Vought output and was designed as an exception report which makes recommendations

to the manager about changing requirements. The Vought program output provides considerably more information designed for the analyst's use. It does make recommendations, but it provides enough information to permit in-depth analysis for trends in changing requirements. For this reason, the CMIP is more applicable to aircraft with well-screened maintenance programs; i.e., multi-engine aircraft with numerous redundant systems. On the other hand, the Vought program is more applicable to fighter-type aircraft (17:17).

Both programs recommend changes in maintenance task intervals based on a "target probability" of having no malfunctions occur between scheduled maintenance for the item being considered. Once the target probability is established, an exponential failure distribution is assumed and an interval is calculated. The Vought program uses a fixed 85 percent target probability while the CMIP permits input of user-controlled target probabilities (17:31; 19:12). Although the programs refer to calculated intervals as "optimum" ones, the objective is not that of minimum cost or maximum availability. Cost considerations are treated separately from intervals and are limited only to evaluation of associated manhour requirements.

#### Summary

This chapter has examined the literature on maintenance policies designed to establish hard time replacement

intervals. Pertinent information was provided concerning optimum replacement policies, Nowlan and Heap's notion of age exploration and computer-assisted maintenance programs to lay a basic framework for the research project.

The literature authored by Berg, Ingram and Scheaffer; Barlow and Campo; Bergman; and Singpurwalla and Talbott greatly influenced the direction of this project. Berg's paper shows that an age replacement policy is the optimal decision rule among all reasonable replacement policies. Research conducted by Ingram and Scheaffer presents a method of determining an estimate of the optimum age replacement interval where an empirical distribution function may be used with no serious loss of information. Barlow and Campo originally introduced the TTT-plot technique that Bergman later uses.

Bergman's research adds to the efforts of Ingram and Scheaffer, and Barlow and Campo, and derives a graphical technique used to obtain an estimate of the optimum age replacement interval. This technique provides an easy method to perform sensitivity analysis with respect to often uncertain cost. It has advantages in application in that it uses an empirical failure distribution versus an assumed/theoretical failure distribution, and provides some intuitive feeling for the uncertainties involved in the estimation. Singpurwalla and Talbott concluded that among the age replacement policies, Bergman's graphical technique was

the most promising because of its ease of application and theoretical correctness.

However, they cautioned that ". . . data over a limited time span, may not adequately represent the true failure distribution thereby introducing sampling error [26:A2-10]." Large samples are necessary for application of the method.

Because of the above stated reasons, it was decided that this research project would focus on Bergman's graphical technique.

## CHAPTER III

### METHODOLOGY

The objective of this research is to demonstrate that Bergman's method can be used to determine optimal maintenance task intervals based on a control strategy which balances cost of replacement with the cost of failure and results in a minimum total long-run average cost per unit time. To accomplish this objective, field data for a given piece of equipment will be analyzed using a Total Time on Test (TTT)-plot originally introduced by Barlow and Campo (1975) and presented in simple form by Bergman. Under this method, the life distribution is assumed to be unknown and observational data are provided (9:468). Once the data is analyzed, a graphical method is applied to obtain a reasonable nonparametric age replacement policy.

It should be noted that Bergman's method to obtain an optimal age replacement policy provides "hard time" intervals for scheduled rework or discard tasks.

The explanation of the methodology used in this research involves a discussion of cost measurement, TTT-plot, graphical solution, sensitivity analysis, sample space and data collection.

### Cost Measurement

For any unit which is believed to be more prone to failure with age, it may be beneficial to replace the old unit with a new one at some point in time. Under an age replacement policy, maintenance tasks are scheduled at intervals. To find the optimal interval requires balancing cost of replacement (scheduled maintenance) with cost of failure (unscheduled maintenance).

For any age replacement policy, there is a cost of replacement (nonfailed item),  $C_0$ , and cost of in-service failure,  $C_0+k$ , where  $k$  represents the difference between the cost of replacement and the cost of failure. Therefore, an age replacement policy is advantageous when  $(C_0+k) > C_0$ .

Bergman expresses cost,  $C$ , as a constant which is equal to the cost of replacement standardized to units of  $k$  dollars. Thus, if

$C_0$  = actual cost of replacement in dollars

$C_0+k$  = actual cost of failure in dollars

Then for all positive  $C_0$  and  $k$ ,

$C = C_0/k$ , the standardized cost of replacement

$C+1 = C_0/k + k/k$ , the standardized cost of failure

To illustrate, let  $C_0 = \$100$ , and  $k = \$200$ , then  $C_0+k = \$300$ . Since  $C = C_0/k$ , then  $C = 100/200 = 0.5$  is the cost of replacement in terms of  $k$  dollars.  $C+1 = 1.5$  is the cost of failure.

In terms of Bergman's graphical technique, the cost of replacement,  $C$ , is a fixed value.

#### Total Time on Test-plot: Analysis of Failures

In arriving at an optimum age replacement policy, the underlying failure distribution,  $F(T)$ , must be known and often, when the distribution is unknown, assumptions are made. Arunkumar (1972) attempted to resolve this problem by estimating the distribution using ordered failure time data (26:A2-5):

$$X_1 \leq X_2 \leq \dots \leq X_n$$

Bergman simplifies Arunkumar's procedure and applies it to the TTT-plot technique. Given  $n$  lifetime observations  $(t_1, \dots, t_n)$ , which are ordered according to size, the  $i$ th observation,  $t_i$ , represents the operating life for the  $i$ th unit. Then, total time on test through the  $i$ th failure time is calculated as

$$T_i = \sum_{j=1}^i = (n-j+1) (t_{(j)} - t_{(j-1)}), \quad i = 1, \dots, n$$

where  $t_{(0)} = 0$ .  $T_i$  is the total time generated by the  $n$  units before age  $t_{(i)}$ .

The ratio  $T_i/T_n$ ,  $i = 1, \dots, n$  is the scaled total time on test at age  $T_i$  denoted by  $U_i$ , i.e.,  $U_i = T_i/T_n$ . The TTT-plot is obtained by plotting  $U_i$  against  $i/n$ . The result is a function of an empirical cumulative distribution function,  $F_n(T)$ .

The following example illustrates the process for constructing a TTT-plot. Given that 10 units are observed to failure, the life times ( $t_{(i)}$ ) are scaled as follows:

| $i$ | $t_{(i)}$ | $T_i$ | $U_i$  |
|-----|-----------|-------|--------|
| 1   | 10.8      | 108.0 | .3397  |
| 2   | 18.5      | 177.3 | .5577  |
| 3   | 27.9      | 252.5 | .7943  |
| 4   | 30.0      | 267.2 | .8405  |
| 5   | 31.1      | 273.8 | .8613  |
| 6   | 35.1      | 293.8 | .9242  |
| 7   | 40.2      | 314.2 | .9884  |
| 8   | 40.6      | 315.4 | .9921  |
| 9   | 41.7      | 317.6 | .9991  |
| 10  | 42.0      | 317.9 | 1.0000 |

A FORTRAN Program (Figure 3-1) will calculate values for  $T_i$  and  $U_i$  reading from the data tape (identified as Tape 11), and will output results in tabular form (Table 3-1).

Figure 3-2 shows the TTT-plot for the sample data. If the failure rate is an increasing function of age (IFR), the plot is concave. If the failure rate is decreasing, the plot is convex. If the failure rate is constant, the plot is a 45-degree slope. Figure 3-3 illustrates the three possibilities.

#### Nonparametric Age Replacement

Bergman's method is a mathematical representation of a stochastic process known as a renewal process (when an

```

100=      PROGRAM TTITLEOT
110=0
120=      REAL Y(100),T(100),U(100)
130=      INTEGER I,J,K,N,K
140=0
150=0      DEFINITIONS: TAFELI CONTAINS ALL
160=0      OBSERVATIONS SMALL T(I)
170=0      N=TOTAL NUMBER OF OBSERVATIONS PLUS ONE
180=0      Y(I)=CAPITAL T(I), U(I)=U(I), I,J,K,X
190=0      ARE INDEXES.
200=0
210=      N=11
220=      K=1
230=0
240=      DATA Y,T,U/332*0.0/
250=0
260=      READ(11,*) (T(X),X=2,N)
270=      PRINT '(1X,10X,"T",6X,"OBSERV",5X,"TOTAL",5X,"SCALED")'
280=      PRINT '(1X,12X,"NO.",6X,"TIME",6X,"TIME",7X,"TIME",//)'
290=0
300=      DO 10 I=2,N
310=          J=I-1
320=          Y(I)=(N-J)*(T(I)-T(K))+T(K)
330=          K=K+1
340=10      CONTINUE
350=0
360=      J=1
370=      DO 20 I=2,N
380=          U(I)=Y(I)/Y(N)
390=          PRINT 40,J,T(I),Y(I),U(I)
400=          WRITE(12,')( " "F0.5)'U(I)
410=          J=J+1
420=20      CONTINUE
430=0
440=40      FORMAT(1X,12X,10,5X,F6.1,4X,F6.1,5X,F6.4)
450=      RETURN
460=      END

```

Fig. 3-1. Program for Scaling Observed Data

TABLE 3-1  
PROGRAM OUTPUT

| I<br>NO.    | OBSERV<br>TIME | TOTAL<br>TIME | SCALED<br>TIME |
|-------------|----------------|---------------|----------------|
| 1           | 18.8           | 188.6         | .3397          |
| 2           | 18.5           | 177.2         | .5577          |
| 3           | 27.9           | 252.5         | .7943          |
| 4           | 38.8           | 267.2         | .8485          |
| 5           | 31.1           | 273.6         | .8613          |
| 6           | 35.1           | 293.8         | .9242          |
| 7           | 48.2           | 314.2         | .9884          |
| 8           | 48.6           | 315.4         | .9921          |
| 9           | 41.7           | 317.6         | .9991          |
| 19          | 42.8           | 317.9         | 1.0000         |
| END TTTPLOT |                |               |                |

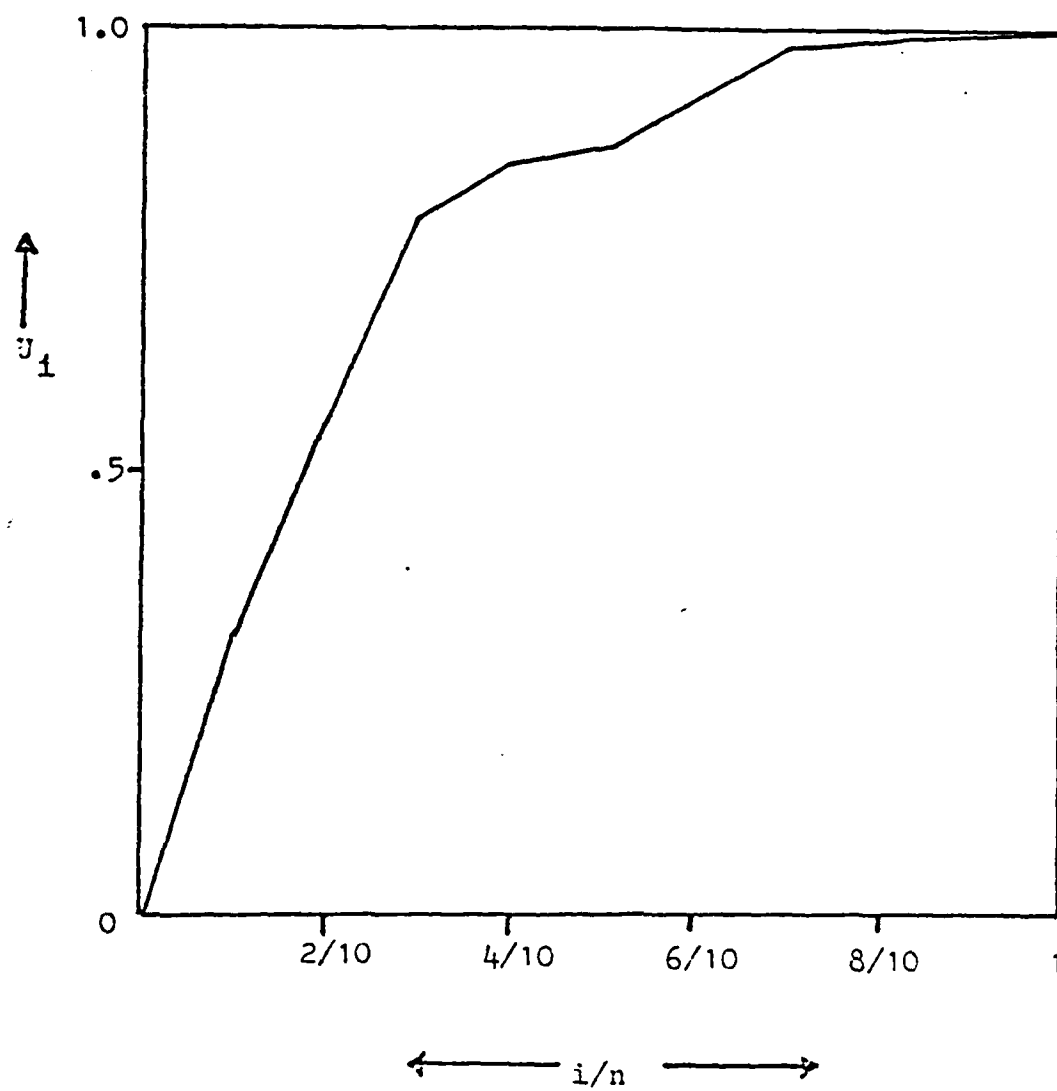


Fig. 3-2. TTT-plot

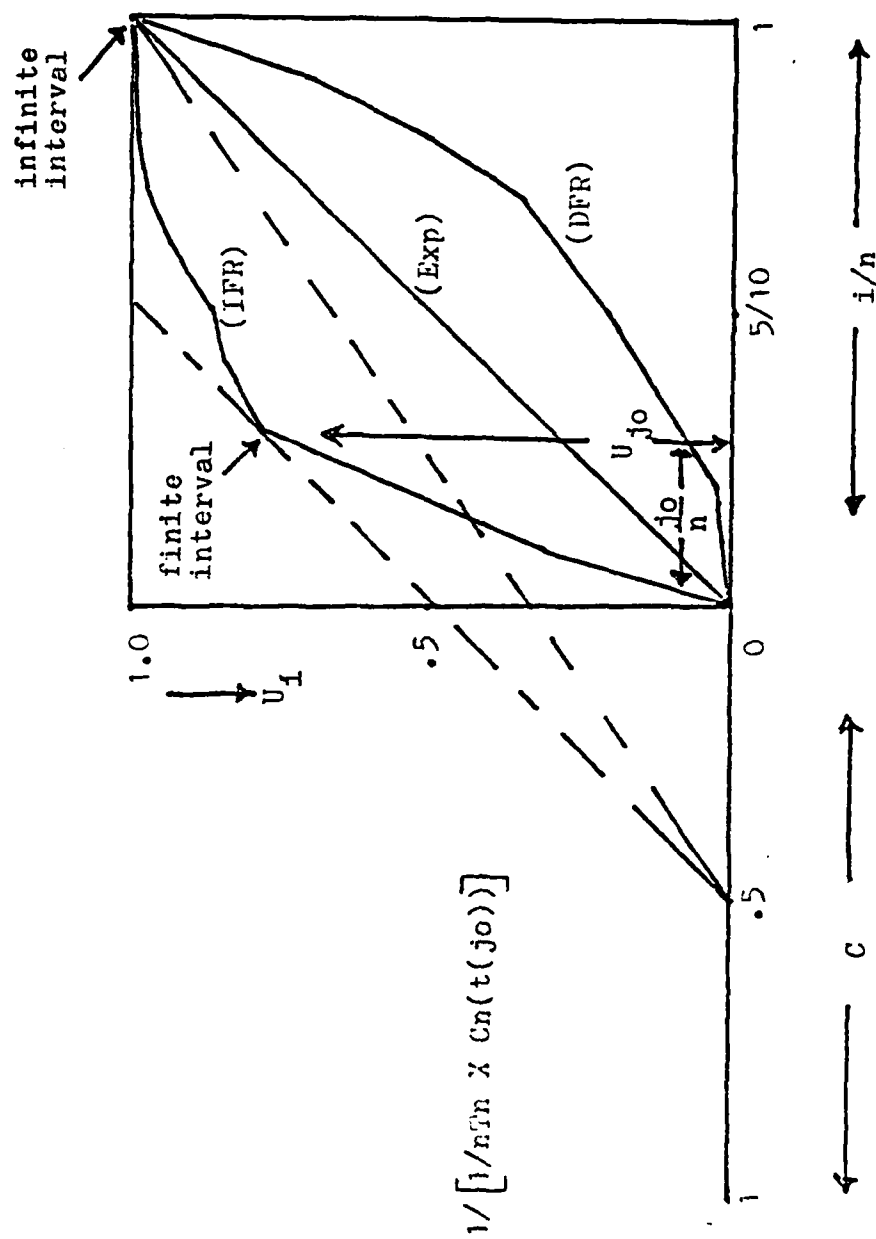


Fig. 3-3. Examples of Empirical Distributions

item is failed or replaced, the cycle starts over again). When rewards or costs (negative rewards) apply, the renewal reward theorem (24:53) states:

$$\text{average long-term cost} = \frac{\text{expected cost in a cycle}}{\text{expected cycle length}}$$

In order to minimize average long-run cost, the objective is then,

$$\text{MIN} \left[ \frac{\text{expected cost/cycle}}{\text{expected cycle length}} \right]$$

This can be expressed as follows (9:467) (for  $T \geq 0$ ):

$$\text{MIN } C(T) = \left[ \frac{C+F(T)}{\int_0^T (1-F(t)) dt} \right] \quad (1)$$

Thus, in finding an estimate of the optimal age replacement interval, a value for  $T$  must be found which minimizes cost  $C(T)$ . Using the empirical life distribution,

$$F_n(t) = (i/n)$$

that is, substituting  $F_n(T)$  for  $F(T)$  in Equation (1), then:

$$C_n(T) = \left[ \frac{C+F_n(T)}{\int_0^T (1-F_n(t)) dt} \right] \quad (2)$$

Relying on a proof presented by Ingram and Scheaffer (18:216), Bergman states that to estimate the optimal age replacement

interval, it is enough to find the index for  $t$ , call it  $j$ , with minimizes

$$C_n(t_j) = \left[ \frac{C + F_n(t_j)}{\int_0^T (1 - F_n(t)) dt} \right] \quad (3)$$

Using the definition of the empirical distribution function

$$F_n(t_j) = j/n \text{ and the fact that } \int_0^T (1 - F_n(t)) dt = 1/n(T_j), \quad j = 1, \dots, n$$

then, Equation (3) becomes

$$C_n(t_j) = \frac{C + j/n}{1/n(T_j)} \quad (4)$$

By manipulation,

$$\frac{C + j/n}{1/n(T_j)} = \frac{C + j/n}{1/n(T_n)(T_j/T_n)} = \frac{C + j/n}{1/n(T_n)(U_j)}$$

Thus,

$$C_n(t_j) = \frac{1}{1/n(T_n)} \left[ \frac{C + j/n}{U_j} \right]$$

where  $T_n$  and  $U_j$ ,  $j = 1, \dots, n$ , are defined under the TTT-plot.

One way to minimize the discrete function  $C_n(t_j)$  is by complete enumeration, but with large numbers of failures, enumeration is tedious. Bergman's graphical approach seeks to minimize  $C(T)$  by maximizing its reciprocal  $[C(T)]^{-1}$ .

Therefore,

$$\frac{1}{C_n(t_j)} = 1/n(T_n) \left[ \frac{(U_j)}{C+j/n} \right]$$

Since  $(1/n(T_n))$  is a constant determined from the discrete sample, to maximize  $1/C_n(t_j)$  is to maximize  $(U_j/(C+j/n))$ .

Moreover,

$$\frac{1}{C_n(t_j)} \text{ is proportional to } \frac{1}{1/n(T_n)(C_n(t_j))} \text{ which is}$$

equal to the slope of any line passing through the point  $(-c,0)$  and some point on the TTT-plot (Figure 3-3). Recall from earlier discussion that  $C$  is a calculated, fixed, scaled value for cost, and that

$$\frac{1}{(C_n(t_j))} \text{ is proportional to } \frac{U_j}{C+j/n} .$$

So to maximize  $(1/C_n(t_j))$  is to maximize  $(U_j/C+j/n)$  and is to maximize slope  $[1/(1/n(T_n))(C_n(t_j))]$ . More specifically (refer to Figure 3-4), in order to maximize

$$\frac{U_j}{C+j/n}$$

$U_j$  in the numerator must be made as large as possible (Y-axis on the graph) and  $j/n$  in the denominator must be made as small as possible (X-axis on the graph). Cost  $C$  in the denominator is a fixed value. By constructing the line through the point  $(-c,0)$  tangent to the TTT-plot, the reciprocal  $[C_n(t_j)]^{-1}$  of the objective function is maximized

and the objective function  $C_n(t_j)$  is minimized. The value  $j_0/n$  is the abscissa of the tangent point and  $j_0$  denotes the index of the optimal age replacement interval.

Using earlier cost and TTT-plot examples, a graphical solution for an optimal replacement interval is in Figure 3-4. For this example, the abscissa of the tangent point is  $j_0/n = 3/10$ . Hence, the optimal index,  $j_0$ , for the replacement interval is 3. Referring to Table 3-1, the value of  $t_i$  (observed time) for the third interval is 27.9 hours. The optimal replacement interval for this example is 27.9 hours. Again, the preciseness of this estimate improves with larger samples. It becomes evident that a finite replacement interval can only be obtained with an IFR distribution since a tangent drawn to a DFR or exponential distribution results in an infinite interval. The decision in the latter two cases would be not to replace.

#### Sensitivity Analysis

Though Bergman's method is based on calculation of a fixed cost  $C$ , a sensitivity analysis on cost can be performed.

A researcher may consider a range of values for  $C$ , for example,  $c \pm e$ , where  $c$  is an estimate of cost and  $e$  represents error within a specified interval. By locating the points  $(-c, 0)$ ,  $(-(c-e), 0)$ ,  $(-(c+e), 0)$  and drawing lines through these points tangent to the TTT-plot, a range is

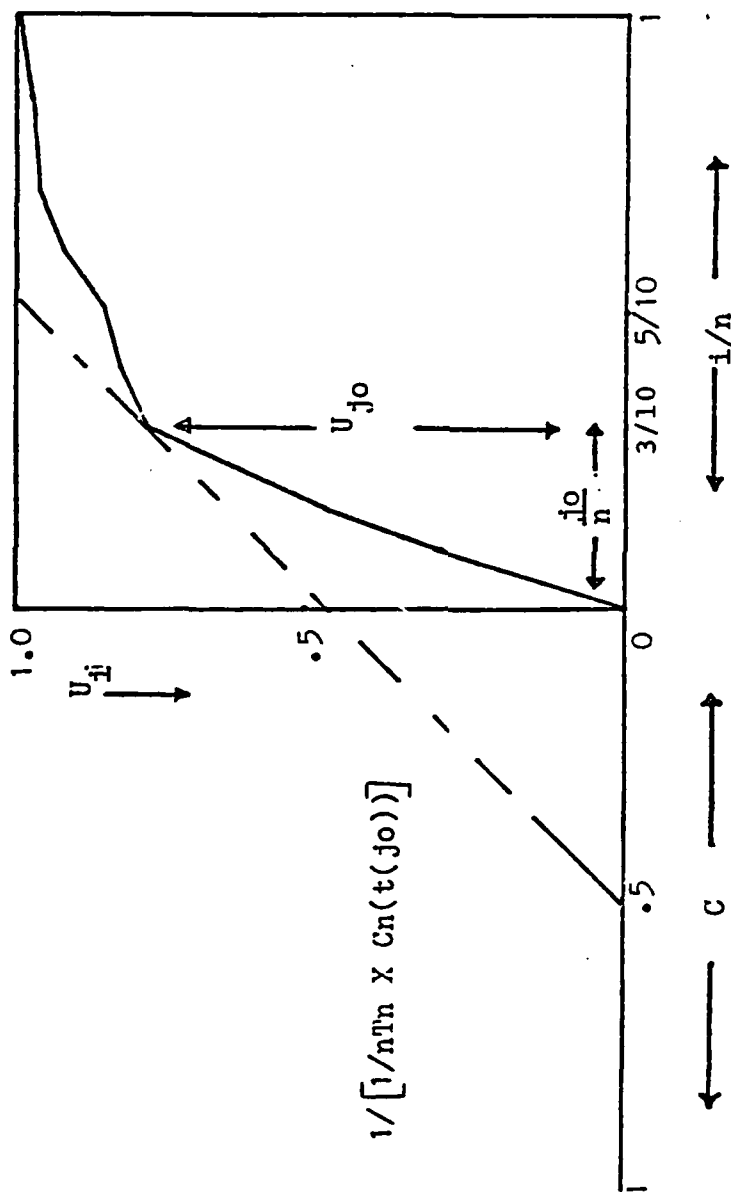


Fig. 3-4. Graphical Solution

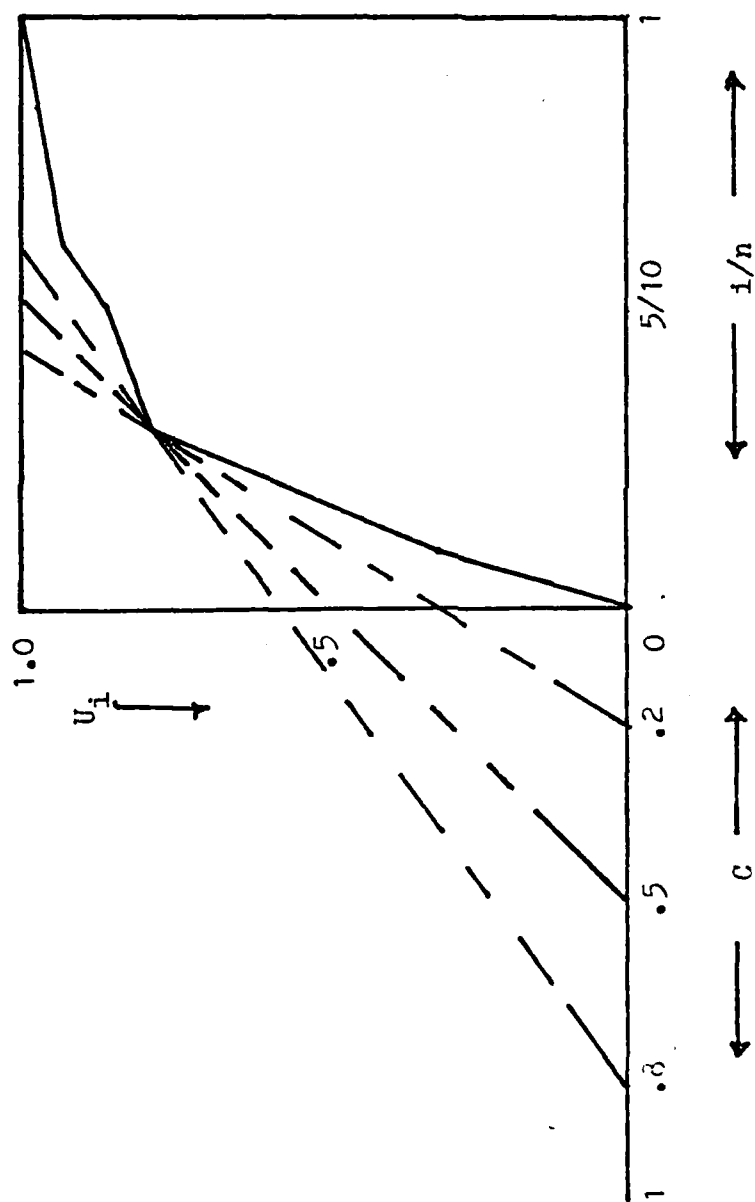
constructed about the optimal replacement interval index ( $j_1 \geq j_0 \geq j_2$ ) shown in Figure 3-5. In this example,  $j_1 = j_0 = j_2$ .

To illustrate further, for an IFR distribution, if  $(-(c+e), 0)$  is close to  $(0, 0)$ , then the optimal index,  $j$ , will be small. This suggests that units should be replaced more often when the difference between cost of replacement and cost of failure is large ( $c$  is small). The difference then, must grow smaller as  $(-(c-e), 0)$  moves away from the origin. But the effect of cost on changes in the index  $j$  is also dependent upon the shape of the TTT-plot. Figure 3-6 shows that as an IFR distribution becomes more concave, the optimal index  $j$  becomes less sensitive to cost. As an IFR distribution becomes less concave, the optimal replacement interval becomes more sensitive to cost.

Performing sensitivity analysis with actual data requires collecting cost data as described in a later section for each in-service failure used in this study. The data will be analyzed using the Statistical Package for the Social Sciences (SPSS) condscriptive computer routine to identify the cost estimates from the sample. The objective of the analysis is to examine the effects of changes in cost  $C$  with regard to the index  $j$  for the optimal replacement interval.

#### The Sample

Selection of a piece of equipment to use was a difficult choice. The KT-73 Inertial Measurement Unit



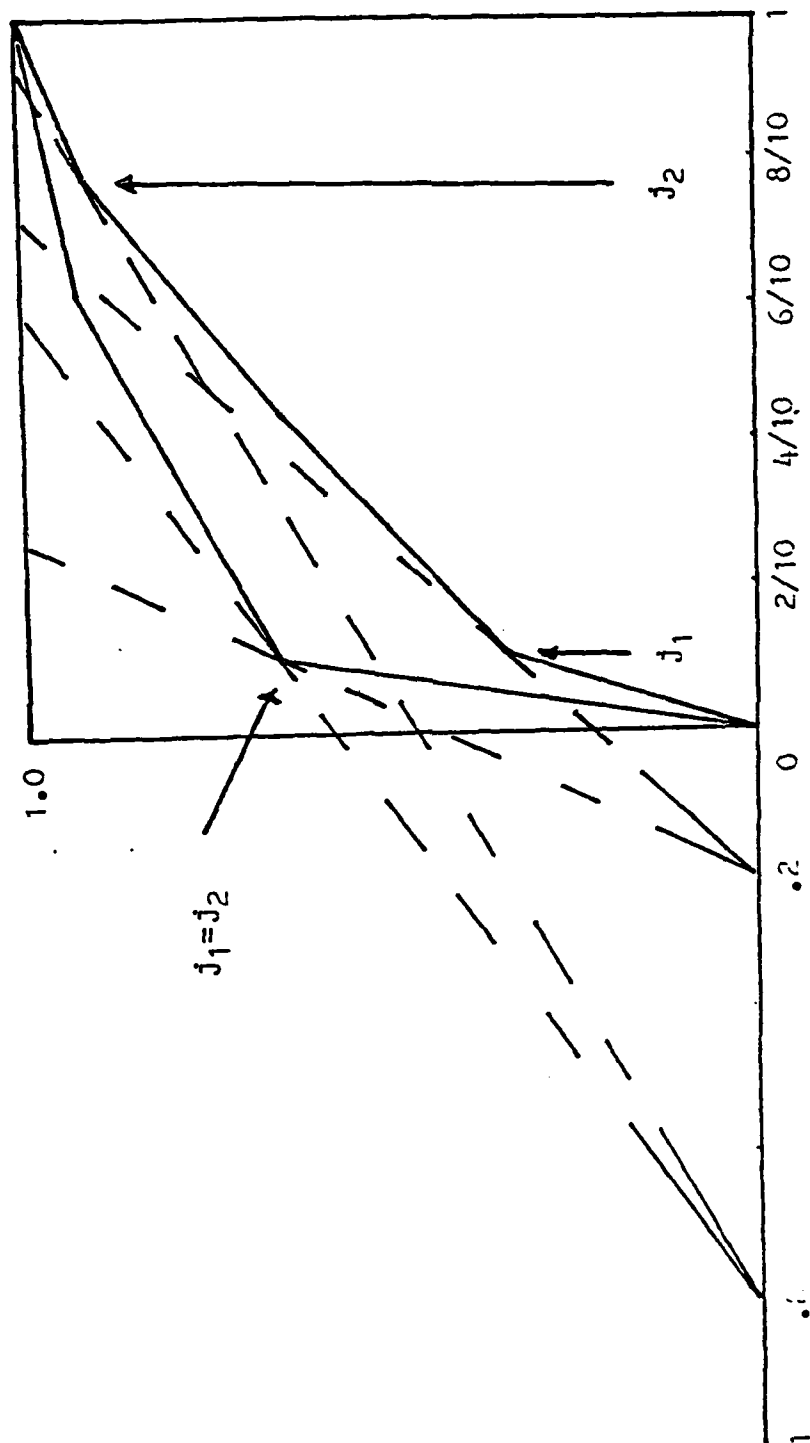


Fig. 3-6. Effects of Shape of Failure Curve on Sensitivity

used on the A-7D aircraft was chosen based on the following considerations:

Consideration A: In Chapter I, attention was given to expectations concerning available cost data. This study requires data for cost of replacement and cost of in-service failure. Since the cost to remove and replace a KT-73 IMU from an aircraft would be the same for both failure and non-failure, this cost is ignored.

The cost of in-service failure must be the sum of the trouble-shooting costs, the cost of transportation to and from depot, and the cost of repair. Since the units are hermetically sealed, repair is made only at the Aerospace Guidance and Metrology Center (AGMC). Thus, repair costs can be retrieved from a single source. Trouble-shooting costs are the costs incurred on the flight line to identify the IMU as having failed.

The cost of replacement must include the cost to transport a unit to and from depot and the cost to renew a nonfailed unit which is removed after a specified interval of time, presumably before failure. This entails repair or replacement of subcomponents from the unit which are approaching failure, thus, restoring the unit to a "good-as-new" condition (renewal). Costs which could be included are labor, materials, laboratory testing, setup costs and opportunity costs.

Consideration B: An in-service failure of the unit must not cause damage to other equipment in the system since this would create an additional variable cost of failure.

Consideration C: The unit must not be safety-critical.

Consideration D: The unit must fail often enough to provide adequate sample failure data.

Consideration E: The units must be traceable by some means of identification and field operating times specified so that failure cycles can be established.

The population of elements for this research study includes all KT-73 Inertial Measurement Units purchased by the Air Force and used on the A-7D aircraft. The sample includes all serial-numbered units beginning with an alpha prefix of "AF" ordered by the Air Force as spares prior to 19 April 1978. The purpose in limiting the sample space is to avoid the complications involving truncation of data. Truncation occurs when units which are not accounted for are removed from the sample. This destroys the validity of the life test.

Cost data for KT-73 in-service failures is available as a cost to repair through the AGMC Resources Division and is added to a cost of trouble-shooting and a cost of transportation, which are available through the K051 Maintenance Data Collection System. The cost to repair will be provided

by AGMC as an actual cost to repair based on averages for each fiscal year. This same cost to repair and cost of transportation will represent the cost of replacement so that the difference,  $k$ , will be the cost of trouble-shooting.

In-service failure of the unit does not cause damage to other equipment, and the unit is not critical to safe operation of the aircraft. Failure does occur often enough to provide adequate data, and units can be traced by serial number, cycle number, and field operating hours. A functional description of the KT-73 IMU is contained in Appendix A.

While Bergman's method may be used to analyze any maintenance item where the objective is to minimize cost, inferences made from this study are applicable only to the sample space.

#### Data Collection

Using data collection methods of Crowe and Loman (11:31-38), actual failure data for the KT-73 units will be collected from the G078C Maintenance Data Collection System.

Data from the G078C includes an elapsed time indicator, a cycle number, and an identification serial number. The elapsed time indicator ensures that the time a unit is awaiting repair and in supply channels is not added to the operating time of the units. The identification serial number is necessary to identify the failure cycles associated with a particular unit. A failure cycle is

defined as the operating time of a unit between renewal and failure.

Using both the "Aircraft Listing" and the "Field Operating Hours (FOH) by Cycle-Quarterly" G078C reports, failure Cycle 1 for each serial number included in the sample is identified. The field operating hours for each unit in Cycle 1 is then recorded and the times ordered from the smallest to largest. This can be accomplished through a simple FORTRAN program. The failure times are transferred to a data tape for use in calculating values for the TTT-plot (Figure 3-1).

According to MIL-STD-785B, Requirements for Military Programs (for Systems and Equipment/Development and Production); MIL-STD-781B, Reliability Tests: Exponential Distribution; and MIL-STD-756A, Reliability Prediction, the military services apply the basic assumption that failures are exponentially distributed; and, in fact, MIL-STD-785B permits a contractor to assume that equipment failures follow an exponential distribution whenever the standard is specified in the contract. The Computer Monitored Inspection Program uses this assumption (17:30). Herein lies one of the advantages of using the TTT-plot to analyze failure data. The TTT-plot method assumes that the life time distribution is unknown and analysis is based purely on observational data.

Since some units are expected to survive for a long period of time (calendar years), only old spares buys coded by "AF" serial numbers for the KT-73 IMU will be collected from the G078C Data Collection System.

The sample will be limited to those KT-73 IMU spares ordered by the Air Force prior to 19 April 1978 to ensure that a record of at least one failure for each unit has been recorded or that the unit is accounted for. The cutoff date is a convenient point between procurement packages in which large quantities of spares were ordered. A unit can be accounted for as not having been operated (on a supply shelf), discarded, or lost prior to normal failure (aircraft attrition). Units which are accounted for can be removed from the sample without bias. The period of time from which the data is drawn will depend upon the time the last unit in the sample fails. Conclusions from this study are limited to the data window.

Part of the cost of replacement is provided by AGMC and is the actual average cost to repair a unit for each fiscal year. Transportation costs are added to the cost to repair to arrive at the total cost of replacement,  $C_0$ . The cost to repair is obtained from data collected by the Resources Division (MAW) at AGMC in terms of dollar amount and is presented as an average actual cost to repair by fiscal year. Transportation costs are provided by the K051 datasystem at Headquarters AFLC. Data is extracted by the

Mission-Design-Series (MDS) of A-7D and by Work Unit Code (WUC) 73FAO for the KT-73 IMU. Under the WUC, a transportation cost in terms of dollar amount is recorded.

The cost of in-service failure,  $C_0 + k$ , will consist of three parts: (1) the cost to repair, (2) the cost of transportation to and from depot, and (3) trouble-shooting cost. The preceding paragraph described how values for  $C_0$  (cost to repair plus cost of transportation) are found. The remaining element, trouble-shooting cost, is provided by the K051 data system under the same MDS, WUC and format as transportation cost. However, trouble-shooting costs are listed as quarterly totals under a separate column labeled "field maintenance" (base labor).

These three costs (repair, transportation, trouble-shooting) cannot be directly matched to the serial-numbered units in the sample, but they are presented as annual averages (for repair), and quarterly totals (for transportation and trouble-shooting), the latter of which can be summed over each fiscal year and averaged using the number of units repaired for each fiscal year, as provided by AGMC. This limitation was discussed in Chapter I.

To arrive at values for  $k$ , the difference between the cost of replacement and the cost of failure,  $C_0$  is subtracted from  $C_0 + k$  for each fiscal year. The value of " $k$ " in this study is the cost to trouble-shoot. Dividing each  $C_0$  by each  $k$ , then, provides a range of cost values,

standardized to units of k dollars, which can be used to calculate an expected value for cost, C. The necessary calculations can be accomplished by a simple FORTRAN program.

The validity of the TTT-plot and graphical solution are dependent on the accuracy of the data collected from the G078C and K051 files. Limitations in this area were addressed in Chapter I. Additionally, a consistent maintenance policy must be assumed, and care will be taken to ensure that either none or all of the KT-73 units included in the sample have undergone modification.

#### Answering the Research Question

Before proceeding to the actual experiment, the research question should be readdressed within the context of the methodology.

The Research Question asks if Bergman's method can be applied in determining an optimal maintenance task interval based on the objective of minimizing total long-run average cost per unit time using actual field data. An optimal maintenance interval can be determined for the item used in this study by collecting data, as discussed in the previous section, for the cost of replacement and cost of failure, and by collecting failure data for the item. Based on the cost data, a value for C can be calculated and plotted. The observed failures collected from the G078C can be scaled and a TTT-plot constructed. Using Bergman's graphical technique, a tangent can be drawn from the point  $(-c, 0)$  to

the failure curve, and the index of the optimal replacement interval can be located at the abscissa ( $j_0/n$ ). If the following specific criteria are met, the research question can be answered in the affirmative.

Must know:

1. Cost of replacement
2. Cost of failure
3. Time from renewal to failure (cycle) for all units in the sample

Must have:

A large sample of life times (greater than 30), since the estimate of the optimal interval improves with larger samples.

Must be able to:

1. Standardize cost of replacement and cost of failure to "k" units of dollars
2. Scale observed life times to Bergman's TTT-plot
3. Construct a graph of the scaled empirical life distribution
4. Construct a tangent to the failure curve with the greatest slope passing through the point plotted for replacement cost
5. Identify the index for the optimal interval using Bergman's graphical technique

If the research question can be answered in the affirmative, there are two secondary questions. Secondary Question "a" asks if the calculated interval for the units tested compares with the existing interval for the item. Since the KT-73 IMU has never had a maintenance interval assigned to it, its current interval is infinite. This study would recommend an infinite interval (fly-to-failure) if the empirical life distribution constructed on the TTT-plot from actual failure data is a 45-degree line (exponential) or convex (DFR). Figure 3-3 illustrates these possibilities. If the following required knowledge and procedures can be satisfied, secondary question "a" can be evaluated.

1. Know the current interval
2. Identify the distribution of observed failure data
3. Identify the index for the optimal interval using Bergman's graphical technique
4. Compare the current and calculated optimal intervals
5. Explain or reconcile differences, if any, between the current and calculated optimal intervals

Secondary Question "b" asks how sensitive the calculated optimal interval is to the uncertainty of cost. Based on individual cost data collected, a range of values for "C" can be calculated and analyzed using the Statistical Package for the Social Sciences (SPSS) Condescriptive

computer program to identify the mean and standard deviation for C. Using values for C of plus and minus a given standard deviation from the mean, new tangents can be drawn to the failure curve and observations can be made concerning the effects of changes in C on the optimal replacement interval index. If the following required procedures can be satisfied, secondary question "b" can be evaluated.

1. Identify the mean and standard deviation of standardized cost values
2. Designate values for "C" above and below the mean, based on the mean and standard deviation
3. Identify the index for the optimal interval using Bergman's graphical technique for new values of "C," based on the standard deviation
4. Draw conclusions about the sensitivity of the optimal interval to uncertainty in cost

## CHAPTER IV

### APPLICATION AND ANALYSIS

Demonstrating Bergman's graphical method to determine an optimal maintenance task interval for an item in Air Force inventory requires application of the methodology described in Chapter III.

#### The Failure Data

Failure data for all KT-73 Inertial Measurement Units were collected for all units with serial numbers coded with an alpha prefix of "AF" ordered prior to 19 April 1978. This includes data on units coded AFORSSG, AFOTST1 and AF00001 through AF00094 for the first failure cycle (acquisition to first failure). The data was retrieved by cross-referencing both the "Aircraft Listing" and the "Field Operating Hours (FOH) by Cycle-Quarterly" reports from the G078C Data Collection System. Excerpts containing data from these reports are contained in Appendix B. Table 4-1 lists the units in the sample by serial number and corresponding times to failure for Cycle 1. The times to failure are listed in G078C reports under Cycle 1 of each serial number and denoted by "ETI IN," the elapsed time indicator reading (actual operating hours) upon arrival at AGMC. There are

TABLE 4-1

## TIMES TO FAILURE BY SERIAL NUMBER

|         |          |         |          |
|---------|----------|---------|----------|
| AFPRSSG | 0855     | AF00044 | 0285     |
| AFOTST1 | 1111     | AF00045 | 0426     |
| AF00001 | 0099     | AF00046 | 0490     |
| AF00002 | 0229     | AF00047 | 0180     |
| AF00003 | 0615     | AF00048 | 0211     |
| AF00004 | 0127     | AF00049 | 0161     |
| AF00005 | 0121     | AF00050 | 2764     |
| AF00006 | 0853     | AF00051 | 0434     |
| AF00007 | 0349     | AF00052 | 0150     |
| AF00008 | 0487     | AF00053 | 0109     |
| AF00009 | 0558     | AF00054 | 1001     |
| AF00010 | 0852     | AF00055 | 3007     |
| AF00011 | 0260     | AF00056 | 0183     |
| AF00012 | 0181     | AF00057 | 0217     |
| AF00013 | Attrited | AF00058 | 0701     |
| AF00014 | 0932     | AF00059 | 0240     |
| AF00015 | 1837     | AF00060 | 0164     |
| AF00016 | 0182     | AF00061 | 0101     |
| AF00017 | 0508     | AF00062 | 0565     |
| AF00018 | 0107     | AF00063 | 0120     |
| AF00019 | Attrited | AF00064 | 0222     |
| AF00020 | 0498     | AF00065 | 0122     |
| AF00021 | 0492     | AF00066 | 0299     |
| AF00022 | 1081     | AF00067 | 0212     |
| AF00023 | 1408     | AF00068 | 0377     |
| AF00024 | 1099     | AF00069 | Attrited |
| AF00025 | 0828     | AF00070 | Attrited |
| AF00026 | 0164     | AF00071 | 0129     |
| AF00027 | 0388     | AF00072 | Attrited |
| AF00028 | 0414     | AF00073 | 0645     |
| AF00029 | 0417     | AF00074 | 0122     |
| AF00030 | 0103     | AF00075 | 0764     |
| AF00031 | 4126     | AF00076 | Attrited |
| AF00032 | 0334     | AF00077 | 0292     |
| AF00033 | 0109     | AF00078 | 0365     |
| AF00034 | 0153     | AF00079 | 0454     |
| AF00035 | 0163     | AF00080 | 0897     |
| AF00036 | 0093     | AF00081 | 2132     |
| AF00037 | 0483     | AF00082 | 0347     |
| AF00038 | 0414     | AF00083 | 1081     |
| AF00039 | 0451     | AF00084 | 0873     |
| AF00040 | 0095     | AF00085 | 0220     |
| AF00041 | 2045     | AF00086 | Attrited |
| AF00042 | 0254     | AF00087 | 0332     |
| AF00043 | 0141     | AF00088 | 0163     |

TABLE 4-1 -Continued

|         |      |         |      |
|---------|------|---------|------|
| AF00089 | 0814 | AF00092 | 0154 |
| AF00090 | 0436 | AF00093 | 1765 |
| AF00091 | 0121 | AF00094 | 1560 |

eighty-nine units in the sample and times to failure were recorded on a raw data file called "TAPE 11" (Figure 4-1).

During collection of the failure data, it was noted that seven serial numbers could not be located: AF00013, AF00019, AF00069, AF00070, AF00072, AF00076 and AF00086. According to information received from AGMC, the KT-73 IMU Item Manager and Singer-Kearfott (manufacturer) any units that are lost to the system, that is, lost, stolen or demolished in an aircraft accident, are no longer tracked and the serial numbers are dropped from the rolls (2;10;16). Since the units contained in the sample used for this study are among the oldest spares buys made by the Air Force (circa 1970), the seven units for which serial numbers are missing are said to have attrited (2;10;16). A zero condemnation rate for the KT-73 IMU makes this the only reasonable conclusion. Hence, the seven units were removed from the sample without bias.

#### Total Time on Test-plot

Once the raw data was recorded on TAPE 11, it was necessary to order the failure times from smallest to largest. This was accomplished using the simple FORTRAN

|          |          |          |
|----------|----------|----------|
| 130=0855 | 420=4126 | 700=0121 |
| 110=1111 | 410=0334 | 710=4565 |
| 120=0079 | 420=0109 | 720=0120 |
| 130=0229 | 430=0153 | 730=0222 |
| 140=0015 | 440=0163 | 740=0122 |
| 150=0127 | 450=0090 | 750=0299 |
| 160=0121 | 460=0460 | 760=0212 |
| 170=0053 | 470=0414 | 770=0377 |
| 180=0349 | 480=0451 | 780=0129 |
| 190=0007 | 490=0095 | 790=0645 |
| 200=0556 | 500=2045 | 800=0122 |
| 210=0652 | 510=0254 | 810=0764 |
| 220=0240 | 520=0141 | 820=0292 |
| 230=0101 | 530=0205 | 830=0065 |
| 240=0932 | 540=0026 | 840=0454 |
| 250=1837 | 550=0490 | 850=0097 |
| 260=0102 | 560=0160 | 860=2132 |
| 270=0506 | 570=0211 | 870=0347 |
| 280=0107 | 580=0161 | 880=1001 |
| 290=0498 | 590=2764 | 890=0070 |
| 300=0492 | 600=0434 | 900=0220 |
| 310=1001 | 610=0150 | 910=0332 |
| 320=1408 | 620=0107 | 920=0163 |
| 330=1399 | 630=1001 | 930=0014 |
| 340=0020 | 640=0007 | 940=0406 |
| 350=0164 | 650=0103 | 950=0121 |
| 360=0003 | 660=0217 | 960=0154 |
| 370=0414 | 670=0701 | 970=1765 |
| 380=0417 | 680=0240 | 980=1563 |
| 390=0103 | 690=0164 | ..       |

Fig. 4-1. TAPE 11: Raw Failure Data

program shown in Figure 4-2. The output, TAPE 12, from the program contains eighty-nine ordered failure times (Figure 4-3).

Having ordered the observed life time,  $t_{(i)}$ , the times were scaled to the total time on test,  $T_i$ , denoted by  $U_i$ . This was accomplished by inputting TAPE 12 to the FORTRAN program illustrated in Figure 4-4. The output of the program is shown in Table 4-2 which contains the observation number ( $i$ ); the observed life times ( $t_{(i)}$ ); the total time on test ( $T_i$ ); and the scaled total time on test ( $U_i$ ). The program also outputs a data file, TAPE 13 (Figure 4-5), containing all of the calculated  $U_i$ 's.

Using Table 4-2, a Total Time on Test-plot was constructed for the eighty-nine observations in the sample. As in the example of Chapter III, Figure 4-6 illustrates the TTT-plot for the KT-73 IMUs used in this study.

An examination of the empirical life distribution shown on the TTT-plot for the eighty-nine observations indicates a failure curve which is slightly DFR (decreasing failure rate). Since the curve represents a plot of observed data, it is not smooth, but it would become smoother with larger samples. Most notable is the immediate leap from 0 to .16 which represents the smallest observed time to failure, 93 hours. Superimposed over the TTT-plot is an assumed theoretical exponential failure curve. The theoretical distribution is derived from consistently large historical sampling and is a perfectly smooth 45-degree slope.

```

120=    PROGRAM ORDER
110=C
120=    REAL T(89),TIME(89),T1(89)
130=    INTEGER I,J,X
140=C
150=C    ORDER FAILURE DATA
160=C
170=    DATA TIME/89*8.8/
180=    READ(11,*) (T(X),X=1,89)
190=C
200=    DO 10 I=1,89
210=        J=I
220=        DO 20 J=1,89
230=            TIME(I)=MAX(TIME(I),T(J))
240=20    CONTINUE
250=        X=I
260=        DO 30 X=1,89
270=            IF (T(X).EQ.TIME(I)) THEN
280=                T(X)=8.8
290=                GO TO 10
300=            END IF
310=30    CONTINUE
320=10    CONTINUE
330=        DO 40 I=1,89
340=            J=90-I
350=            T1(J)=TIME(I)
360=40    CONTINUE
370=        DO 50 I=1,89
380=            WRITE(12,')( " ",F8.1)'T1(I)
390=50    CONTINUE
400=C
410=    RETURN
420=    END

```

Fig. 4-2. Program to Order Failure Data

|      |       |      |       |      |        |
|------|-------|------|-------|------|--------|
| 100= | 93.0  | 400= | 217.0 | 700= | 509.0  |
| 110= | 95.0  | 410= | 222.0 | 710= | 555.0  |
| 120= | 99.0  | 420= | 222.0 | 720= | 565.0  |
| 130= | 101.0 | 430= | 229.0 | 730= | 615.0  |
| 140= | 103.0 | 440= | 240.0 | 740= | 645.0  |
| 150= | 107.0 | 450= | 254.0 | 750= | 701.0  |
| 160= | 109.0 | 460= | 260.0 | 760= | 764.0  |
| 170= | 109.0 | 470= | 255.0 | 770= | 814.0  |
| 180= | 120.0 | 480= | 292.0 | 780= | 828.0  |
| 190= | 121.0 | 490= | 299.0 | 790= | 852.0  |
| 200= | 121.0 | 500= | 332.0 | 800= | 853.0  |
| 210= | 122.0 | 510= | 334.0 | 810= | 855.0  |
| 220= | 122.0 | 520= | 347.0 | 820= | 873.0  |
| 230= | 127.0 | 530= | 349.0 | 830= | 897.0  |
| 240= | 129.0 | 540= | 365.0 | 840= | 932.0  |
| 250= | 141.0 | 550= | 377.0 | 850= | 1001.0 |
| 260= | 150.0 | 560= | 388.0 | 860= | 1081.0 |
| 270= | 153.0 | 570= | 414.0 | 870= | 1081.0 |
| 280= | 154.0 | 580= | 414.0 | 880= | 1099.0 |
| 290= | 161.0 | 590= | 417.0 | 890= | 1111.0 |
| 300= | 163.0 | 600= | 426.0 | 900= | 1408.0 |
| 310= | 163.0 | 610= | 434.0 | 910= | 1560.0 |
| 320= | 164.0 | 620= | 436.0 | 920= | 1765.0 |
| 330= | 164.0 | 630= | 451.0 | 930= | 1837.0 |
| 340= | 168.0 | 640= | 454.0 | 940= | 2645.0 |
| 350= | 181.0 | 650= | 463.0 | 950= | 2132.0 |
| 360= | 182.0 | 660= | 487.0 | 960= | 2764.0 |
| 370= | 183.0 | 670= | 490.0 | 970= | 3607.0 |
| 380= | 211.0 | 680= | 492.0 | 980= | 4126.0 |
| 390= | 212.0 | 690= | 496.0 | ..   |        |

Fig. 4-3. TAPE 12: Ordered Failure Data

```

100=      PROGRAM TTTPLOT
110=C
120=      REAL Y(90),T(90),U(90)
130=      INTEGER I,J,K,N,X
140=C
150=C      DEFINITIONS: TAPE12 CONTAINS ALL
160=C      OBSERVATIONS SMALL T(I)
170=C      N=TOTAL NUMBER OF OBSERVATIONS PLUS ONE
180=C      Y(I)=CAPITAL T(I), U(I)=U(I), I,J,K,X
190=C      ARE INDEXES
200=C
210=      N=90
220=      K=1
230=C
240=      DATA Y,T,U/270*0.0/
250=C
260=      READ(12,*) (T(X),X=2,N)
270=      PRINT '(1X,10X,"T",6X,"OBSERV",5X,"TOTAL",5X,"SCALED")'
280=      PRINT '(1X,12X,"K0.",6X,"TIME",6X,"TIME",7X,"TIME",/)'
290=C
300=      DO 10 I=2,N
310=          J=I-1
320=          Y(I)=(N-J)*(T(I)-T(K))+Y(K)
330=          K=K+1
340=10      CONTINUE
350=C
360=      J=1
370=      DO 20 I=2,N
380=          U(I)=Y(I)/Y(N)
390=          PRINT 40,J,T(I),Y(I),U(I)
400=          WRITE(13,1) (" ",F9.6)'U(I)
410=          J=J+1
420=20      CONTINUE
430=C
440=40      FORMAT(1X,12X,10,5X,F6.1,3X,F9.1,5X,F6.4)
450=      RETURN
460=      END

```

Fig. 4-4. Program to Scale Total Time on Test

TABLE 4-2  
SCALED TIMES TO FAILURE

| I<br>NO. | OBSERV<br>TIME | TOTAL<br>TIME | SCALED<br>TIME |    |        |         |        |
|----------|----------------|---------------|----------------|----|--------|---------|--------|
| 1        | 93.3           | 8277.0        | .1579          | 46 | 377.3  | 25373.0 | .4763  |
| 2        | 95.3           | 8453.0        | .1612          | 47 | 383.3  | 25346.0 | .4673  |
| 3        | 99.3           | 8531.0        | .1679          | 48 | 414.3  | 26638.0 | .5381  |
| 4        | 101.3          | 8973.0        | .1712          | 49 | 414.3  | 26638.0 | .5381  |
| 5        | 103.3          | 9143.0        | .1744          | 50 | 417.3  | 26753.0 | .5194  |
| 6        | 107.3          | 9479.0        | .1803          | 51 | 426.3  | 27139.0 | .5171  |
| 7        | 109.3          | 9645.0        | .1840          | 52 | 434.3  | 27413.0 | .5229  |
| 8        | 109.3          | 9645.0        | .1840          | 53 | 436.3  | 27437.0 | .5243  |
| 9        | 122.3          | 10536.0       | .2010          | 54 | 451.3  | 28227.0 | .5346  |
| 10       | 121.3          | 10616.0       | .2025          | 55 | 454.3  | 28132.0 | .5326  |
| 11       | 121.3          | 10616.0       | .2025          | 56 | 463.3  | 29113.0 | .5554  |
| 12       | 122.3          | 10694.0       | .2040          | 57 | 487.3  | 29253.0 | .5580  |
| 13       | 122.3          | 10694.0       | .2040          | 58 | 493.3  | 29346.0 | .5598  |
| 14       | 127.3          | 11074.0       | .2112          | 59 | 492.3  | 29438.0 | .5613  |
| 15       | 129.3          | 11224.0       | .2141          | 60 | 498.3  | 29538.0 | .5644  |
| 16       | 141.3          | 12112.0       | .2310          | 61 | 508.3  | 29878.0 | .5699  |
| 17       | 152.3          | 12769.0       | .2436          | 62 | 558.3  | 31278.0 | .5966  |
| 18       | 153.3          | 12935.0       | .2477          | 63 | 563.3  | 31467.0 | .6003  |
| 19       | 154.3          | 13056.0       | .2491          | 64 | 615.3  | 32767.0 | .6251  |
| 20       | 161.3          | 13546.0       | .2564          | 65 | 645.3  | 33517.0 | .6394  |
| 21       | 163.3          | 13684.0       | .2613          | 66 | 701.3  | 34851.0 | .6658  |
| 22       | 163.3          | 13684.0       | .2613          | 67 | 764.3  | 36212.0 | .6923  |
| 23       | 164.3          | 13751.0       | .2623          | 68 | 814.3  | 37412.0 | .7136  |
| 24       | 164.3          | 13751.0       | .2623          | 69 | 828.3  | 37734.0 | .7192  |
| 25       | 180.3          | 14791.0       | .2821          | 70 | 852.3  | 38184.0 | .7284  |
| 26       | 181.3          | 14855.0       | .2834          | 71 | 853.3  | 38253.0 | .7287  |
| 27       | 182.3          | 14918.0       | .2846          | 72 | 855.3  | 38239.0 | .7294  |
| 28       | 183.3          | 14988.0       | .2858          | 73 | 873.3  | 38545.0 | .7353  |
| 29       | 211.3          | 16688.0       | .3163          | 74 | 897.3  | 38729.0 | .7426  |
| 30       | 212.3          | 16748.0       | .3195          | 75 | 932.3  | 39454.0 | .7526  |
| 31       | 217.3          | 17043.0       | .3251          | 76 | 1001.3 | 40428.0 | .7710  |
| 32       | 223.3          | 17217.0       | .3284          | 77 | 1031.3 | 41468.0 | .7909  |
| 33       | 222.3          | 17331.0       | .3306          | 78 | 1081.3 | 41463.0 | .7909  |
| 34       | 229.3          | 17723.0       | .3381          | 79 | 1099.3 | 41653.0 | .7947  |
| 35       | 240.3          | 18323.0       | .3496          | 80 | 1111.3 | 41778.0 | .7969  |
| 36       | 254.3          | 19084.0       | .3640          | 81 | 1402.3 | 44451.0 | .8479  |
| 37       | 263.3          | 19402.0       | .3701          | 82 | 1568.3 | 45667.0 | .8711  |
| 38       | 285.3          | 20732.0       | .3949          | 83 | 1765.3 | 47102.0 | .8985  |
| 39       | 292.3          | 21357.0       | .4017          | 84 | 1837.3 | 47534.0 | .9067  |
| 40       | 299.3          | 21489.0       | .4034          | 85 | 2245.3 | 48574.0 | .9266  |
| 41       | 302.3          | 22026.0       | .4092          | 86 | 2132.3 | 49922.0 | .9392  |
| 42       | 334.3          | 23122.0       | .4411          | 87 | 2764.3 | 50819.0 | .9694  |
| 43       | 347.3          | 23732.0       | .4527          | 88 | 3637.3 | 51334.0 | .9787  |
| 44       | 349.3          | 23825.0       | .4543          | 89 | 4123.3 | 52423.0 | 1.0000 |
| 45       | 365.3          | 24545.0       | .4612          |    |        |         |        |

|      |         |      |         |      |          |
|------|---------|------|---------|------|----------|
| 100= | .157689 | 400= | .325105 | 700= | .569741  |
| 110= | .161246 | 410= | .328425 | 710= | .596647  |
| 120= | .167884 | 420= | .330599 | 720= | .630252  |
| 130= | .171165 | 430= | .335277 | 730= | .625053  |
| 140= | .174406 | 440= | .349618 | 740= | .639357  |
| 150= | .180818 | 450= | .364039 | 750= | .664994  |
| 160= | .183984 | 460= | .370185 | 760= | .692635  |
| 170= | .183984 | 470= | .394983 | 770= | .713618  |
| 180= | .200988 | 480= | .401713 | 780= | .719226  |
| 190= | .202587 | 490= | .426389 | 790= | .725363  |
| 200= | .202587 | 500= | .439235 | 800= | .728745  |
| 210= | .203994 | 510= | .441066 | 810= | .729432  |
| 220= | .203994 | 520= | .452721 | 820= | .735269  |
| 230= | .211243 | 530= | .454476 | 830= | .742594  |
| 240= | .214184 | 540= | .466211 | 840= | .752689  |
| 250= | .231844 | 550= | .478282 | 850= | .771836  |
| 260= | .243576 | 560= | .467385 | 860= | .790874  |
| 270= | .247687 | 570= | .508136 | 870= | .790874  |
| 280= | .249051 | 580= | .508136 | 880= | .794651  |
| 290= | .258398 | 590= | .518425 | 890= | .796748  |
| 300= | .261353 | 600= | .517120 | 900= | .847929  |
| 310= | .261830 | 610= | .522919 | 910= | .871125  |
| 320= | .262289 | 620= | .524331 | 920= | .856499  |
| 330= | .262289 | 630= | .534632 | 930= | .936737  |
| 340= | .280147 | 640= | .536635 | 940= | .926573  |
| 350= | .280349 | 650= | .555443 | 950= | .933216  |
| 360= | .284570 | 660= | .557961 | 960= | .969384  |
| 370= | .285752 | 670= | .559792 | 970= | .976654  |
| 380= | .310334 | 680= | .568975 | 980= | 1.000000 |
| 390= | .319478 | 690= | .564489 | ..   |          |

Fig. 4-5. TAPE 13: Calculated  $U_i$ 's

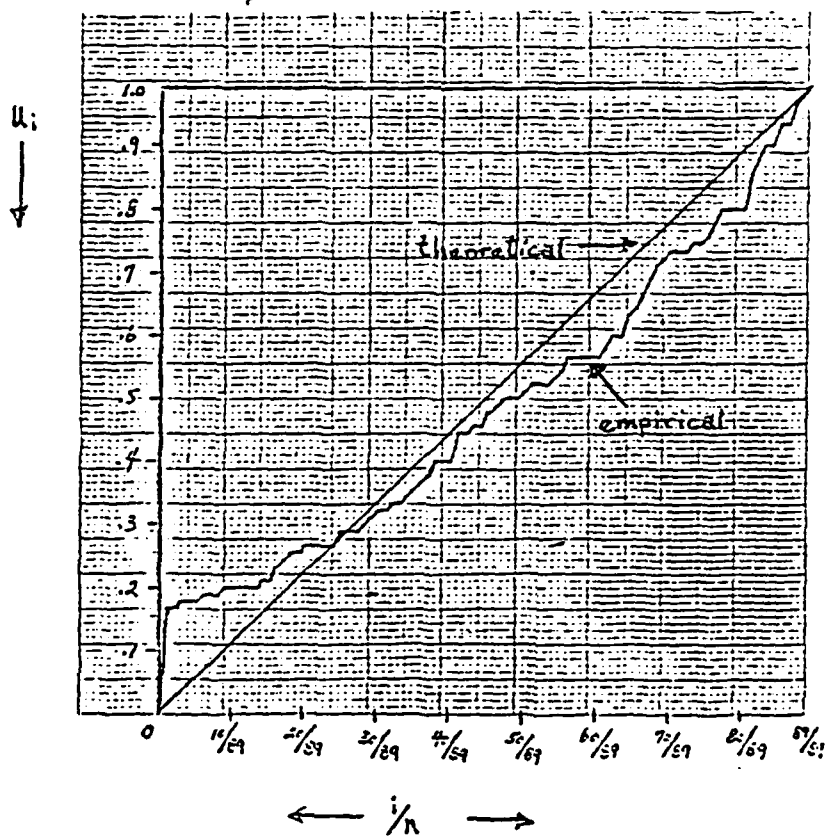


Fig. 4-6. Total Time on Test-plot

According to MIL-STD-756A and engineers at AGMC, a complex electronic component, such as the KT-73 IMU, when in steady state operation, is assumed to exhibit exponential failure characteristics (the flat portion of a typical bathtub curve).

Visually examining the two distributions, the difference in their shapes does not appear dramatic. While the assumed distribution exhibits a constant failure rate, the empirical distribution exhibits a slightly decreasing failure rate. The statistical significance of the difference was not analyzed. With Bergman's method, the empirical distribution can be visually recognized as a DFR, exponential or IFR (9:468).

#### Cost Data

To find the optimal replacement interval, requires balancing the cost of replacement (scheduled maintenance),  $C_0$ , with the cost of failure (unscheduled maintenance),  $C_0 + k$ , where  $k$  represents the difference between cost of replacement and cost of failure.

The collection of cost data was influenced by the formats used by the data collection systems which contained the needed information. As explained in Chapters I and III, the cost of replacement includes the cost to repair and the cost of transporting units to and from depot. The cost of failure includes these costs plus the additional cost of trouble-shooting. Cost data was collected for the period

from FY 72 through FY 81 to generally coincide with the time period during which failures occurred for units in the sample. However, since the cost data collected for this period was in aggregated form, they represent the expected costs for the entire population of KT-73 IMUs repaired and processed through the system.

The cost to repair a unit at depot was provided by the AGMC Resources Division and represents an actual cost to repair based on averages for each fiscal year beginning with FY 81 and going back to FY 72. Table 4-3 contains average repair cost by fiscal year and total number of units repaired for each time period. It should be noted that AGMC provided separate averages for FY 76 (ending 30 June 1976) and for the transition quarter 76T (ending 30 September 1976). A single average for FY 76 was derived by multiplying the average cost per unit for FY 76 times four and adding the average cost per unit for 76T, then dividing by five.

TABLE 4-3  
AVERAGE COST TO REPAIR KT-73 IMU

| Period | Average Cost/<br>Unit | Total Units<br>Repaired |
|--------|-----------------------|-------------------------|
| FY 81  | \$4350                | 312                     |
| FY 80  | 4053                  | 358                     |
| FY 79  | 3378                  | 358                     |
| FY 78  | 4104                  | 335                     |
| FY 77  | 2873                  | 360                     |

TABLE 4-3—Continued

| Period | Average Cost/<br>Unit | Total Units<br>Repaired |
|--------|-----------------------|-------------------------|
| FY 76  | \$4138                | 489                     |
| FY 75  | 3126                  | 447                     |
| FY 74  | 2967                  | 502                     |
| FY 73  | 4005                  | 344                     |
| FY 72  | 3203                  | 73                      |

Transportation costs were extracted from the K051 Maintenance Data Collection System as quarterly totals under "packing-shipping cost" for WUC 73FAO. The listing was found under the Logistic Support Cost Breakdown for the A7-D Aircraft. Copies of the microfiche files containing the data are contained in Appendix C. Cost data was only available as far back as the fourth quarter of FY 72, and not all of the information was available at Headquarters AFLC. Data for the second quarter of FY 79 was retrieved by telephone from the Sacramento Air Logistics Center. Table 4-4 contains the quarterly transportation cost totals for each quarter beginning with the fourth quarter of FY 81 and going back to include the fourth quarter of FY 72. Annual averages were then computed by summing the four quarterly totals in each fiscal year and dividing by the number of known units repaired by AGMC (Table 4-3) in the same year. For FY 76, an annual average was derived by summing the four quarterly totals for FY 76 and the quarterly total for 76T, then dividing by the number of units repaired

in FY 76 (which includes 76T). The average transportation cost per unit for FY 72 was derived by counting the number of units repaired by AGMC between the 183 and 274 days (fourth quarter) of FY 72 using the G078C reports and dividing that number into the fourth quarter total for FY 72.

TABLE 4-4  
TROUBLE-SHOOTING AND TRANSPORTATION COSTS  
QUARTERLY TOTALS

| Period  | Trouble-shooting | Transportation |
|---------|------------------|----------------|
| 4 FY 81 | \$108367         | \$2841         |
| 3 FY 81 | 91920            | 1527           |
| 2 FY 81 | 95520            | 1951           |
| 1 FY 81 | 105206           | 2071           |
| 4 FY 80 | 124926           | 2868           |
| 3 FY 80 | 132477           | 3134           |
| 2 FY 80 | 85000            | 4531           |
| 1 FY 80 | 65264            | 2822           |
| 4 FY 79 | 97117            | 5129           |
| 3 FY 79 | 69190            | 3505           |
| 2 FY 79 | 71969            | 2992           |
| 1 FY 79 | 94732            | 3932           |
| 4 FY 78 | 98908            | 5386           |
| 3 FY 78 | 72248            | 3896           |
| 2 FY 78 | 69022            | 2961           |
| 1 FY 78 | 63424            | 2546           |
| 4 FY 77 | 69613            | 3543           |
| 3 FY 77 | 66644            | 3769           |
| 2 FY 77 | 66932            | 2384           |
| 1 FY 77 | 64854            | 3154           |
| FY 76T  | 88377            | 4313           |
| 4 FY 76 | 78458            | 5407           |
| 3 FY 76 | 75966            | 2877           |
| 2 FY 76 | 57687            | 2970           |
| 1 FY 76 | 75126            | 3942           |
| 4 FY 75 | 79169            | 3926           |
| 3 FY 75 | 89018            | 5700           |
| 2 FY 75 | 58926            | 3476           |
| 1 FY 75 | 76344            | 3669           |
| 4 FY 74 | 55584            | 3898           |
| 3 FY 74 | 43003            | 2711           |
| 2 FY 74 | 40731            | 2659           |

TABLE 4-4—Continued

| Period  | Trouble-shooting | Transportation |
|---------|------------------|----------------|
| 1 FY 74 | \$ 44290         | \$3173         |
| 4 FY 73 | 51740            | 3424           |
| 3 FY 73 | 47143            | 1930           |
| 2 FY 73 | 39361            | 1750           |
| 1 FY 73 | 41243            | 2249           |
| 4 FY 72 | 34127            | 814            |

Once annual averages were collected for the cost to repair and computed for the cost of transportation, these two costs were added for each corresponding fiscal year to produce annual averages for the cost of replacement,  $C_o$ , for FY 72 through FY 81.

The cost of failure includes the cost of replacement,  $C_o$ , plus an additional cost,  $k$ . For this study, the additional cost or difference,  $k$ , was defined as the cost to trouble-shoot a unit failure. Trouble-shooting costs, like transportation costs, were collected from the Logistic Support Cost Breakdown of the K051 MDC System (Appendix C). The quarterly totals are listed under "field maintenance cost" for WUC 73FAO. Annual average trouble-shooting costs per unit failure were derived in the same way that transportation costs were computed. Table 4-4 contains the quarterly trouble-shooting cost totals for the same time period that transportation costs were collected.

In order to facilitate Bergman's graphical method, the cost of replacement,  $C_o$ , must be standardized to units

of  $k$  dollars. Bergman refers to this standardized value as "C." To find  $C$ , the cost of replacement,  $C_0$ , which includes the cost of repair and the cost of transportation, must be divided by the additional cost of failure,  $k$ . In this study, a value for  $C$  was calculated for each fiscal year, from FY 72 through FY 81.

The entire range of calculations necessary to arrive at values for  $C$  for each fiscal year were accomplished using a FORTRAN program (Figure 4-7). The program calculates annual values for  $C_0$ ,  $k$  and  $C$ . Data input included TAPE 20 and TAPE 21 which contained values transcribed from Tables 4-3 and 4-4, respectively (Figures 4-8 and 4-9). The output TAPE 22, displays ten values for  $C$ , one for each fiscal year (Figure 4-10).

Since Bergman requires a single fixed value for  $C$ , which represents an average long-term cost of replacement, a mean value for  $C$  based on the sample was required. Values for both the mean and standard deviation were found by subjecting TAPE 22 to the SPSS Condescriptive computer program. The program and results are contained in Figure 4-11.

#### Graphical Solution

Using the mean value of 5.206 for  $C$ , the point  $(-c,0)$  was located and a tangent drawn to the failure curve. Figure 4-12 indicates that the tangent point is at the upper right most portion of the failure curve. The abscissa of the

```

100=  PROGRAM= COST
110=C
120=C  COMPUTE COST OF REPLACEMENT IN TERMS OF "K" DOLLARS
130=C  FOR GRAPHICAL ANALYSIS
140=C
150=  REAL CO(10),K(30),TRANS(30),C(10)
160=  INTEGER NREP(10),I,J
170=C
180=  DATA CO,K,TRANS,C,NREP/9648.8,10*0/
190=C
200=  READ(20,*) (CO(I),NREP(I),I=1,10)
210=  READ(21,*) (K(I),TRANS(I),I=1,30)
220=  J=1
230=C
240=  DO 10 I=1,10
250=      TRANS(I)=TRANS(J)
260=      IF(J.EQ.30) GO TO 50
270=      J=J+1
280=      TRANS(I)=TRANS(I)+TRANS(J)
290=      J=J+1
300=      TRANS(I)=TRANS(I)+TRANS(J)
310=      J=J+1
320=70  TRANS(I)=TRANS(I)+TRANS(J)
330=      J=J+1
340=      IF(J.EQ.25) GO TO 70
350=50  TRANS(I)=TRANS(I)/NREP(I)
360=10  CONTINUE
370=C
380=  J=1
390=  DO 20 I=1,10
400=      K(I)=K(J)
410=      IF(J.EQ.30) GO TO 60
420=      J=J+1
430=      K(I)=K(I)+K(J)
440=      J=J+1
450=      K(I)=K(I)+K(J)
460=      J=J+1
470=60  K(I)=K(I)+K(J)
480=      J=J+1
490=      IF(J.EQ.25) GO TO 60
500=60  K(I)=K(I)/NREP(I)
510=20  CONTINUE
520=C
530=  DO 30 I=1,10
540=      CO(I)=CO(I)+TRANS(I)
550=30  CONTINUE
560=C
570=  DO 40 I=1,10
580=      C(I)=CO(I)/K(I)
590=      WRITE(22,*) (" ",FS.2)C(I)
600=40  CONTINUE
610=C
620=  RETURN
630=  END
..

```

Fig. 4-7. Program to Calculate Cost "C"

| <u>Cost</u> | <u>No.</u> | <u>FY</u> |
|-------------|------------|-----------|
| 100-4353    | 312        | 81        |
| 110-4253    | 358        | 80        |
| 120-3376    | 358        | 79        |
| 130-4194    | 335        | 78        |
| 140-2973    | 363        | 77        |
| 150-4138    | 489        | 76        |
| 160-3126    | 447        | 75        |
| 170-2967    | 502        | 74        |
| 180-4005    | 344        | 73        |
| 190-3293    | 73         | 72        |

..

Fig. 4-8. TAPE 20: Average Cost to Repair  
and Total Number of Units Repaired

| <u>Trouble-</u><br><u>shooting</u> | <u>Trans</u> | <u>FY</u> |
|------------------------------------|--------------|-----------|
| 100=100067                         | 2841         |           |
| 110=91920                          | 1527         | 81        |
| 120=95520                          | 1951         |           |
| 130=105206                         | 2071         |           |
| 140=124926                         | 2068         |           |
| 150=132477                         | 3134         | 80        |
| 160=85000                          | 4531         |           |
| 170=65264                          | 2022         |           |
| 180=97117                          | 5129         |           |
| 190=69190                          | 3505         | 79        |
| 200=71969                          | 2592         |           |
| 210=94732                          | 3932         |           |
| 220=98908                          | 5386         |           |
| 230=72248                          | 3896         | 78        |
| 240=69022                          | 2961         |           |
| 250=60424                          | 2546         |           |
| 260=69613                          | 3543         |           |
| 270=66644                          | 3769         | 77        |
| 280=66932                          | 2304         |           |
| 290=64854                          | 3154         |           |
| 300=80377                          | 4313         | 76T       |
| 310=78458                          | 5407         |           |
| 320=75966                          | 2877         | 76        |
| 330=57607                          | 2970         |           |
| 340=75126                          | 3942         |           |
| 350=79169                          | 3926         |           |
| 360=89018                          | 5700         | 75        |
| 370=58926                          | 3476         |           |
| 380=76044                          | 3669         |           |
| 390=55584                          | 3898         |           |
| 400=43003                          | 2711         | 74        |
| 410=43701                          | 2659         |           |
| 420=44290                          | 3173         |           |
| 430=51740                          | 3424         |           |
| 440=47140                          | 1930         | 73        |
| 450=39061                          | 1750         |           |
| 460=41240                          | 2249         |           |
| 470=04127                          | 814          | 72        |

Fig. 4-9. TAPE 21: Costs of Trouble-shooting and Transportation

| <u>Cost</u> | <u>"C"</u> | <u>FY</u> |
|-------------|------------|-----------|
| 100=        | 3.41       | 81        |
| 110=        | 3.59       | 80        |
| 120=        | 3.68       | 79        |
| 130=        | 4.58       | -78       |
| 140=        | 3.91       | 77        |
| 150=        | 5.44       | 76        |
| 160=        | 4.86       | 75        |
| 170=        | 8.18       | 74        |
| 180=        | 7.73       | 73        |
| 190=        | 6.60       | 72        |

..

Fig. 4-10. TAPE 22: Standardized Cost of Replacement "C"

```

RUN NAME      CON
VARIABLE LIST  C
VAR LABEL     C-COST OF REPLACEMENT/
INPUT FORMAT   FREEFIELD
INPUT MEDIUM  DISC
N OF CASES     10
CONDSCRIPTIVE  C
STATISTICS     ALL
READ INPUT DATA

```

00035500 CM NEEDED FOR CONDSCRIPTIVE

CON  
2

08/25/82 16.57.50. PAGE

FILE - NAME (CREATED - 08/25/82)

| VARIABLE C | COST OF REPLACEMENT |          |        |          |
|------------|---------------------|----------|--------|----------|
| MEAN       | 5.206               | STD ERR  | .564   | STD DEV  |
| VARIANCE   | 3.179               | KURTOSIS | -1.048 | SKEWNESS |
| MINIMUM    | 3.410               | MAXIMUM  | 8.180  | SUM      |
| C.V. PCT   | 34.246              | .95 C.I. | 3.931  | 17       |
|            |                     |          |        | 1.783    |
|            |                     |          |        | .752     |
|            |                     |          |        | 52.050   |
|            |                     |          |        | 0.481    |

Fig. 4-11. SPSS Condscriptive Routine and Results

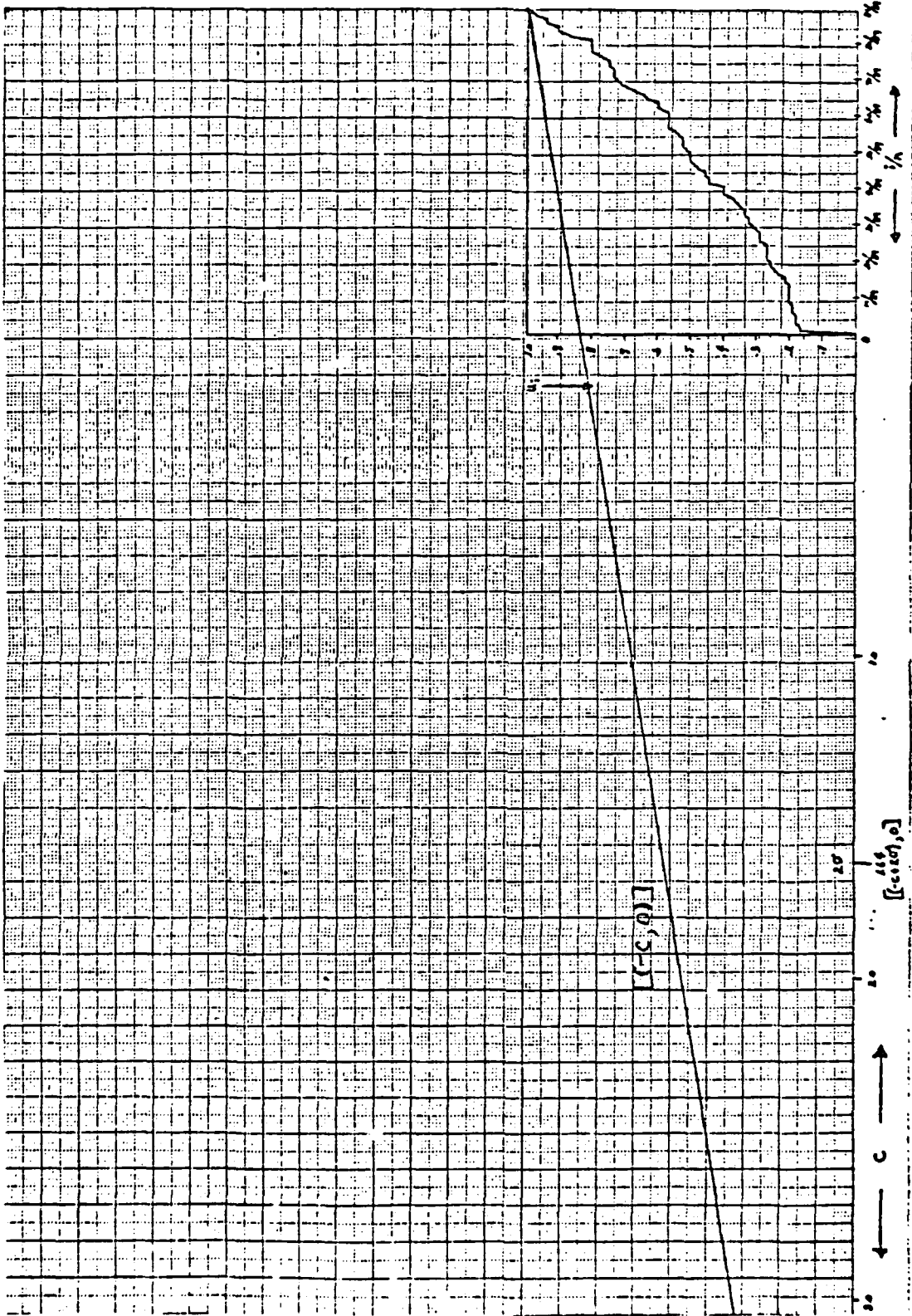


Fig. 4-12. Graphical Solution

AD-A123 025

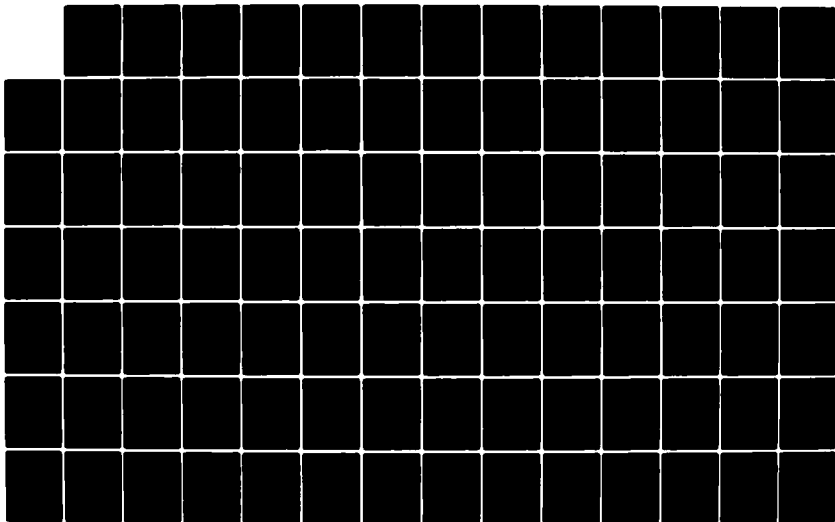
A STUDY TO DEMONSTRATE THE APPLICATION OF A GRAPHICAL  
METHOD TO DETERMINE..(U) AIR FORCE INST OF TECH  
WRIGHT-PATTERSON AFB OH SCHOOL OF SYST..

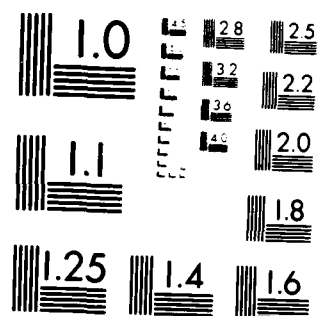
2/3

UNCLASSIFIED

D C BECKWITH ET AL. SEP 82 AFIT-LSSR-60-82 F/G 5/1

NL





MICROCOPY RESOLUTION TEST CHART  
NATIONAL BUREAU OF STANDARDS-1963-A

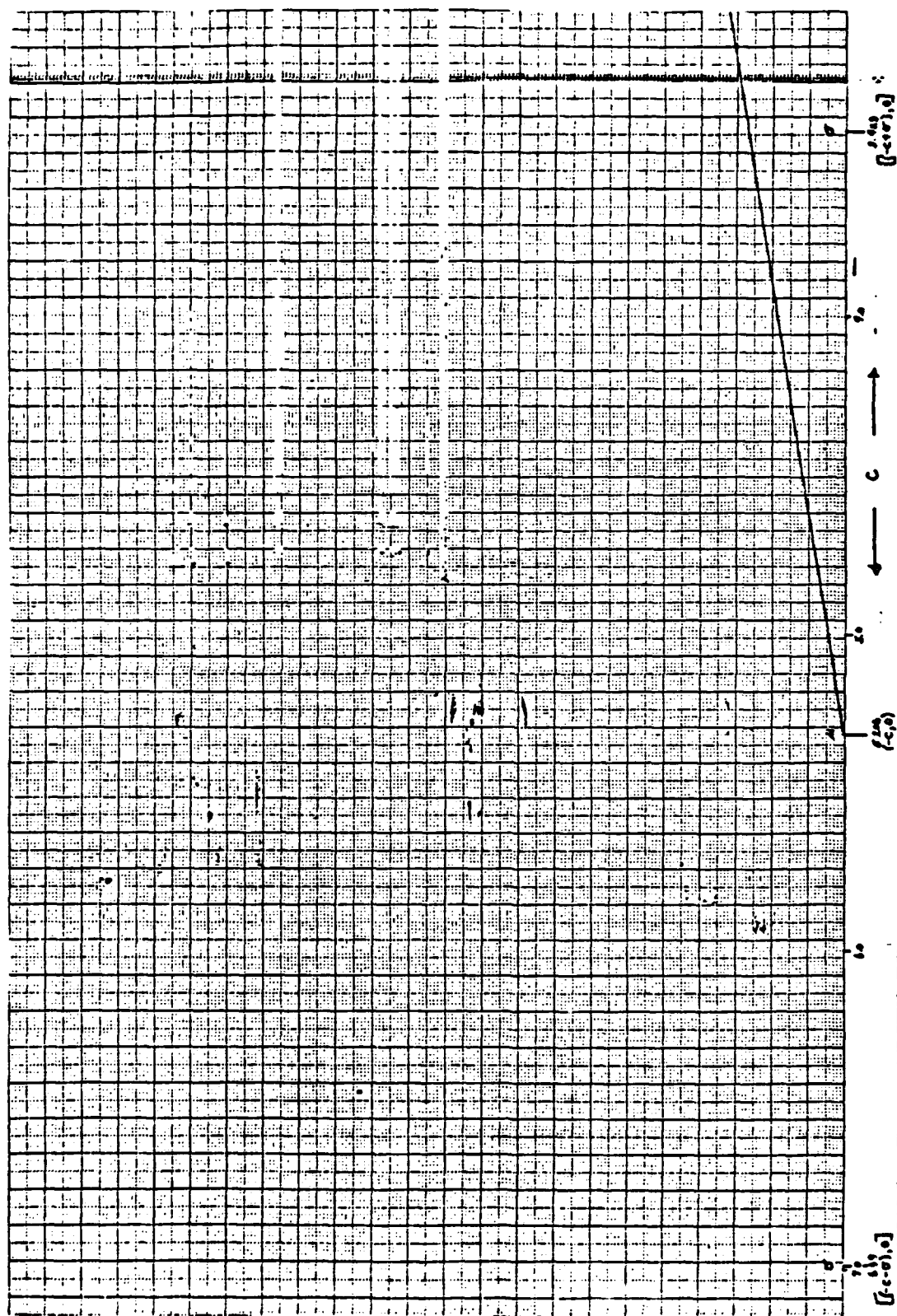


Fig. 4-12—Continued

tangent point is the value 89/89 or 1 and denotes the index of the optimal replacement interval,  $j_0$ . In this case, the estimate of the optimal replacement interval was interpreted to be infinite. As explained in Chapter III, this conclusion could have been reached without having performed the graphical solution since, by definition, exponential and DFR curves yield infinite replacement intervals.

The current interval and the optimal interval found using Bergman's method are the same. They are both infinite, and the optimal maintenance policy for the KT-73 IMUs in the sample is to operate until failure.

#### Sensitivity Analysis

In Chapters I and III, a large portion of discussion was devoted to limitations regarding cost measurement and cost uncertainty. Cost estimation results in a degree of uncertainty, and Bergman's graphical method can be used to perform sensitivity analysis with respect to cost.

By constructing a range of values for cost,  $C$ , about the mean, new lines tangent to the failure curve can be drawn through these points and observations can be made to identify changes, if any, in the optimal replacement interval index,  $j_0$ . In the last section, the mean value of 5.206 was used for  $C$  in finding the estimate of the optimal replacement index. The results of this study indicate that the replacement interval for the KT-73 IMU is infinite. Knowing this, it can be concluded at this point that the replacement

interval is totally insensitive to changes in cost, C. However, for the purpose of demonstrating the method, a sensitivity analysis was performed.

The degree of uncertainty of cost for this study is unknown, and the variability of cost in the sample may not reflect the true variability of the population of costs associated with the KT-73 IMU. The size of the sample of cost values (ten cases) preclude efficient analysis of the distribution of costs calculated in this study. Employing a rule from Chebyshev's theorem that applies to any sample of measurements, regardless of the shape of the frequency distribution, at least 75 percent of the observations are expected to fall within two standard deviations of the mean (13:149). Figure 4-11 shows the calculated standard deviation for the sample to be 1.783. Since the mean is 5.206, the two standard deviations from the mean are calculated as

$$\bar{X} \pm S = (3.42, 6.99)$$

$$\bar{X} \pm 2S = (1.64, 8.77)$$

These values (except 8.77) were plotted on the graph in Figure 4-13 and new lines drawn tangent to the failure curve. In the interest of conserving space, the point  $(-8.77, 0)$ , which represents two standard deviations above the mean, was not plotted. Also, since the point representing one standard deviation above the mean resulted in an

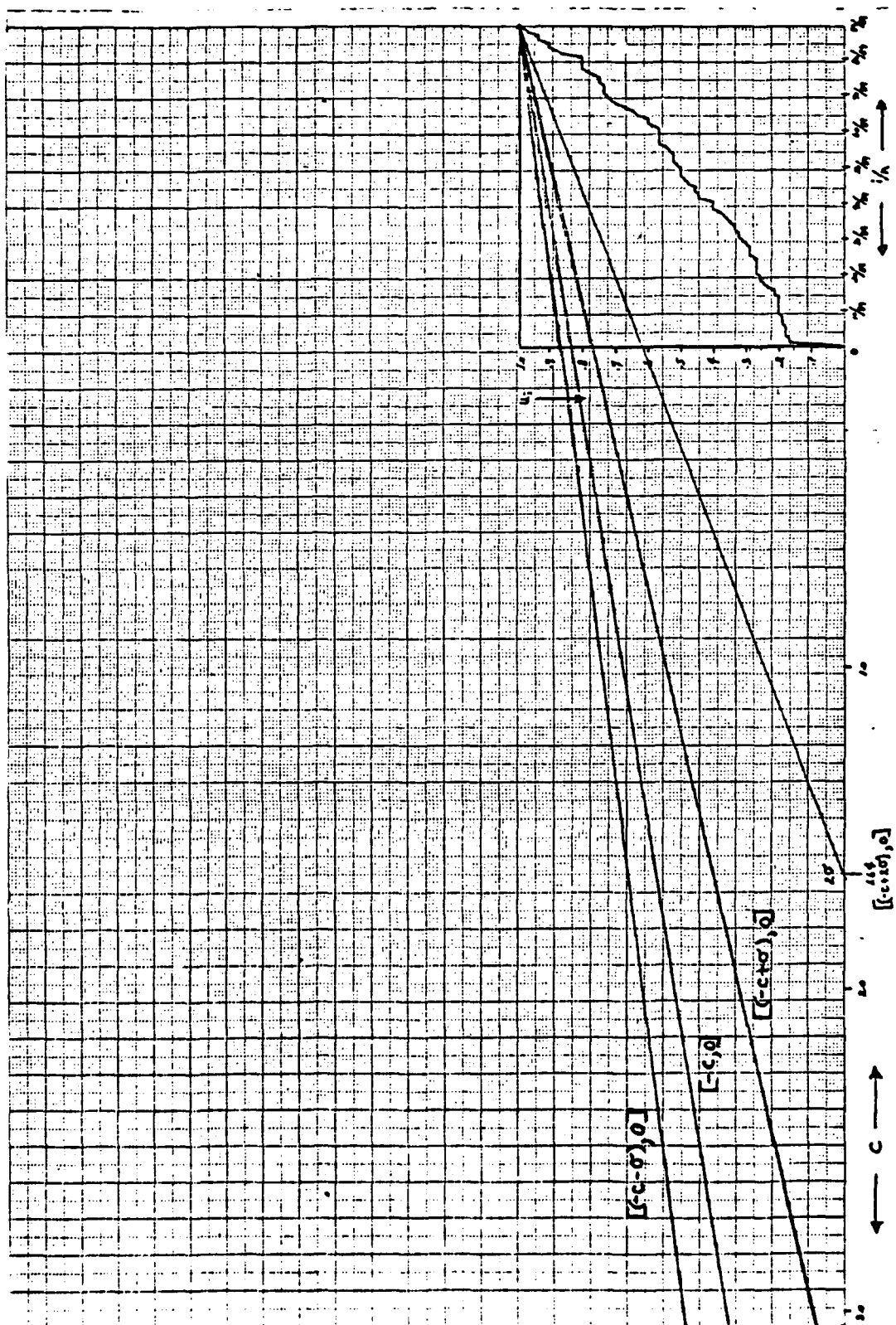


Fig. 4-13. Sensitivity Analysis

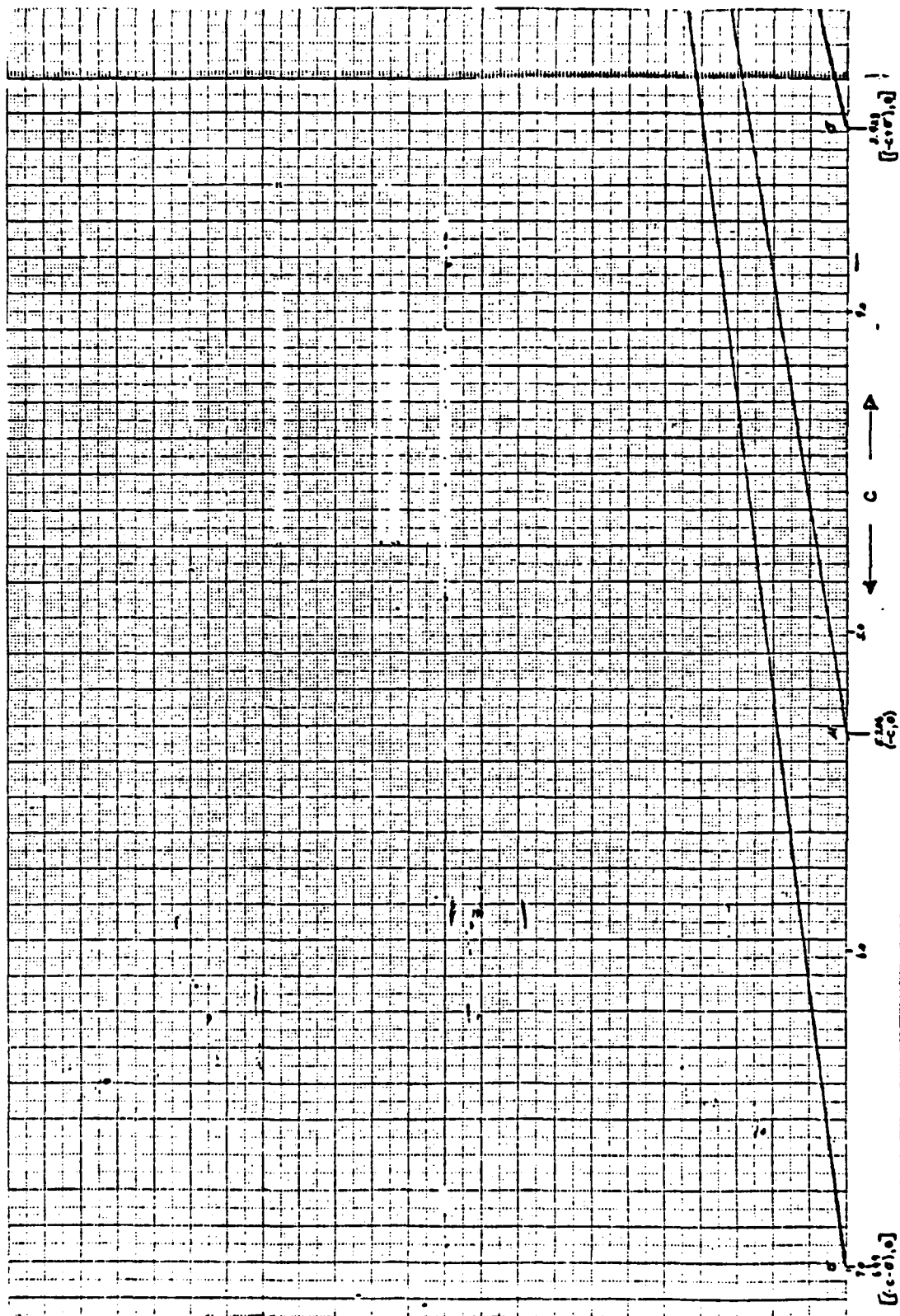


Fig. 4-13—Continued

infinite solution, it is known that any point beyond one standard deviation would produce an identical result given the failure curve for the units.

For this study, in each case in which a new line was drawn tangent to the failure curve from a new value for  $C$ , the solution was the same. In each case, the estimate of the optimal replacement interval was infinite resulting in a recommendation to operate the KT-73 IMU until failure. Hence, the optimal replacement interval is totally insensitive to changes in cost,  $C$ . Furthermore, it should be noted that all ten values for  $C$  contained in the sample fall within two standard deviations of the mean. This observation provides a "feel," as Bergman states it, for the confidence in the estimate of the optimal replacement interval.

#### Summary

The application and analysis of Bergman's method is summarized in light of the research question and the two secondary questions. In Chapter III, a set of criteria was established so that the degree to which the research answers these questions can be evaluated.

The research question asks if Bergman's method can be applied in determining an optimal maintenance task interval based on the objective of minimizing total long-run average cost per unit of time using actual field data. To answer the question, the cost of replacement, the cost of

failure and the time from renewal to failure (cycle) for all units in the sample, must first be known.

The cost of replacement,  $C_0$ , was defined as the sum of the cost to repair a unit at AGMC and the cost to transport a unit to and from the depot. Data was gathered from the AGMC Resources Division and the K051 MDC for the KT-73 IMU in the form of dollar amounts. The cost of failure,  $C_0+k$ , includes these costs plus the additional cost of trouble-shooting a failed unit. Data for trouble-shooting costs was also gathered from the K051 MDC for the KT-73 IMU in the form of dollar amounts. No attempt was made to quantify other cost factors, such as Not-Mission-Capable time or readiness. Adding these costs to the cost of failure would have resulted in a larger value for  $k$  and a smaller value for  $C$ . However, since the interval for the KT-73 IMU is totally insensitive to changes in cost, the results would have been the same if these additional costs had been added to  $k$ .

The times from renewal to failure were taken as Cycle 1 for all units in the sample. The data was gathered from the G078C reports by serial number and cycle number. Seven serial numbers in the original sample of ninety-six were said to have attrited and were removed from the sample without bias, leaving eighty-nine units for the study.

The second set of criteria which must be met to answer the research question is to have a large sample

(greater than 30). The sample of eighty-nine units meets this criterion.

The final set of criteria concerns procedures necessary to apply Bergman's method. If (1) the cost of replacement can be standardized to  $k$  units of dollars, (2) the observed life times can be scaled to Bergman's TTT-plot, (3) a graph of the scaled empirical life distribution can be constructed, (4) a tangent to the failure curve with the greatest slope passing through the point plotted for replacement cost can be drawn, and (5) the index for the optimal replacement interval can be identified using Bergman's graphical technique, then the research question can be answered in the affirmative.

Using a FORTRAN program, annual per unit averages for the cost of replacement and the additional cost of failure,  $k$ , were computed. The cost of replacement,  $C_0$ , was then standardized to  $k$  units of dollars by dividing  $C_0$  by  $k$  to arrive at values for  $C$ . The values for  $C$  were then analyzed for parameters and the mean value of 5.206 used to plot a point representing  $(-c, 0)$ . A line with the greatest slope passing through this point and tangent to the failure curve was drawn and the index for the optimal replacement interval identified as infinite. Accordingly, the recommendation based on this study is to operate the KT-73 IMU until failure.

Having met all of the criteria necessary, the research question is answered in the affirmative. As explained in Chapter III, having successfully applied Bergman's method for arriving at an optimal maintenance task interval, the reciprocal,  $[C(T)]^{-1}$ , of the objective function  $C(T)$  is minimized. The resultant solution is an optimal maintenance task interval which balances the cost of replacement with the cost of failure, and results in a minimum total long-run average cost per unit time.

Secondary Research Question "a" asks how the optimal interval for the units tested compares with the current interval for the item. To answer this question, (1) the current interval must be known, (2) the distribution of observed failure data must be identified, (3) the index for the optimal interval must be identified using Bergman's graphical technique, (4) the current and optimal intervals must be compared, and (5) differences, if any, between the two intervals must be explained or reconciled.

The KT-73 IMU is replaced upon failure and so the current task interval is infinite. The empirical life distribution revealed by the TTT-plot using field data for the units was slightly DFR, and the index for the optimal replacement interval denoted an infinite interval. Thus, the current and optimal intervals are the same. Since all of the criteria for answering secondary Research Question

"a" were successfully met, the conclusion that the two intervals are identical can be asserted.

Secondary Research Question "b" asks how sensitive the calculated optimal interval is to the uncertainty of cost. To answer this question, (1) the mean and standard deviation for standardized cost values must be identified, (2) a range of values for C above and below the mean must be identified for use in performing the sensitivity analysis, (3) changes in the optimal index must be identified based on changes in C, and (4) conclusions about the sensitivity of the optimal interval to uncertainty in cost must be drawn from the analysis.

The ten values for cost of replacement, C, were subjected to analysis by the SPSS Condescriptive computer program to find values for the mean and standard deviation. Computing values for one and two standard deviations above and below the mean, new lines were drawn through these points and tangent to the failure curve. The index for the optimal replacement interval in each case denoted an infinite interval. Hence, it was concluded that the interval is totally insensitive to changes in cost, C.

Having successfully met all of the criteria, it was concluded that the optimal interval is totally insensitive to changes in cost.

## CHAPTER V

### CONCLUSIONS, IMPLICATIONS AND RECOMMENDATIONS

In this chapter, the authors endeavor to place in perspective the findings and observations gained through the demonstration of a simple graphical method for determining optimal maintenance task intervals using actual field data for equipment used in aircraft. The method is based on a control strategy which balances cost of replacement with the cost of failure resulting in a minimum total long-run average cost per unit time. The research conclusions, implications and recommendations are presented in the following sections.

#### Conclusions

The research objective was attained by answering the following research question and secondary questions:

#### Research Question

Can Bergman's graphical method be applied in determining an optimal maintenance task interval based on the objective of minimizing total long-run average cost per unit time using actual field data?

Bergman's method was successfully applied to a sample of KT-73 Inertial Measurement Units (IMUs) used in the Air Force A-7D aircraft. The study indicated that the component's

optimal replacement interval is an infinite one (operate until failure). The solution was found graphically. Bergman's method assigns an infinite task interval to any component displaying an exponential failure distribution or decreasing failure rate (DFR); therefore, by definition, the task interval could have been specified once the TTT-plot had been constructed and the distribution identified as DFR.

#### Secondary Research Question "a"

How does the calculated optimal interval for the units tested compare with the current interval for that item?

The units tested exhibited a DFR, thus, an infinite task interval was assigned. The current interval is also infinite. Comparison of the optimal and current intervals show that they are identical. Hence, the current interval is optimal.

#### Secondary Research Question "b"

How sensitive is the calculated optimal interval to the uncertainty of cost?

It was demonstrated in Chapter IV that a range of values for cost on the order of two standard deviations about the mean caused no change in the optimal replacement interval. Therefore, it was concluded that the optimal replacement interval is totally insensitive to changes in

cost. This conclusion could have been reached without performing the analysis since, by definition, a failure distribution which is DFR must yield an infinite interval.

The item chosen to demonstrate the graphical technique was not ideal for use in performing sensitivity analysis. The authors were unable to identify a unit of equipment that would display an increasing failure rate and that was traceable by serial number. This constraint severely limited demonstrating the usefulness of sensitivity analysis and the ease in which it can be accomplished using Bergman's method. However, the significant prospects that are offered for analyzing the uncertainty associated with cost through sensitivity analysis should not be overlooked.

Having answered the research questions, the researchers conclude that the application of Bergman's graphical technique to an IMU demonstrated a viable method for determining an optimal interval for an item in the Air Force inventory. It provides: (1) an easy way to give sensitivity analysis with respect to the uncertain relationship between cost of replacement and cost of failure, and (2) help in solving the problem of communication between the analyst and the decision maker (9:471) by presenting a visual means for analyzing failure data and by giving the analyst a "feel" for the uncertainties and relationships involved in arriving at the graphical solution.

## Implications

### Managerial Tool

Bergman's graphical method could provide the item manager with information to better manage the item. An empirical representation of the item's failure distribution would be known versus an assumed theoretical exponential failure distribution. The manager's planning could be influenced and enhanced significantly by better understanding the effects of changing cost on item intervals.

### Opportunistic Maintenance Policy

This research was limited in scope in that it addresses optimal task intervals for individual components. To achieve an optimal maintenance policy for an end item, i.e., aircraft, the intervals of all components must be effectively incorporated into an optimal maintenance strategy for the end item. It is conceivable to combine optimal task intervals, achieved through Bergman's method, with the comprehensive maintenance strategy of an Opportunistic Maintenance Policy. Under such a policy, complex end items, i.e., aircraft, can be considered so that maintenance action taken on one part is made to depend on the state of the rest of the system. The use of such a maintenance policy in conjunction with optimal task intervals would result in some suboptimization of task intervals for the major end item; however, the final product would be a more effective maintenance strategy.

Smith conducted a Government-contracted study in 1980 in which he applied an opportunistic maintenance policy to the F100PW100 aircraft engine. The F100 engine is currently maintained under an on-condition policy, whereby the engine is removed and maintenance is performed to preclude failure of "driving" items only when required. Driving items are items whose failures are undesirable due to safety or economic consequences. Hence, this type of policy disallows scheduled maintenance for engine components on a hard time basis (27:3).

By applying an opportunistic policy, Smith reasons that maintenance actions not required at the time of engine removal (the opportunity) can be performed so as to avoid future costs (27:4). Using a total engine life-cycle cost formula, he balances the marginal cost to replace an item with the marginal cost of failure for the item and develops optimal Conditional Part Level (CPL) screens conditioned on engine status (27:22). A simulation of the engine's twenty-year life cycle indicated substantial savings, measured primarily by a reduction in engine removals. One of the major weaknesses in the analysis, according to Smith, regards assumptions in part failure distributions (27:39).

Since one of the keys to success of the model is the input of valid cost and failure data, Bergman's method could provide assistance in establishing an information storehouse

from which to feed the opportunistic maintenance screening process.

Within the context of the Reliability-Centered Maintenance Program, the use of an Opportunistic Maintenance Policy for major end items, based on individual analyses of components through Bergman's method, might better realize the objective of the program which is to develop a scheduled maintenance program that will realize the inherent reliability levels of complex equipment at minimum total cost.

#### Recommendations

It was found during the course of this research that some areas were worthy of further study:

##### General

There is much theory (see Chapter II) concerning optimal maintenance policies used to determine task intervals and typically based on the objective of finding the interval which minimizes cost. A need exists to begin closing the gap between theoretical and practical applications of methodology to determine maintenance task intervals.

The Air Force is dedicated to pursuing a means of improving the analytical process for determining scheduled maintenance task intervals; therefore, there is a need to restructure portions of the data collection system so it is responsive to the data needs of managers and, ultimately,

the analytical process brought about for determining task intervals.

#### Recommendations for Future Research

The amount of significant information obtainable through the use of Bergman's method is somewhat dependent on the failure distribution exhibited by the item under study. This is to say that sensitivity analyses and cost and interval relationships are better demonstrated by Bergman's method if the item displays an increasing failure rate versus an exponential failure distribution or decreasing failure rate. Therefore, it is suggested that further research be conducted with Bergman's graphical technique using an item which exhibits an increasing failure rate.

Any attempt to demonstrate the practical application of theoretical optimal maintenance models should be made within the context of an existing maintenance program. Only under this condition can the impact of the test be truly appreciated by an audience of potential benefactors. The attempt was made in this study to demonstrate Bergman's method within the context of the RCMP. However, in future research made within this context, a different approach is suggested. It is recommended that the item used for study be selected and characterized in accordance with the basic steps necessary to integrate items into the RCMP. Specifically, the item (1) should be identified as a significant item, (2) should have failure consequences (cost of failure)

identified through FMEA, (3) should have a specific type of maintenance task assigned to it, and (4) should have a maintenance task interval assigned to it.

Complying with these basic steps will accomplish the following: (1) it will be known that the item for study qualifies for RCM analysis because of its value in terms of safety and/or economics, (2) specific failure consequences can be identified and subsequent attempts made to quantify them for purposes of the study, (3) it will be known which type of maintenance task (hard time, on-condition, condition monitoring) has been assigned to the item so that an appropriate methodology for selecting the interval can be used, and (4) it will be known what task interval (finite or infinite) has been assigned to the item so that the optimality of the interval can be evaluated based on the results of the study. In this way, conclusions can be made about the applicability of the method under study as well as about the appropriateness of current intervals.

APPENDICES

APPENDIX A  
FUNCTIONAL DESCRIPTION AND INSPECTION CHECKLIST--  
KT-73 IMU

The purpose of this booklet is to familiarise the reader with the basic modes of operation of the A7 DMU. This information should be of value in determining and isolating malfunctions of the system.

It is recognized that this is not an in-depth analysis of system operation. This information will be supplemented by on-the-job training and technical assistance from the Logistics Support Engineering staff.

### VERTICAL G.W.S.

The motor windings of the gyro have a / 0° and / 90° 20 volt peak to peak 480 cycle signal applied at all times after system turn on. This voltage is supplied by the Power Supply Board.

When the sequencing switch for Vertical G.W.S. is energized, a signal is applied to a relay driver on the Switching board. The relay K3 will couple an external supplied ground to the Vertical gyro which energizes the wheel.

### CAGE MODE (A7 IMU)

The Cage Mode is for the purpose of aligning four gimbals to the attitude of the fixed frame of the platform. The various loops are standard servo loops employing direct current torquers.

The Azimuth pitch and outer roll synchros employ 26 vac. 400 Hz excitation from an external source while the Inner Roll pickoff excitation is a system supplied 19.2 KHZ at 8 vrms. This signal is supplied by the Power Supply Board.

**OUTER ROLL LOOP** - The stators of the outer roll Synchro are mechanically connected to the fixed Gimbal; while the rotor winding is essentially part of the outer roll Gimbal. The displacement angle of the rotor winding to the stator winding (S3) is indicated by a voltage. When this voltage is at a null with the proper phasing the mechanical position of the gimbal is zero degrees. The 400 cycle error is routed to the switching board to the O.R. Amp. The O.R. Amp. demodulates the A.C. to D.C. The D.C. signal is then coupled thru the gimbal board. The D.C. then is applied to the O.R. torquer (B9) which rotates the O.R. gimbal until it is positioned to point at which error signal is nulled. The remaining stator outputs are used to display O.R. position on the Roll P.A.I. at initiation of vertical isolation.

**PITCH LOOP** - The pitch Loop is similar to the O.R. channel in as the stators of (B6) Pitch CX are physically mounted on the O.R. gimbal and the rotor is on the Pitch Gimbal. The 400 cycle error signal is taken off of S3 and coupled through the switching board via relays to the Gimbal board. At the Gimbal board the 400 cycle signal is applied to a demodulator circuit which also receives a 400 cycle reference signal. The output is a positive or negative D.C. voltage depending on the phase of the error signal. The  $\pm$  D.C. is applied to a Power Amp. and coupled out to the torquer (B7) which drives the gimbal until the error is nulled. The remaining stator outputs are used to display Pitch angle on the P.A.T. during Vertical Isolation.

Inner Roll Loop - The I.R. Loop differs from the O.R. and Pitch only in the excitation used on the pick off which is 6 vrms. 19.2 kha. The pick off winding is mounted on the pitch gimbal and the rotor is positioned by the I.R. gimbal itself. The error signal from B4 is routed through the switching board and sent to the Gimbal board. The signal is then applied to demodulator which has a fixed reference signal of 19.2 kha. The  $\pm$  D.C. level is then amplified by the Power Amp. and applied to the I.R. torquer B5 which drives the I.R. gimbal until the error signal is nulled.

Asimuth Loop - The Asimuth Loop differs from the previously described loops in as it uses an external reference for its positioning. The Asimuth CX is positioned so that when the rotor and the stator (S1) are parallel to the X Axis of the frame of reference the output represent Zero degrees. The error signal from the stators of B2 is routed out of the IMI and applied to a synchronous transformer. In the test equipment the rotor of the C.T. is mechanically positioned to the desired Asimuth angle. The stator outputs represents this angle and is applied to the transformer. The output of the transformer is the difference of the two inputs. The error signal is then amplified and applied to the Asimuth channel on the Gimbal board. There the signal is demodulated and amplified. The  $\pm$  D.C. is applied to the Asimuth torquer B3. The Asimuth gimbal is driving until the error signal out of the test equipment is nulled. The stator outputs of B2 are also used to drive the Asimuth PAI.

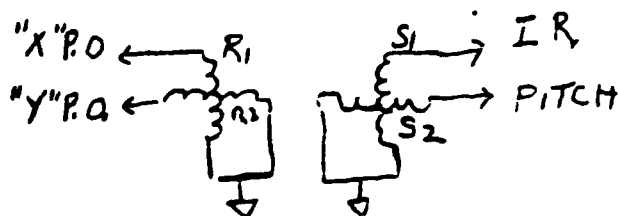
The various relays on the switching and Gimbal boards which are used for signal routing during the Cage Mode are energized by logic circuits on the switching board. The logic circuits are initiated by the sequencing switches on the test equipment.

### VERTICAL ISOLATION

In this mode of operation there are actually two phases. The first being Low Gain and the second, Normal Gain. The only difference in the two phases is the input resistance to the demodulators in the Inner Roll and Pitch channels. These resistors are large during Low Gain and smaller during Normal Gain.

The purpose of Vertical Isolation is to cage the Inner Roll, Pitch and Outer Roll gimbals to the pick offs of the Vertical Gyro rather than to the synchros as in the Cage Mode. The circuit operation is as follows:

The outputs of the Vertical Gyro referred to as "X" axis pick off and "Y" axis pick off are amplified in the Gyro electronics board and applied to the rotor windings of the coordinate resolver (B1). The rotor of B1 is mechanically positioned at the function of the Azimuth gimbal. The stators position is fixed due to the fact that they are physically attached to the Inner Roll Cap in which the cluster is housed. The rotor windings R1 and R2 and stator windings S1 and S2 are displaced from each other by 90 degrees. Refer to the figure below.



When the Azimuth is positioned to zero degrees and the Platform is aligned along the X axis frame of reference the rotor R1 and the stator S1 are both aligned to zero degrees. At this time the "X" pick off is applied to R1 and induced into the S2 winding. If the Azimuth or the Platform is repositioned to an angle of 90 or 270 degrees the voltage applied to R1 would be induced in the S2 winding and any voltage on R2 would be coupled to S1.

The signal representing "X" axis pick off which is applied to R1 and induced into S1 is applied to the Inner Roll channel on the Gimbal board. The signal is demodulated, amplified and applied to the Inner Roll torquer.

At this time, the Outer Roll gimbal, which was caged to its own synchro output, is caged to the output of the Inner Roll pick off. The I.R. pick off signal is coupled to the Outer Roll Amp. on the Switching board. The reference input is switched from 400 HZ to 19.2 KHZ by circuits on the Switching board. The output from the O.R. Amp. is sent through the Gimbal board and applied to the Outer Roll torquer B9. The outputs of the O.R. CX (B8) are used to display position on the Roll P.A.I.

The "Y" pick off signal is applied to R2 of B1 coupled to S2 and applied to the Pitch channel on the Gimbal board. At this time the reference input to the demodulator is switched from 400 HZ to 19.2 KHZ by circuits on the Switching board. The signal is demodulated, amplified and applied to the Pitch torquer B7. The outputs of the Pitch CX (B6) are used to display position on the Pitch P.A.I.

The Azimuth loop remains as it was in Cage Mode. The various relays on the Gimbal and Switching boards are driven by inputs to the Switching board from the sequencing switches on the test console.

AZIMUTH G.W.S.

The operation of Azimuth G.W.S is identical to Vertical G.W.S. except that the switching of the ground is performed by relay KB.

See Vertical G.W.S. signal flow print.

### AXIMUTH ISOLATION

This mode consists of two phases of operation. The first being, caging of the Azimuth gimbal to the Z Axis pick off of the Azimuth gyro. The "Z" pick off is applied to the Gyro EI-electronics board where it is amplified to a useful output level and then is sent to the Azimuth channel of the Gimbal board. The signal is coupled through a 1 megohm resistor by the action of relay K10 and through the contacts of K6 to the demodulator stage. The reference input is switched during this mode of operation from 400 HZ to 19.2 KHZ by the Switching board. The D.C output is applied to the amplifier section and applied to the Azimuth torquer (B3).

The second phase consists of two separate actions; switching to high gain in the azimuth channel and the caging of the Redundant loop to its own pick off.

High gain switching of the Azimuth channel is accomplished by the energizing of relay K10. The contacts of K10 will insert a 30K ohm resistor in place of the 1 megohm resistor thus increasing gain of the stage.

The output of the Redundant axis of the Azimuth Gyro is amplified, demodulated and amplified again and applied to the redundant torquer. The circuit is completed by the action of relay K2 on the Switching board which places the other side of the torquer to ground.

### COURSE LEVEL

The purpose of this mode of operation is to level the double axis accelerometer so that the two axis are perpendicular to the gravity vector. Since both channels are effectively identical, only the "X" axis will be discussed.

Following the previously discussed modes of operations the accelerometers, particularly the double axis, will not be perfectly level to the earth and there will be an output representing this misalignment. The output signal which is 19.2 KHZ is amplified by pre-amps located on the D/A. The signal is then sent to the restoring amp. on the accelerometer Electronics board. The output is a  $\pm$  D.C. representing the amount of off level. The D.C. signal is applied through the torquer coil and routed to a junction point. Also tied to the junction point is a D.C. level which is used to null out the amount of error signal which is due to mass unbalance of the accelerometer. This voltage is supplied by the resistor network R32 and R33 on the Compensation Board.

The D.C. signal is applied to the Power Supply Board and through relay K2 to the "X" Coarse Level amp. The amplified signal is then sent to the Switching board. On this board the relay K10 serves a function of increasing or decreasing the gain of the signal. During Back-up level the 3.4K resistor is inserted into the circuit to lower the gain. In Coarse Level the relay is as above. The output of the Switching board is sent back to the Compensation board, through R18 and R19 and applied to the "Y" axis torquer of the Vertical Gyro. This signal will precess the gyro wheel causing an output on the "Y" pick off. The pick off signal is then amplified and applied to the rotor winding of the coordinate Resolver (S1). At this time if the Platform is aligned along the "X" axis and the heading is zero degrees, the signal will be coupled into the stator winding which feeds the Pitch channel of the Gimbal board. As the Pitch gimbal is rotated the output of the "X" axis accelerometer will diminish. The Pitch gimbal will continue to torque until the output of the accelerometer is nulled out.

The "Y" axis error signal will cause torque to be applied to the "X" axis of the Vertical Gyro whose output will cause the Inner Roll gimbal to be rotated until the error signal is nulled.

### ALIGN NORMAL

In this mode of operation the Platform is free to drift with Earth Rate. At this present position of Latitude the drift rate about the X axis is 11.519 DEG/HR. and the drift rate about the X-Z axis is 9.672 DEG/HR. This drift will appear as movement on the Roll and Azimuth API's respectively.

There are certain corrections in respect to the Gyroflex that are taken into consideration at this time. All gyros exhibit drift characteristics and there are two classifications of drift. The first is referred to as "random drift" and is not acceptable for use in an IMU. The second is "fixed drift". The rate of drift is measurable and can be compensated for.

There are two other characteristics of the Gyroflex to be accounted and corrected for. They are both due to the actual construction of the wheel assembly of the gyro and will not be discussed in detail.

Both the X and Y axis of the Vertical Gyro and the Z axis of the Azimuth will have in their pick-off signal a voltage which is due to "in phase" error, also referred to as Spring Rates. Located on the Compensation Board are Amplified/Demodulator stages and "select during test" resistors which are used to null out the "In phase" error.

The other type of error is referred to as quadrature. Due to the "torque about - precess about" principle of gyros, this signal is applied to the axis 90 degrees displaced from where the error is detected. In other words, if the quadrature error is taken off the X axis pick-off it is applied to the Y axis torquer.

The fixed drift mentioned previously is compensated by applying a voltage to the X, Y and Z torquers, which will cause movement that is equal but opposite the drift, therefore, eliminating the affect of drift. This voltage is inserted into the circuit by R10, R11 and R12. The pots are also referred to as Restraints.

### ALIGN NORMAL (FAST SLAVE)

In fast slave mode the Azimuth, Pitch and Roll gimbal position is determined by the angular displacement of their respective PAI's. As the PAI position is changed a signal is applied to the proper gyro torquer causing the gimbal to be repositioned.

The signal flow for Fast Slave is as follows:

AZIMUTH - A demodulated signal representing Azimuth PAI position is coupled across the contacts of relay K15 on the Switching Board and is applied through resistors R22 and R23 on the Compensation Board. This D.C. signal is applied to the Z torquer. The other side of the torquer is tied to ground via the Switching Board from an external source. The resultant Z pick off is amplified in the Gyro Electronics Board and applied to the Azimuth channel of the Gimbal Board. The output of the Gimbal Board is applied to the Azimuth Torquer which causes the Azimuth CS output to change. When the Azimuth CX position output is equal to the PAI's position the error signal applied to the Z torquer drops to zero and the Cluster stops driving.

The operation of the Pitch and Roll Gimbals during Fast Slave is identical except the error signals are applied directly from the PAI's to the X and Y gyro torquers.

### ALIGN NORMAL (SLEW)

This mode of operation is identical to Fast Slave except the Azimuth, Pitch and Roll Gimbals are not repositioned by an error signal from the API's but rather by a  $\pm 15$  vdc signal from the Switching Board.

The selection of which Gimbal is slewed and in what direction is controlled by switches on the test equipment. Since the method of slewing all three of the Gimbals are somewhat ~~int~~ identical only the Pitch will be explained:

When Y Slew is selected relay K14 is de-energized by the signal applied to Z20 on the Switching Board. This ties the contacts of K14 to the Contacts of K12. Depending upon if K12 is energized or not a  $\pm 15$  vdc signal is applied to the Y torquer via the Compensation Board. The Y pick off signal is amplified and applied to the coordinate resolver and sent to the Pitch channel on the Gimbal board. The signal is applied to the Pitch Torquer Relay K12 determines direction of Slew.

The Azimuth Slew differs from Pitch and Roll to the extent that the Z torquer has a  $\pm 15$  vdc on one side and a  $- 15$  vdc on the other. These polarities are reversed by the action of K9 when actuated by the polarity switch on the T/E.

### DIGITAL LEVEL

This is the mode of operation where the system is refined. That is to say that we want to perfectly level the system in respect to the earth's surface and insure that the system is pointed exactly north.

This is accomplished in the following manner. The X, Y and Z accelerometer signals are applied to the CAPRI Board where they are integrated into X, Y and Z velocity signals. These signals are displayed on the CAPRI counters. The X and Y CAPRI signals are also applied through the Digital Level Control Module to the Gyro Control Module. The X CAPRI signal is converted to pulses and is applied as Y Gyro pulses to the Switching Board. The Switching Board circuitry changes the one signal into two signals 180 apart. The two signals representing Y Gyro are applied to a push-pull circuit on the Gyro Electronics Board and the Y Bias torquer. This signal will null out any off level condition of the X accelerometer.

The X Gyro circuitry is identical to the Y Gyro except for the amount of pulses that the X Gyro puts out. As discussed previously, the X axis of the Vertical Gyro if not corrected would appear to drift with Earth's Rate. In Digital Level the output of the Y accelerometer is due to the Earth's Rate on the X axis Gyro. The false acceleration signal is integrated in the CAPRI Board and converted to pulses to be applied to the X bias torquer. The amount of pulses required to keep the Y axis of the D/A accelerometer perfectly level with the Earth's surface is the Earth's Rate correction signal for the X axis Gyro.

The Z Gyro circuit is used to null out the effect of Earth's Rate about the Z axis. To supply the correct signal for the Azimuth Gyro the output of the Azimuth CX is used. As the Z axis starts to drift, the Azimuth CX output changes to indicate this apparent precession. The signal is applied to the "Z" VCO Module where the 400 cps signal is converted into digital pulses. This signal is applied through the Test Equipment to the Z Gyro circuitry on the Switching Board and finally to the Z Bias torquer. The torquing signal is used to drive the Z axis of the Azimuth Gyro in a direction which is equal but opposite the drift rate..

ROLL FUSE NORTH

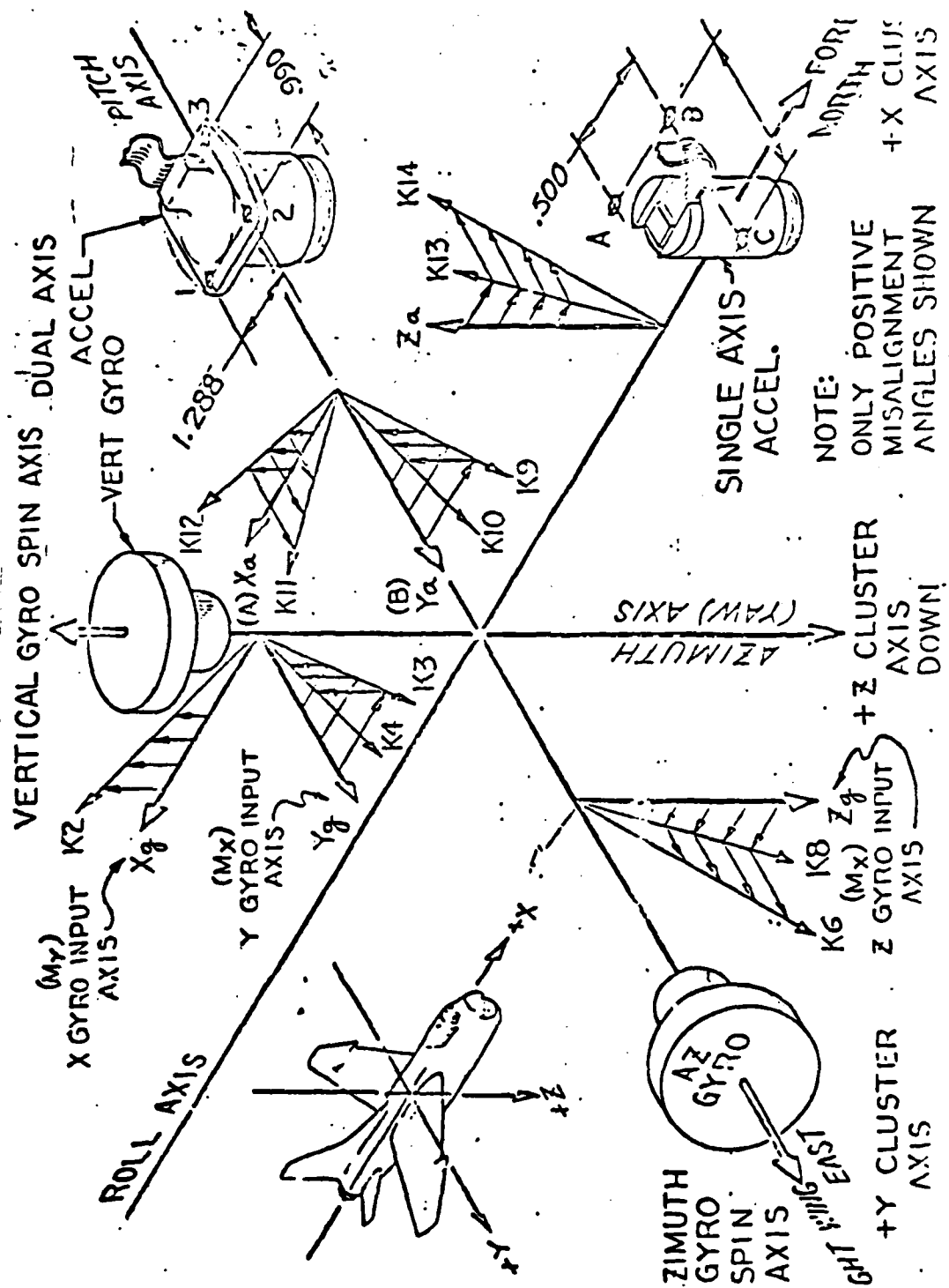
AZIMUTH DOWN

OUTER GYRO

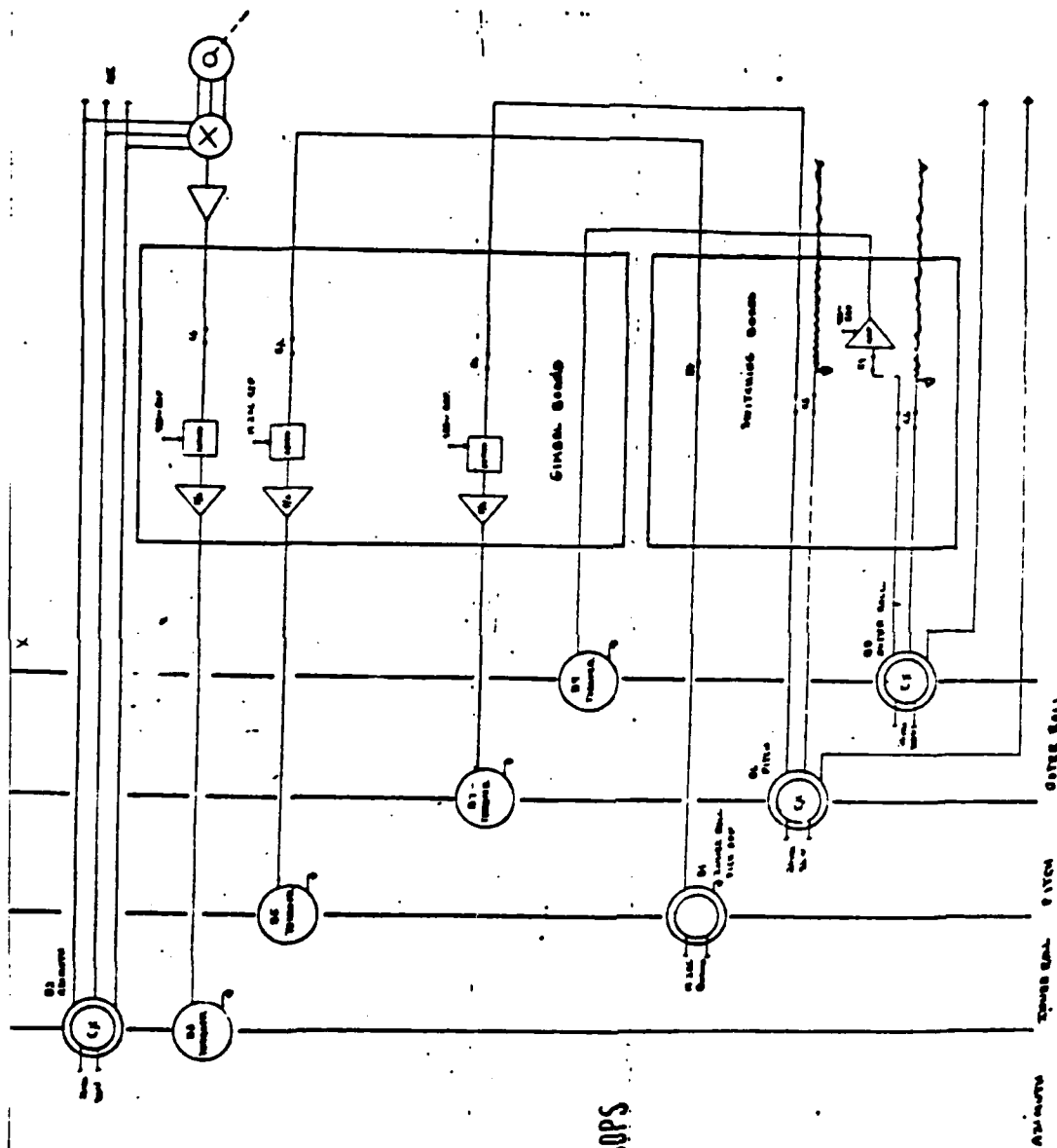
INNER GYRO

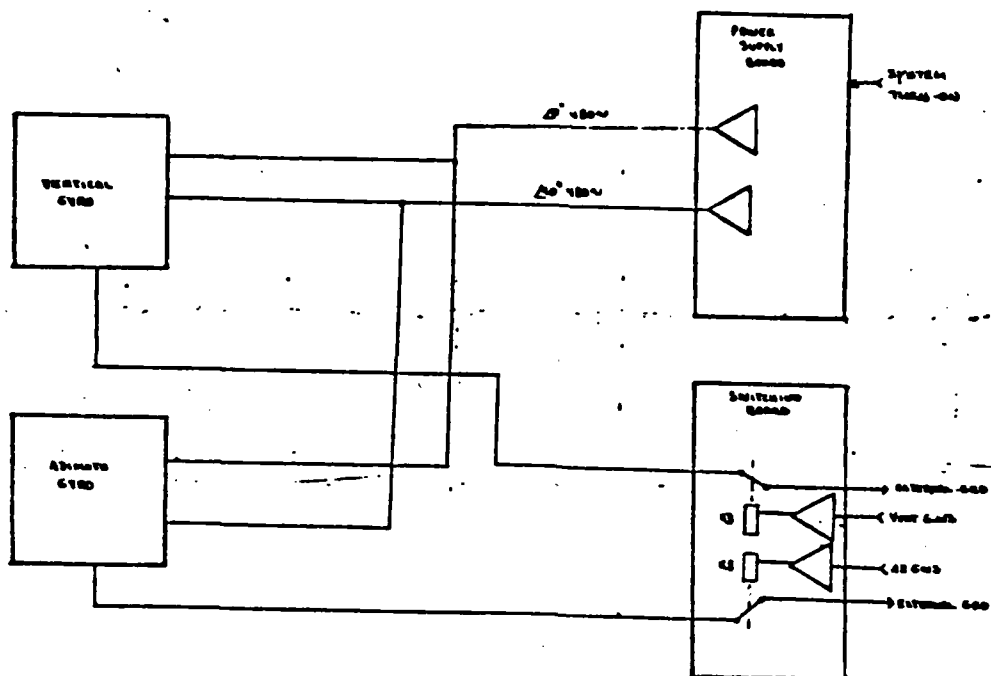
A1 - Two Axis Accelerometer (X, Y)  
 A2 - Six Axis Accelerometer (VERT)  
 CX - Synchronous Transmitter  
 CR - Coordinate Resolver  
 MP1 - Vertical Gyro (X, Y)  
 MP2 - Azimuth Gyro (Z, RED)  
 PO - Inner Roll Pickoff  
 T - Gimbal Torquer

A1-Two Axis Accelerometer (X, Y)  
 A2-Single Axis Accelerometer (VERT)  
 CX-Stereo Transmitter  
 CR-Correlate Resolver  
 MP1-Critical Gyro (X, Y)  
 MP2-Azimuth Gyro (Z, RED)  
 PO-Inner Roll Pickoff  
 T-Gimbal Torquer



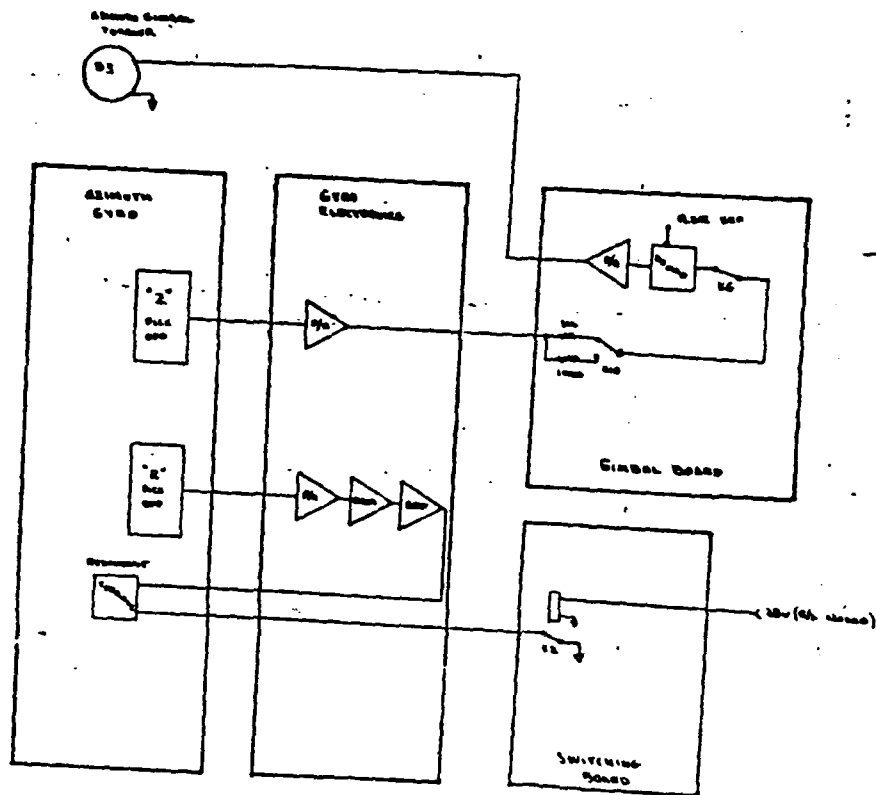
**SDOT CMVY**



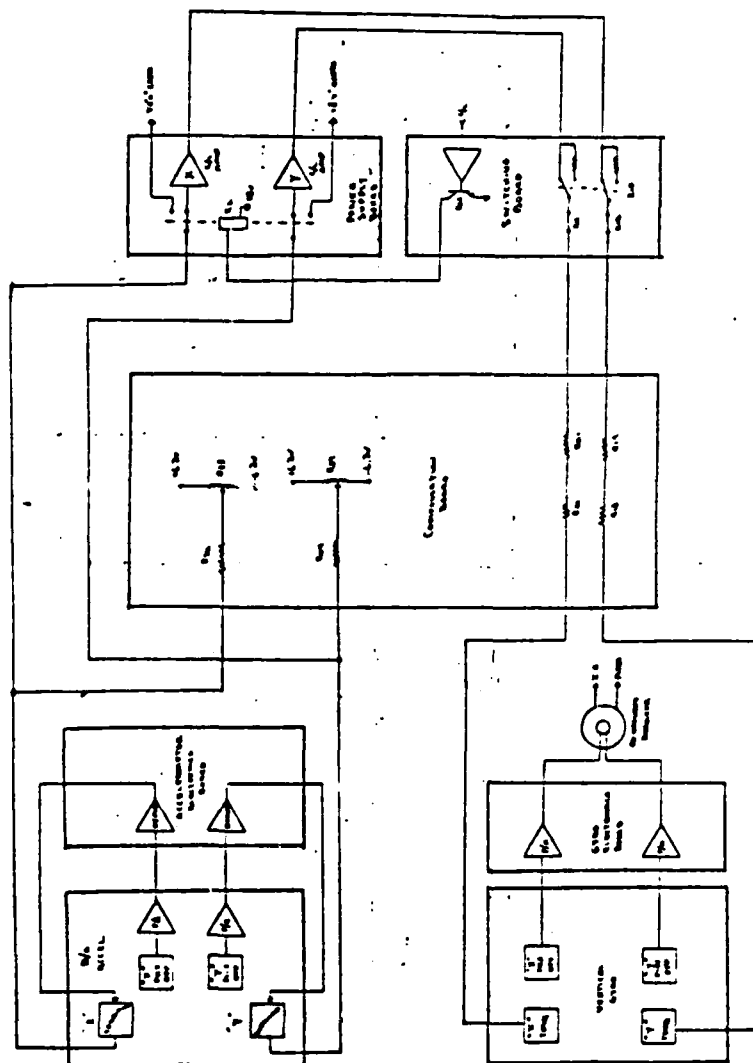


— VERTICAL GWS  
 — AZIMUTH GWS

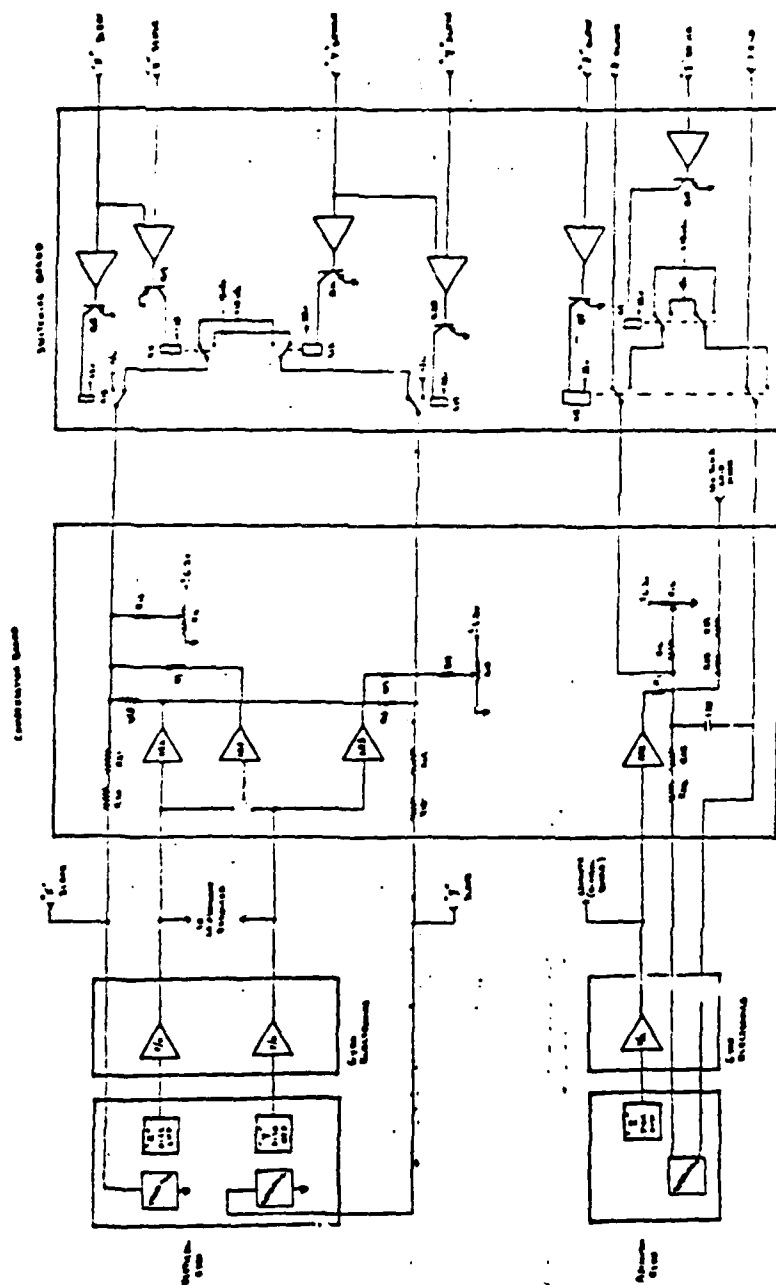




AZIMUTH ISOLATION



COARSE & BACK-UP LEVEL



ALIGN NORMAL  
SLEW & SIAVE



# VIEW OF A7 PLATFORM

P1, P10, J5, J6 CONNECTORS  
WITH CORRESPONDING PIN LOCATIONS



VIEW OF P1 CONNECTOR  
LOOKING TOWARDS  
COMPENSATION BOARD



VIEW OF J5 CONNECTOR  
LOOKING AT IMU HOUSING

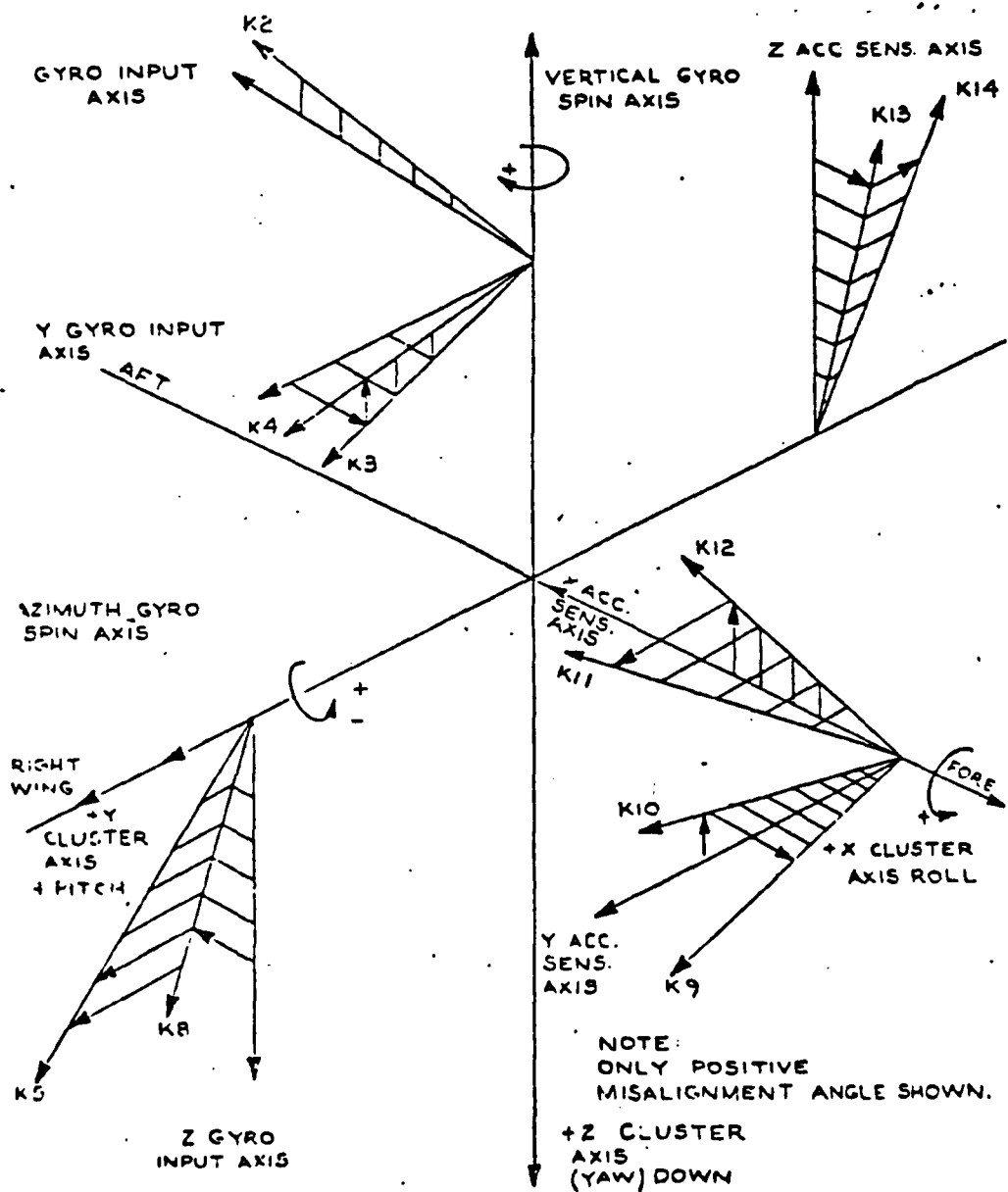


VIEW OF J6 CONNECTOR  
LOOKING AT IMU HOUSING

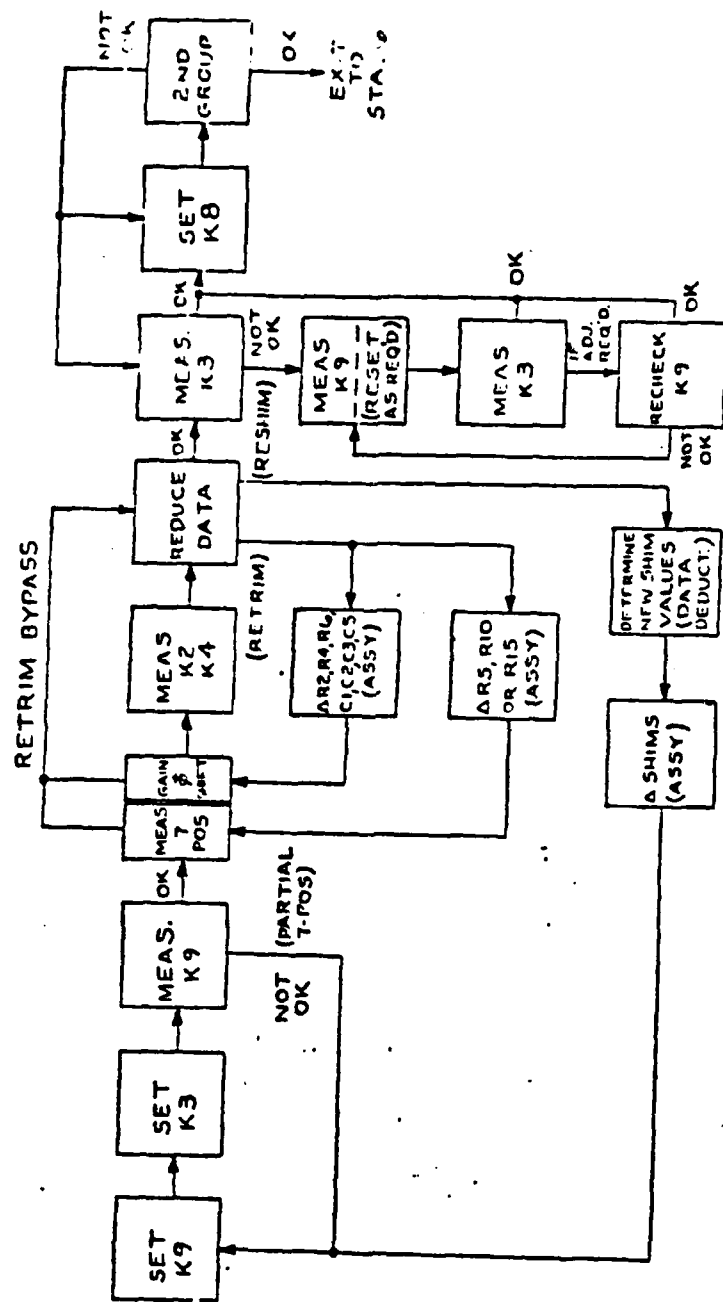


VIEW OF P10 CONNECTOR  
LOOKING TOWARDS COMPENSATION  
BOARD

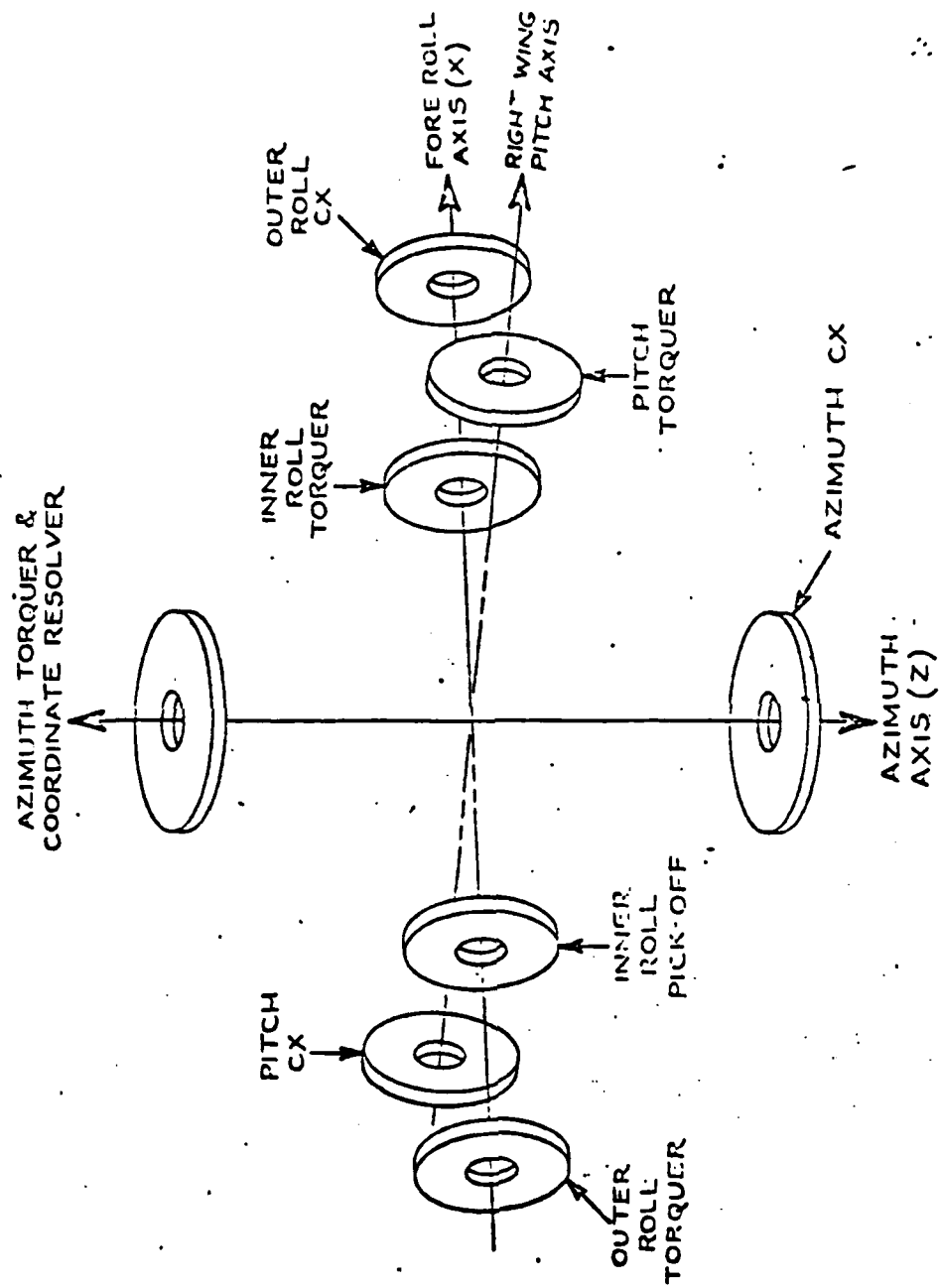
# PLATFORM MISALIGNMENT ANGLE DEFINITION



# SEQUENCE OF ALIGNMENT - A-7 CLUSTER



# GIMBAL COMPONENT & AXES ORIENTATION



IDENT NO. 80378

VOUGHT AERONAUTICS COMPANY  
LTV AEROSPACE CORPORATION  
P.O. BOX 9907 - DALLAS TEXAS 75222

No. 206-16-98e

Page 106

## ENGINEERING DEPARTMENT SPECIFICATION

TABLE XIII  
AUTOMATIC IMS TESTING FAIL NUMBERS

| BASIC TEST | FAIL NO. |     | INDICATED FAULT                                                                                |
|------------|----------|-----|------------------------------------------------------------------------------------------------|
|            | PRI*     | SEC |                                                                                                |
| A          | 1        |     | IMS failed and/or IMS System ready not indicated                                               |
| B          | 2        |     | IMS ground align mode not indicated                                                            |
| C          | 5        |     | IMS self contained analog level incorrect                                                      |
| D          | 6        |     | IMS self contained hdg loop initialization incorrect (Mag Var difference of 10° not indicated) |
| E          |          |     | Accelerometer X and Y null bias & vertical accel. 1"G" bias not within prescribed limits:      |
|            | 7        |     | X accel/CAPRI high gain null bias out of tolerance                                             |
|            | 8        |     | Y accel/CAPRI high gain null bias out of tolerance                                             |
|            | 9        |     | X accel/CAPRI low gain null bias out of tolerance                                              |
|            | 10       |     | Y accel/CAPRI low gain null bias out of tolerance                                              |
|            | 11       |     | Z accel/CAPRI 1"G" bias out of tolerance                                                       |
|            | 27       |     | X and/or Y accel/CAPRI low gain output saturated                                               |
| F          |          |     | Continuous platform slew condition:                                                            |
|            | 12       |     | Continuous platform slew in X and/or Y axes                                                    |
|            | 13       |     | Continuous platform slew in azimuth axis                                                       |
| G          | 17       |     | IMS not under computer control:                                                                |
|            |          | 14  | No response to positive X & Y slew commands (X & Y accel measurements)                         |
|            |          | 15  | No response to positive Az slew commands (Az synchro measurement)                              |
|            |          | 16  | No response to positive Az slew commands (mag hdg synchro measurements)                        |
|            | 3        |     | Y slew sense malfunction (slews in one direction only)                                         |
|            | 4        |     | X slew sense malfunction (slews in one direction only)                                         |
|            | 69       |     | Continuous computer control                                                                    |
| H          |          |     | Azimuth slew function malfunctions and/or hdg synchro signals invalid:                         |
|            |          | 18  | Positive Az slew malfunction                                                                   |
|            |          | 19  | No response to negative Az slew commands (Az synchro measurement)                              |
|            |          | 20  | No response to negative Az slew commands (mag hdg synchro measurement)                         |
|            |          | 21  | Negative Az slew malfunction                                                                   |
|            | 22       |     | Platform Az synchro invalid                                                                    |

IDENT NO. 80378

VOUGHT AERONAUTICS COMPANY  
LTV AEROSPACE CORPORATION  
P.O. BOX 1907 - DALLAS TEXAS 75222

No. 206-16-98e

Page 107

## ENGINEERING DEPARTMENT SPECIFICATION

TABLE XIII (Continued)

| BASIC<br>TEST | FAIL NO. |     | INDICATED FAULT                                                                                      |
|---------------|----------|-----|------------------------------------------------------------------------------------------------------|
|               | PRI*     | SEC |                                                                                                      |
|               | 23       |     | Mag hdg synchro invalid                                                                              |
|               | 24       |     | No Az slew function                                                                                  |
|               | 25       |     | Azimuth slew sense malfunction (slew in one direction only)                                          |
| I             | 26       |     | Malfunction of auto reversion to and/or operation of backup grid mode (plat hdg • mag hdg)           |
| J             | 31       |     | Fast magnetic heading update malfunction:                                                            |
|               |          | 24  | Fast mag hdg update response rates not indicated (plat Az synchro measurement)                       |
|               |          | 40  | Fast mag hdg update response rates not indicated (mag hdg synchro measurement)                       |
| K             | 34       |     | Malfunction of auto reversion to and/or operation of backup mag slave mode (land only):              |
|               |          | 32  | Response rates not proper for mag slave mode (plat Az synchro measurement)                           |
|               |          | 33  | Response rates not proper for mag slave mode (mag hdg synchro measurement)                           |
| L             |          |     | Malfunction of X & Y slew functions and/or accel/CAPRI signals and/or roll & pitch attitude signals: |
|               |          | 45  | Improper response to + X slew commands (roll synchro measurement)                                    |
|               |          | 46  | Improper response to + Y slew commands (pitch synchro measurement)                                   |
|               |          | 47  | Improper response to + Y slew commands (X low gain accelerometer measurement)                        |
|               |          | 38  | Improper response to + X slew commands (Y low gain accelerometer measurement)                        |
|               |          | 39  | Improper response to + Y slew commands (X high gain accelerometer measurement)                       |
|               |          | 40  | Improper response to + X slew commands (Y high gain accelerometer measurement)                       |
|               |          | 41  | Positive X slew malfunction                                                                          |
|               |          | 42  | Positive Y slew malfunction                                                                          |
|               |          | 43  | Improper response to -X slew commands (roll synchro measurement)                                     |
|               |          | 44  | Improper response to -Y slew commands (pitch synchro measurement)                                    |
|               |          | 45  | Improper response to -Y slew commands (X low gain accelerometer measurement)                         |
|               |          | 46  | Improper response to -X slew commands (Y low gain accelerometer measurement)                         |
|               |          | 47  | Improper response to -Y slew commands (X high gain accelerometer measurement)                        |

IDENT NO. 80378

VOUGHT AERONAUTICS COMPANY  
LTV AEROSPACE CORPORATION  
P.O. BOX 9907 DALLAS TEXAS 75222

No. 206-16-98e

Page 108

ENGINEERING DEPARTMENT SPECIFICATION

TABLE XIII (Continued)

| BASIC<br>TEST | FAIL NO. |     | INDICATED FAULT                                                               |
|---------------|----------|-----|-------------------------------------------------------------------------------|
|               | PRI*     | SEC |                                                                               |
|               |          | 48  | Improper response to -X slew commands (Y high gain accelerometer measurement) |
|               |          | 49  | Negative X slew malfunction                                                   |
|               |          | 50  | Negative Y slew malfunction                                                   |
|               | 51       |     | Positive Y accel/CAPRI malfunction                                            |
|               | 52       |     | Negative Y accel/CAPRI malfunction                                            |
|               | 53       |     | Y accel/CAPRI malfunction                                                     |
|               | 54       |     | Negative X accel/CAPRI malfunction                                            |
|               | 55       |     | Positive X accel/CAPRI malfunction                                            |
|               | 56       |     | X accel/CAPRI malfunction                                                     |
|               | 57       |     | Accelerometer scale factor change function malfunction                        |
|               | 58       |     | Roll synchro invalid                                                          |
|               | 59       |     | Pitch synchro invalid                                                         |
|               | 60       |     | No X slew response                                                            |
|               | 61       |     | No Y slew response                                                            |
| M             |          |     | Gyro digital torquing function malfunctions:                                  |
|               | 62       |     | GYPTO clock line malfunction (open/short)                                     |
|               | 63       |     | Positive Y torque malfunction                                                 |
|               | 64       |     | Negative X torque malfunction                                                 |
|               | 65       |     | Negative Y torque malfunction                                                 |
|               | 66       |     | Positive X torque malfunction                                                 |
|               | 67       |     | Positive Az torque malfunction                                                |
|               | 68       |     | Negative Az torque malfunction                                                |
| N             | 70       |     | Vertical accel/CAPRI malfunction                                              |

\*Primary fail numbers underlined are critical failures which discontinue testing.

APPENDIX B

G078C REPORTS - "AIRCRAFT LISTING"  
AND "FIELD OPERATING HOURS (FOH) BY CYCLE - QUARTERLY"

Explanation. The appendix contains extracts from the "Aircraft Listing" and "Field Operating Hours (FOH) by Cycle - Quarterly" G078C reports. The listings are prepared by unit serial number (second column) and cycle number (first column). Failure data for units in the sample were taken by serial number for Cycle 1 (underlined entries). Actual times to failure (hours) were taken from the column labeled "ETI IN," the elapsed time indicator reading.

PREPARED BY MAY 20

MASTER LIST 81-73 K-55-H-U-R-1 (AF) PREPARED MAY 1982

CAN G 118

| PL<br>CY | PLAT-EN | UAF<br>RELU | HAS<br>L<br>K | (71)<br>TH | DTI<br>OUT | HRS  | SHIPU<br>AIL | W-U<br>M | 350<br>M | 612<br>M | 612<br>M   | 1AG<br>T   |            |
|----------|---------|-------------|---------------|------------|------------|------|--------------|----------|----------|----------|------------|------------|------------|
| 01       | AF00000 | 76117       | MIL           | 0325       | 0077       | 0000 | 76120        | MIL      | 246      | A        | 1500000119 |            |            |
| 02       | AF00001 | 71315       | MIL           | 0399       | 0177       | 0000 | 72033        | MIL      |          |          |            |            |            |
| 03       | AF00002 | 72002       | MIL           | 0224       | 0200       | 0027 | 72077        | MIL      | 799      | B        | 1104508696 |            |            |
| 04       | AF00003 | 72109       | MIL           | 0271       | 0342       | 0011 | 72129        | LAC      |          |          |            |            |            |
| 05       | AF00004 | 72200       | MIL           | 0300       | 0423       | 0044 | 72292        | MIL      |          |          |            |            |            |
| 06       | AF00005 | 72327       | MIL           | 0475       | 0502       | 0022 | 72333        | MIL      |          |          |            |            |            |
| 07       | AF00006 | 72410       | MIL           | 1100       | 1139       | 0599 | 72420        | MIL      | 037      | 086      | F          | 1701439773 |            |
| 08       | AF00007 | 72410       | MIL           | 1352       | 1393       | 0213 | 74142        | MIL      | 051      | G        |            |            |            |
| 09       | AF00008 | 76245       | MIL           | 2471       | 2514       | 1079 | 77009        | EOL      | 654      | FUA      | F          | 2150431230 |            |
| 10       | AF00009 | 76003       | MIL           | 2770       | 2832       | 0264 | 78025        |          | CAO      | F        | 0999999999 |            |            |
| 11       | AF00010 | 72027       | MIL           | 0229       | 0313       | 0000 | 72108        | MIL      | 799      | B        | 0184921342 |            |            |
| 12       | AF00011 | 72341       | MIL           | 0490       | 0534       | 0103 | 73005        | EOL      |          |          |            |            |            |
| 13       | AF00012 | 73072       | EOL           | 0500       | 0603       | 0009 | 73121        | KUR      | 824      | 615      | F          | 0611253259 |            |
| 14       | AF00013 | 74023       | MIL           | 0705       | 1797       | 0162 | 74330        | ENG      | 242      | 00N      | F          | 0172824459 |            |
| 15       | AF00014 | 75304       | ENG           | 2155       | 2195       | 0350 | 75315        | MIL      | 0        | 255      | 677        | A          | 2621251095 |
| 16       | AF00015 | 72350       | MIL           | 0515       | 0648       | 0000 | 73064        | ENG      |          |          |            |            |            |
| 17       | AF00016 | 74207       | ENG           | 1307       | 1007       | 0439 | 74208        | ENG      | 656      | 246      | A          | 2400463026 |            |
| 18       | AF00017 | 76243       | ENG           | 1759       | 1802       | 0672 | 77014        | MIL      | 0        | 657      | FBS        | F          | 3351306583 |
| 19       | AF00018 | 77110       | MIL           | 1037       | 1077       | 0035 | 77130        | PIT      | 0        | 653      | CAN        | G          | 0750201756 |
| 20       | AF00019 | 71320       | MIL           | 0127       | 0182       | 0000 | 71364        | MIL      |          |          |            |            |            |
| 21       | AF00020 | 72112       | MIL           | 0184       | 0295       | 0002 | 72156        | MIL      |          |          |            |            |            |
| 22       | AF00021 | 73020       | MIL           | 0540       | 0595       | 0253 | 73001        | ENG      | 242      | 127      | G          | 0052814406 |            |

FOR 1114007

PAGE 2



CAN # 1.

R-5-P-0-R-I  
(AF) PREPARED MAY 1982

PREPARED 22 MAY 20

NAJLX LIST 21-3

| PL | PLAT-SN | DATE  | RECU | PLS  | LT1  | DTT  | HR5   | SHIFU | PLS | W-U | 350 | 612 | 612 | TAG        |
|----|---------|-------|------|------|------|------|-------|-------|-----|-----|-----|-----|-----|------------|
| LI |         |       |      | R    | IN   | OUT  |       | ATL   | IP  | H   | H   | A   | T   |            |
| 04 | AF00000 | 76347 | 110  | 1709 | 1773 | 0223 | 79079 |       |     |     |     |     |     |            |
| 01 | AF00000 | 72311 | 0000 | 0000 | 0000 | 0000 | 0000  |       |     |     |     |     |     | 2800455021 |
| 01 | AF00000 | 72353 | MIL  | 0927 | 0513 | 0000 | 73031 | KJK   |     |     |     |     |     |            |
| 02 | AF00000 | 73000 | KJK  | 0534 | 0550 | 0021 | 73134 | U4H   |     |     | 255 | 086 | K   | 0742816877 |
| 03 | AF00000 | 73172 | UNK  | 0572 | 0612 | 0014 | 73214 | KUR   |     |     | 654 | 086 | A   | 1570597811 |
| 04 | AF00000 | 73234 | KJK  | 0624 | 0671 | 0012 | 73292 | MIL   |     |     | 242 | 246 | A   | 2322988935 |
| 05 | AF00000 | 74050 | MIL  | 0706 | 0739 | 0035 | 74063 | TIN   |     |     | UNK | UNK | F   | 0242822885 |
| 06 | AF00000 | 74212 | KJK  | 0740 | 0773 | 0001 | 74241 | MIL   |     |     | UNK | 086 | K   | 0004234631 |
| 07 | AF00000 | 75199 | KJK  | 1052 | 1092 | 0279 | 75209 | KIK   | U   |     | 652 | 799 | B   | 1622354475 |
| 08 | AF00000 | 75352 | KIK  | 1233 | 1265 | 0141 | 76008 | KIC   |     |     | UNK | 799 | U   | 3360000000 |
| 09 | AF00000 | 76334 | KIC  | 1743 | 1790 | 0458 | 76363 | PIT   | U   |     | 654 | 246 | K   | 3187500372 |
| 10 | AF00000 | 77103 | PIT  | 1717 | 1747 | 0121 | 77160 | MIL   | U   |     | 901 | 086 | K   | 1474025650 |
| 11 | AF00000 | 78103 |      | 2146 | 2203 | 0159 | 78289 |       |     |     |     |     |     |            |
| 01 | AF00000 | 73000 | UNK  | 0528 | 0610 | 0000 | 73127 | L46   |     |     | 654 | 084 | F   | 0470581679 |
| 02 | AF00000 | 75239 | ENG  | 1308 | 1430 | 0778 | 75275 | MIL   | U   |     | 657 | 080 | F   | 2300510283 |
| 03 | AF00000 | 76083 | MIL  | 1509 | 1631 | 0159 | 76091 | MIL   | U   |     | 657 | 246 | A   | 0752801239 |
| 04 | AF00000 | 76123 | MIL  | 1540 | 1609 | 0009 | 76181 | LUL   | U   |     | 374 | 246 | A   | 1261007202 |
| 05 | AF00000 | 76223 | LUL  | 1746 | 1794 | 0057 | 76254 | DES   | U   |     | 958 | 799 | B   | 2097129664 |
| 06 | AF00000 | 76122 | JLS  | 1057 |      | 0063 | 78136 |       |     |     |     |     |     |            |
| 01 | AF00010 | 73204 | MIL  | 0552 | 0936 | 0300 | 74063 | TIN   |     |     | 037 | 051 | F   | 2772523224 |
| 02 | AF00010 | 74204 | 030  | 1045 | 1081 | 0109 | 74227 | MIL   |     |     | UNK | 799 | B   | 0004221692 |
| 03 | AF00010 | 74297 | MIL  | 1099 | 1103 | 0010 | 74310 | MIL   |     |     | 255 | 799 | B   | 2912020422 |

PLR 0114307

PAGE

4



PHILADELPHIA 06 MAY 20

MAJILH LIT A-7-5

К-Е-Р-У-К-1  
(4F) РКЕРАКЕУ МАУ 1962

LAN 11

| PLAT-SN | DATE     | BAS   | EFF  | TIME | HRS  | CHRGD | BAS | W-D | 350 | 612 | 612 | TAG        |
|---------|----------|-------|------|------|------|-------|-----|-----|-----|-----|-----|------------|
|         | KLCD     | LE    | LT   | UOT  |      | ATE   | LSH |     | H   | H   | A   |            |
| 01      | AF000106 | 12215 | 0107 | 0137 | 0000 | 72225 | MIL |     | 799 |     |     | 2091599109 |
| 02      | AF000110 | 12333 | 0133 | 0232 | 0020 | 1300E | KUR |     | 242 |     |     | 3002804343 |
| 03      | AF000110 | 73002 | 0310 | 0421 | 0044 | 73141 | DMN |     | 031 | 246 | A   | 0422879672 |
| 04      | AF000110 | 73310 | 0470 | 0535 | 0057 | 73340 | KUR |     | 958 | 799 | B   | 2447000093 |
| 05      | AF000110 | 74004 | 0653 | 0709 | 0110 | 74109 | TIN |     |     | 051 | F   |            |
| 06      | AF000110 | 75070 | 0709 | 0829 | 0020 | 75110 | KIK | Y   | 799 | 246 | K   | 0722250955 |
| 07      | AF000110 | 75103 | 0347 | 0401 | 0010 | 75211 | TIN | U   | 290 | 799 | B   | 1260008278 |
| 08      | AF000020 | 73037 | 0438 | 0539 | 0000 | 73080 | ENG |     | 255 | 127 | F   | 0232814202 |
| 09      | AF000020 | 74244 | 1092 | 1152 | 0553 | 74209 | ENG |     | 255 | F8A | F   | 2080549006 |
| 10      | AF000020 | 75071 | 1190 | 1251 | 0038 | 75099 | MIL | U   | 052 | 799 | B   | 0590451263 |
| 11      | AF000020 | 75150 | 1208 | 1329 | 0037 | 75101 | LNG | U   | 057 | 246 | A   | 1342803951 |
| 12      | AF000020 | 75343 | 1402 | 1512 | 0133 | 76051 | ENG | U   | 054 | F8D | F   | 3301273222 |
| 13      | AF000020 | 76000 | 1524 | 1545 | 0012 | 76093 | MIL | U   | 054 | 799 | B   | 0761254052 |
| 14      | AF000020 | 76139 | 1504 | 1603 | 0019 | 76163 | MIL | U   | 057 | ADJ | G   | 1272852290 |
| 15      | AF000020 | 76189 | 1633 | 1675 | 0030 | 76219 | LCL | U   | UNK | 799 | B   | MU 350 1AC |
| 16      | AF000020 | 77002 | 1701 | 1824 | 0106 | 77082 | LCL | U   | 057 | 799 | B   | 0485118376 |
| 17      | AF000020 | 78010 | 2005 | 0027 | 0101 | 78044 | LCL | U   | 958 | 002 | F   | 0045067131 |
| 18      | AF000020 | 78152 | 0002 |      | 0035 | 78159 |     |     |     |     |     |            |
| 19      | AF000020 | 78320 | 0103 | 0210 | 0103 | 78332 |     |     |     |     |     |            |
| 20      | AF000021 | 73172 | 0492 | 0530 | 0000 | 73183 | KUR |     | 053 | 246 | K   | 1622810521 |
| 21      | AF000021 | 74102 | 0720 | 0777 | 0400 | 74192 | MIL |     | UNK | 799 | B   | 0004186704 |
| 22      | AF000021 | 76173 | 1050 | 1102 | 0001 | 76190 | MIL | U   | 037 | 799 | B   | 1254017329 |

PCN 1.114507

PAGE 6

CAN 6 1

MASTER LIST K1-73 (AF) PREPARED MAY 1982

PREPARED 02 MAY 20

| PL | PLAT-ON | DATE  | RECD | BAS | ELL  | ELL  | ELL  | HR   | SUPP  | BAS | W-D | H   | 350 | 612 | 612 | 196        |
|----|---------|-------|------|-----|------|------|------|------|-------|-----|-----|-----|-----|-----|-----|------------|
| LI |         |       |      | K   | IN   | OUT  | OUT  |      | ATE   | ESN | H   | H   | H   | H   | H   |            |
| 04 | AF00021 | 77259 |      | SUU | 2091 | 2169 | 0389 | 0389 | 77286 |     | D   | 943 | TSD | C   |     | 2322603106 |
| 01 | AF00022 | 74007 |      | KUK | 1009 | 1163 | 0000 | 0000 | 74006 |     |     | 242 | 051 | F   |     | 3480908406 |
| 02 | AF00022 | 74134 |      | KUK | 1253 | 1321 | 0070 | 0070 | 74133 |     |     | 242 | 799 | B   |     | 1170636983 |
| 03 | AF00022 | 75015 |      | KIK | 1412 | 1456 | 0091 | 0091 | 75023 |     |     | 654 | 799 | B   |     | 3401036144 |
| 04 | AF00022 | 76021 |      | KIK | 1824 | 1883 | 0368 | 0368 | 76061 |     | D   | 654 | LBA | F   |     | 3581026689 |
| 01 | AF00023 | 76036 |      | MCE | 1406 | 1467 |      |      | 76058 |     | D   | 253 | HSM | C   |     | NU JCN NR. |
| 02 | AF00023 | 76344 |      | KIK | 1714 | 1819 | 0247 | 0247 | 77061 |     | D   | 654 | C80 | F   |     | 3231027824 |
| 03 | AF00023 | 77157 |      | PIT | 1893 | 1930 | 0074 | 0074 | 77175 |     |     | UNK | 799 | B   |     | NU 350 TAG |
| 04 | AF00023 | 77276 |      | LIV | 1973 | 2021 | 0043 | 0043 | 77285 |     |     | UNK | 799 | B   |     | NU 350 TAG |
| 05 | AF00023 | 78333 |      | IN  | 2064 | 2108 | 0043 | 0043 | 79031 |     |     |     |     |     |     |            |
| 01 | AF00024 | 73319 |      | KUK | 1099 | 1141 | 0000 | 0000 | 73324 |     |     | UNK | ERA | F   |     | 0003327280 |
| 02 | AF00024 | 74094 |      | KUK | 1171 | 1230 | 0030 | 0030 | 74134 |     |     |     |     |     |     | 0052505064 |
| 03 | AF00024 | 74217 |      | KUK | 1242 | 1274 | 0012 | 0012 | 74252 |     |     | UNK | 086 | A   |     | 1220115983 |
| 04 | AF00024 | 75021 |      | KIC | 1339 | 1373 | 0065 | 0065 | 75045 |     |     | 607 | MBF | F   |     | 0027503814 |
| 05 | AF00024 | 76029 |      | ENG | 1539 | 1591 | 0106 | 0106 | 76041 |     | D   | 253 | ASU | C   |     | 0221308615 |
| 06 | AF00024 | 76097 |      | LGL | 1601 | 1636 | 0010 | 0010 | 76106 |     | Y   | 958 | 799 | B   |     | 0647126383 |
| 07 | AF00024 | 76245 |      | LGL | 1743 | 1786 | 0085 | 0085 | 76267 |     | D   | 656 | 799 | B   |     | 2336071157 |
| 08 | AF00024 | 76329 |      | MIL | 1810 | 1912 | 0024 | 0024 | 77016 |     | Y   | 799 | AAQ | C   |     | 2882003759 |
| 09 | AF00024 | 78005 |      |     | 1927 | 1973 | 0015 | 0015 | 78072 |     |     |     | UBD | F   |     | 0090000009 |
| 10 | AF00024 | 78200 |      |     | 2076 |      | 0103 | 0103 | 78220 |     |     |     |     |     |     |            |
| 11 | AF00024 | 78339 |      | LOC | 2252 | 2288 | 2252 | 2252 | 78346 |     |     |     |     |     |     |            |
| 01 | AF00025 | 74133 |      | UMH | 0326 | 0903 |      |      | 74162 |     |     | 958 | CUD | C   |     | 1190553032 |

PAGE 7

FILE 1114507

CAN 0 11.

PALPARLO 02 MAY 20

PLAT-34

02

03

04

05

06

07

08

09

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

26

27

28

29

30

31

32

33

34

35

36

37

38

39

40

41

42

43

44

45

46

47

48

49

50

51

52

53

54

55

56

57

58

59

60

61

62

63

64

65

66

67

68

69

70

71

72

73

74

75

76

77

78

79

80

81

82

83

84

85

86

87

88

89

90

91

92

93

94

95

96

97

98

99

100

101

102

103

104

105

106

107

108

109

110

111

112

113

114

115

116

117

118

119

120

121

122

123

124

125

126

127

128

129

130

131

132

133

134

135

136

137

138

139

140

141

142

143

144

145

146

147

148

149

150

151

152

153

154

155

156

157

158

159

160

161

162

163

164

165

166

167

168

169

170

171

172

173

174

175

176

177

178

179

180

181

182

183

184

185

186

187

188

189

190

191

192

193

194

195

196

197

198

199

200

201

202

203

204

205

206

207

208

209

210

211

212

213

214

215

216

217

218

219

220

221

222

223

224

225

226

227

228

229

230

231

232

233

234

235

236

237

238

239

240

241

242

243

244

245

246

247

248

249

250

251

252

253

254

255

256

257

258

259

260

261

262

263

264

265

266

267

268

269

270

271

272

273

274

275

276

277

278

279

280

281

282

283

284

285

286

287

288

289

290

291

292

293

294

295

296

297

298

299

300

301

302

303

304

305

306

307

308

309

310

311

312

313

314

315

316

317

318

319

320

321

322

323

324

325

326

327

328

329

330

331

332

333

334

335

336

337

338

339

340

341

342

343

344

345

346

347

348

349

350

351

352

353

354

355

356

357

358

359

360

361

362

363

364

365

366

367

368

369

370

371

372

373

374

375

376

CAN 11

MASTER LIST K1-73 K-E-P-D-K-J  
PREPARED MAY 1982

PREPARED 62 MAY 20

| AL | PLAT-SN | DAIL  | REC | EAS | ETI  | UUT  | HK5  | SHIPD | HAS | W-U | 350 | 612 | 612 | TAG        |
|----|---------|-------|-----|-----|------|------|------|-------|-----|-----|-----|-----|-----|------------|
| LY |         |       |     | E   | IN   |      |      | ATE   | FSH |     | H   | H   | A   |            |
| 09 | AF00020 | 77215 |     | 11N | 1794 | 1831 | 0044 | 77220 |     |     | UNK | 246 | A   | NU 350 TAG |
| 10 | AF00020 | 77200 |     | MCE | 1846 | 1870 | 0017 | 77301 |     | Y   | 290 | 780 | F   | 2351192312 |
| 01 | AF00020 | 73021 |     | KUR | 0417 | 0463 | 0000 | 73009 | NEL |     | 457 | 160 | G   | 3472043209 |
| 02 | AF00029 | 73204 |     | 11N | 0697 | 0737 | 0234 | 73319 | EGL |     | UNK | 246 | A   | 0003309362 |
| 03 | AF00029 | 74196 |     | EGL | 0745 | 0835 | 0008 | 74249 | DMN |     | 374 | YBM | F   | 1220115983 |
| 04 | AF00029 | 76267 |     | DMN | 1730 | 1783 | 0895 | 76301 | ENG | 0   | 958 | 799 | B   | 2576512783 |
| 01 | AF00030 | 72215 |     | MIL | 0103 | 0165 | 0000 | 72237 | ENG |     |     |     |     |            |
| 02 | AF00030 | 73096 |     | ENG | 0170 | 0195 | 0005 | 73136 | ENG |     | 255 | 799 | B   | 0682406056 |
| 03 | AF00030 | 74176 |     | ENG | 0649 | 0693 | 0454 | 74212 | KUR |     | UNK | 051 | G   | 0004200731 |
| 04 | AF00030 | 76512 |     | ENG | 1391 | 1474 | 1198 | 76512 | ENG |     | 354 | 246 | A   | 3550402191 |
| 01 | AF00031 | 73016 |     | UNK | 0334 | 0364 | 0000 | 73035 | ENG |     | UNK | FBA | F   | NU 350 TAG |
| 02 | AF00032 | 77144 |     | MIL | 1950 | 2018 | 1592 | 77166 | MIL |     |     |     |     |            |
| 01 | AF00033 | 72257 |     | 11N | 0109 | 0143 | 0000 | 72272 | MIL |     |     |     |     |            |
| 02 | AF00033 | 72348 |     | DMN | 0158 | 0202 | 0615 | 73081 | ENG |     |     | 246 | A   | 3140352422 |
| 03 | AF00033 | 73211 |     | ENG | 0327 | 0382 | 0125 | 74077 | KUR |     | 255 | FBA | F   | 1950467524 |
| 01 | AF00034 | 72319 |     | MIL | 0123 | 0184 | 0000 | 72333 | KUR |     |     | 799 | B   | 2494018910 |
| 02 | AF00034 | 73016 |     | KUR | 0207 | 0232 | 0023 | 73034 | KUR |     | 901 | 799 | B   | 3492996734 |
| 03 | AF00034 | 73360 |     | KUR | 0701 | 0740 | 0469 | 74024 | 11N |     | 242 | 246 | A   | 3320910102 |
| 04 | AF00034 | 74067 |     | KIN | 0742 | 0797 | 0002 | 74064 | KUR |     | 290 | 246 | A   | 0241331781 |
| 05 | AF00034 | 76315 |     | MIL | 1750 | 1789 | 0933 | 76355 | EGL | U   | 290 | LBD | F   | 3022014711 |
| 06 | AF00034 | 77103 |     | EGL | 1710 | 1936 | 0121 | 77111 | MCE |     | 958 | 086 | K   | 0905067897 |
| 07 | AF00034 | 77200 |     | MCE | 1998 | 2008 | 0062 | 77209 |     | A   | 255 | AAQ | G   | 1750161562 |

CAN G 1)

MASTER LIST K-1-73 K-F-P-U-R-I  
PREPARED 02 MAY 20 (AF) PREPARED MAY 1982

PREPARED 02 MAY 20

| PLAT-SN | DATE<br>RECD | BAS<br>E<br>K | LT<br>IN | EST<br>OUT | HRS  | SHIP<br>ATE | BAS<br>EST<br>13 | W-U<br>H<br>H | 350<br>H<br>H | 612<br>H<br>H | 612<br>A<br>T | TAG        |
|---------|--------------|---------------|----------|------------|------|-------------|------------------|---------------|---------------|---------------|---------------|------------|
| 06      | AF00034      | 78016         | MMH      | 2020       | 2093 | 0042        | 78033            | U             | 657           | LU2           | F             | 3567503914 |
| 09      | AF00034      | 78318         | TIN      | 2261       | 2299 | 0168        | 78340            |               |               |               |               |            |
| 10      | AF00034      | 79043         | SFS      | 2314       |      | 0015        |                  |               |               |               |               |            |
| 01      | AF00035      | 72242         | MMH      | 0163       | 0196 | 0000        | 72266            | TIN           |               |               |               |            |
| 02      | AF00035      | 72326         | MMH      | 0246       | 0312 | 0052        | 72347            | KUR           |               |               |               |            |
| 03      | AF00035      | 73302         | KUR      | 0890       | 0931 | 0578        | 73340            | MIL           | 242           | 051           | G             | 0760831326 |
| 04      | AF00035      | 74199         | MTL      | 1133       | 1192 | 0202        | 74226            | KUR           | 657           | 051           | G             | 3320910102 |
| 05      | AF00035      | 75022         | KUR      | 1365       | 1421 | 0173        | 75034            | KIC           | UNK           | 246           | A             | 1842591590 |
| 06      | AF00035      | 75135         | KIC      | 1455       | 1517 | 0034        | 75181            | TIN           | 290           | CBZ           | F             | 0024001005 |
| 07      | AF00035      | 76183         | MCE      | 1907       | 1941 | 0390        | 76216            | ENG           | UNK           | AAU           | G             | 1227502136 |
| 08      | AF00035      | 77123         | ENG      | 2204       | 2340 | 0343        | 77137            | KIR           | UNK           | AAU           | G             | NU 350 TAG |
| 01      | AF00036      | 72221         | MMH      | 0093       | 0131 | 0000        | 72235            | MIL           | 652           | 246           | K             | 1121258016 |
| 02      | AF00036      | 72324         | REL      | 0168       | 0198 | 0037        | 72343            | MMH           |               |               |               |            |
| 03      | AF00036      | 73037         | KUR      | 0202       | 0283 | 0004        | 73089            | ENG           | UNK           | 246           | A             | 3561501756 |
| 04      | AF00036      | 75058         | KIC      | 0929       | 0975 | 0646        | 75074            | KIR           | UNK           | 070           | G             | 0000000302 |
| 01      | AF00037      | 73144         | MMH      | 0403       | 0517 | 0030        | 73193            | MMH           | 656           | 246           | A             | 1280537920 |
| 02      | AF00037      | 73346         | MMH      | 0505       | 0604 | 0048        | 74024            | TIN           |               |               |               |            |
| 03      | AF00037      | 75107         | MMH      | 0977       | 1017 | 0373        | 75132            | MMH           | 958           | P50           | G             | 2234140632 |
| 04      | AF00037      | 75163         | MMH      | 1075       | 1141 | 0058        | 75181            | TIN           | UNK           | 799           | B             | 0980461349 |
| 05      | AF00037      | 76121         | SUU      | 2353       | 2381 | 1212        | 76132            |               |               |               |               |            |
| 01      | AF00038      | 73113         | MMH      | 0414       | 0516 | 0000        | 73192            | KUR           | UNK           | 246           | F             | 0003152482 |
| 02      | AF00038      | 73221         | KUR      | 0539       | 0581 | 0023        | 73236            | KUR           | 242           | 296           | A             | 2070000598 |

PLN A114607

PAGE 10

CAN # 11

U-L-1-5 R-F-P-U-M-I  
MASTER LIST K-73 (AF) PREPARED MAY 1982

PREPARED 02 MAY 20

| AL | PLAT-SN | DATE  | BAS | ELL  | ELL  | HRS  | SHIPD | BAS | W-U | 350 | 612 | 612 | TAG        |
|----|---------|-------|-----|------|------|------|-------|-----|-----|-----|-----|-----|------------|
| CT |         | RECD  | L   | IN   | OUT  |      | ATE   | SP  |     | M   | M   | A   |            |
| 03 | AF00038 | 73271 | KUR | 0592 | 0631 | 0011 | 73296 | DMN |     | 799 | 086 | A   | 2530911314 |
| 04 | AF00038 | 73324 | DMN | 0652 | 0677 | 0021 | 73353 | MIL |     | 654 | 070 | G   | 3060550564 |
| 05 | AF00038 | 74023 | MIL | 0698 | 0732 | 0001 | 74038 | TIN |     | 242 | A50 | G   | 0041549027 |
| 06 | AF00038 | 74067 | KIR | 0736 | 0807 | 0006 | 74122 | DMN |     |     | GBZ | F   |            |
| 07 | AF00038 | 74255 | DMN | 0842 | 0863 | 0035 | 74266 | ENG |     | 654 | 246 | A   | 1400553375 |
| 08 | AF00038 | 75164 | ENG | 1234 | 1262 | 0371 | 75202 | MIL | U   | 658 | 086 | A   | 1750564251 |
| 09 | AF00038 | 76076 | MIL | 1352 | 1444 | 0130 | 76093 | KIR | U   | 657 | F80 | F   | 0642810460 |
| 10 | AF00038 | 76181 | KIR | 1537 | 1581 | 0093 | 76212 | MIL | D   | UNK | 599 | G   | NU 350 TAG |
| 11 | AF00038 | 76253 | MIL | 1591 | 1631 | 0010 | 76300 | EVL | U   | 958 | NPC | G   | 2432803171 |
| 12 | AF00038 | 77045 | EGL | 1554 | 1707 | 0028 | 77055 | ENG | F   | UNK | 799 | B   | 0201502395 |
| 13 | AF00038 | 78328 | TIN | 2390 | 2418 | 0683 | 78340 |     |     |     |     |     |            |
| 01 | AF00039 | 72339 | EGL | 0421 | 0482 | 0000 | 73016 | KUR |     | 799 | B   |     |            |
| 02 | AF00039 | 73165 | MIL | 0651 | 0681 | 0169 | 73212 | TIN |     | 037 | 246 | A   | 1562512755 |
| 03 | AF00039 | 75224 | MIL | 1254 | 0000 | 0573 | 75303 | ENG | U   | 652 | Y80 | F   | 2172812600 |
| 04 | AF00039 | 76349 | ENG | 0460 | 0519 | 0460 | 77006 | EGL | A   | 657 | AAQ | G   | 3421115905 |
| 05 | AF00039 | 77260 | EGL | 0759 | 0840 | 0280 | 77300 |     | U   | 958 | NPT | G   | 2642013579 |
| 06 | AF00039 | 78134 | ENG | 0872 | 0909 | 0032 | 78136 |     |     |     |     |     |            |
| 01 | AF00040 | 72245 | ENG | 0095 | 0136 | 0000 | 72269 | EGL |     |     |     |     |            |
| 02 | AF00040 | 72349 | EGL | 0105 | 0223 | 0049 | 73024 | ENG |     | 799 | B   |     |            |
| 03 | AF00040 | 74126 | LTV | 0464 | 0513 | 0241 | 74190 | KIR |     | UNK | 246 | A   | 0004165186 |
| 04 | AF00040 | 75072 | KIR | 0767 | 0925 | 0254 | 75139 | KIC | U   | 654 | H88 | F   | 0511028790 |
| 05 | AF00040 | 75216 | KIC | 0785 | 1036 | 0060 | 75272 | TIN | U   | 037 | H80 | F   | 1977501705 |

PLN M114007

PAGE 11



PREPARED 02 MAY 20  
 MASIRK LIST K1-73 (AF) PREPARED MAY 1982

K-E-P-U-W-I

| PLAT-SN | DALL    | RECU  | BAS | ETI  | IN   | KII  | DOJ   | HKS | SHIPO | BAS | W-U | 350 | 612 | 612 | TAG         |
|---------|---------|-------|-----|------|------|------|-------|-----|-------|-----|-----|-----|-----|-----|-------------|
|         |         |       | E   |      |      |      |       |     | ATL   | ESH |     | H   | H   | A   |             |
| 01      | AF00045 | 76180 |     | 2307 |      | 0037 | 76195 | UNK | 070   | A   |     |     |     |     | 00033064303 |
| 02      | AF00046 | 73204 | NIL | 0490 | 0524 | 0000 | 73312 |     |       |     |     |     |     |     | 0144112154  |
| 03      | AF00047 | 74055 | UBU | 0526 | 0500 | 0004 | 74114 |     |       |     |     |     |     |     | 2801027801  |
| 04      | AF00048 | 75309 | KIR | 1209 | 1245 | 0643 | 75330 | 0   | 654   | FBA | F   |     |     |     | 1676493925  |
| 05      | AF00049 | 72334 | ENG | 0180 | 0212 | 0000 | 72362 |     |       |     |     |     |     |     | 0722812096  |
| 06      | AF00050 | 74068 | KUK | 0983 | 1690 | 0771 | 74351 |     |       |     |     |     |     |     | 0710807059  |
| 07      | AF00051 | 75094 | KUK | 1726 | 1705 | 0030 | 75121 | 0   | 654   | 246 | A   |     |     |     | 1676493925  |
| 08      | AF00052 | 76181 | DMN | 2204 | 2261 | 0439 | 76216 | 0   | 958   | 246 | A   |     |     |     | 2434011272  |
| 09      | AF00053 | 77272 | KIR | 2676 | 2731 | 0417 | 77300 |     |       |     |     |     |     |     | 0101258722  |
| 10      | AF00054 | 78244 |     | 2909 | 2943 | 0178 | 78260 |     |       |     |     |     |     |     | 3102804105  |
| 11      | AF00055 | 73144 | INN | 0211 | 0247 | 0000 | 73236 |     |       |     |     |     |     |     | 0044001547  |
| 12      | AF00056 | 73332 | KUK | 0343 | 0378 | 0096 | 73353 |     |       |     |     |     |     |     | 2341101099  |
| 13      | AF00057 | 74052 | KUK | 0380 | 0438 | 0002 | 74070 |     |       |     |     |     |     |     |             |
| 14      | AF00058 | 77254 | MCE | 1740 | 1704 | 1308 | 77270 |     |       |     |     |     |     |     |             |
| 15      | AF00059 | 72242 | EGU | 0161 | 0202 | 0000 | 72258 |     |       |     |     |     |     |     |             |
| 16      | AF00060 | 75189 | DMN | 1199 | 1243 | 0997 | 75231 | 0   | 653   | A40 | F   |     |     |     | 1820495730  |
| 17      | AF00061 | 76153 | ENG | 1407 | 1525 | 0244 | 76180 | 0   | 656   | DUM | G   |     |     |     | 1421117839  |
| 18      | AF00062 | 77165 | MCE | 1807 | 1894 | 0347 | 77193 |     |       |     |     |     |     |     | NU 350 TAG  |
| 19      | AF00063 | 78344 | DMN | 0434 | 0466 | 0000 | 78371 |     |       |     |     |     |     |     | 0580609313  |
| 20      | AF00064 | 74102 | KIR | 0782 | 0824 | 0316 | 74142 |     |       |     |     |     |     |     |             |
| 21      | AF00065 | 72264 | INN | 0120 | 0206 | 0000 | 73009 |     |       |     |     |     |     |     |             |
| 22      | AF00066 | 73060 | NLL | 0232 | 0265 | 0026 | 73136 |     |       |     |     |     |     |     |             |
| 23      | AF00067 |       |     |      |      |      |       | 290 | 246   | A   |     |     |     |     | 0430617984  |

PLN A114307

PAGE 13

CAN # 11

MASTER LIST RT-73 (AF) PREPARED MAY 1982

PREPARED 62 MAY 20

| AF<br>CY | PLAT-SN | DATE<br>REC'D | WAS<br>R | ETI<br>IN | ETI<br>OUT | HKS  | SHIPD<br>ATE | WAS<br>ESH | W-U | 350<br>H | 612<br>H | 612<br>A | TAG        |
|----------|---------|---------------|----------|-----------|------------|------|--------------|------------|-----|----------|----------|----------|------------|
| 03       | AF00052 | 76064         | PIT      | 1166      | 1221       | 0701 | 76105        | ENG        | A   | 609      | LHJ      | F        | 0554001117 |
| 04       | AF00052 | 76229         | ENG      | 1367      | 1393       | 0146 | 76260        | TIN        | U   | 658      | 749      | B        | 1421165028 |
| 05       | AF00052 | 76356         | TIN      | 1395      | 1451       | 0002 | 77024        | MFL        | S   | 242      | HBA      | F        | 2016300027 |
| 06       | AF00052 | 77161         | MFL      | 1650      | 1658       | 0179 | 77179        | MFL        | U   | 657      | 749      | B        | 1535332225 |
| 07       | AF00052 | 76054         | SFS      | 1854      | 1999       | 0196 | 78135        |            | U   | 127      | MAN      | F        | 0410266194 |
| 08       | AF00052 | 78275         |          | 2074      | 2108       | 0075 | 78285        |            |     |          |          |          |            |
| 01       | AF00053 | 72234         | LIV      | 0109      | 0151       | 0000 | 72243        | LUL        |     |          |          |          |            |
| 02       | AF00053 | 73196         | TIN      | 0192      | 0233       | 0041 | 73229        | MPT        |     | 242      | 246      | K        | 0301255962 |
| 03       | AF00053 | 74142         | MPT      | 0319      | 0355       | 0066 | 74150        | BUC        |     |          | 070      | A        |            |
| 04       | AF00053 | 76035         | BUC      | 0906      | 0977       | 0551 | 76093        | KIC        | U   | 255      | CDA      | F        | 0150503202 |
| 05       | AF00053 | 77259         | KIC      | 1269      | 0010       | 0292 | 77271        |            | U   | 037      | 599      | G        | 2437505030 |
| 01       | AF00054 | 75055         | MFL      | 1001      | 1039       |      | 75065        | KUR        | U   | 949      | 877      | A        | 0442804293 |
| 02       | AF00054 | 76161         | EGU      | 1543      | 1594       | 0504 | 76212        | LUL        | U   | 958      | 799      | B        | 1677146874 |
| 03       | AF00054 | 78124         | LUL      | 2211      | 2242       | 0617 | 78136        |            |     |          |          |          |            |
| 04       | AF00054 | 76341         | KIC      | 2360      | 3046       | 0118 | 76355        |            |     |          |          |          |            |
| 01       | AF00055 | 72319         | MFL      | 0103      | 0227       | 0000 | 72325        | UMN        |     |          |          |          |            |
| 04       | AF00056 | 75220         | PIT      | 1123      | 1170       | 0396 | 75246        | LUG        | U   | 037      | CAQ      | G        | 3014831619 |
| 05       | AF00056 | 76111         | ENG      | 1401      | 1450       | 0231 | 76120        | TIN        |     | UNK      | ZDM      | G        | 2054006387 |
| 01       | AF00057 | 72334         | ENG      | 0217      | 0270       | 0000 | 73031        | KUR        |     |          | 374      | F        | ND 350 TAG |
| 02       | AF00057 | 73071         | KUR      | 9330      | 0367       | 0060 | 73109        | UMN        |     | 624      | 246      | K        | 0512994046 |
| 03       | AF00057 | 75352         | UMN      | 1275      | 1311       | 0708 | 76005        | TIN        | U   | 958      | JSD      | G        | 3436554008 |
| 01       | AF00056 | 74607         | ENG      | 0701      | 0742       | 0000 | 74123        | MFL        |     |          | 246      | A        | 0630468011 |

PCN N114607

PAGE 14

CAN # 1

MASTER LIST K1-73 (AF) PREPARED MAY 1982

PREPARED 02 MAY 80

| PLAT-SN | DATE     | REL   | R   | ETI  | ETI  | ETI  | URS  | SHIPD | WAS | W-U | 350 | 612 | 612 | TAG         |
|---------|----------|-------|-----|------|------|------|------|-------|-----|-----|-----|-----|-----|-------------|
|         |          |       |     | IN   | OUT  | OUT  |      | ATE   | LSH | H   | H   | H   | A   | T           |
| 02      | AF000058 | 74200 | MTL | 0774 | 0010 | 0032 | 0032 | 74275 | KIK |     | 242 | 246 | A   | 1552853546  |
| 03      | AF000058 | 75217 | KIK | 1056 | 1123 | 0246 | 0246 | 75303 | ENG | U   | 240 | LBA | F   | 1651028280  |
| 04      | AF000058 | 77109 | ENG | 1331 | 1360 | 0208 | 0208 | 77116 | DMN | U   | 652 | ADL | C   | 1041301588  |
| 01      | AF000059 | 73003 | DMN | 0240 | 0277 | 0000 | 0000 | 73031 | DMN |     | 037 | 086 | A   | 3240598888  |
| 02      | AF000059 | 77226 |     | 1952 | 2024 | 1675 | 1675 | 77243 |     |     | UNK | 070 | A   | ND 350 TAG  |
| 01      | AF000060 | 72500 | ENG | 0164 | 0194 | 0000 | 0000 | 72505 | TIN |     |     |     |     |             |
| 02      | AF000060 | 73000 | ENG | 0308 | 0344 | 0114 | 0114 | 73115 | UOU |     | 654 | 246 | K   | 05800491503 |
| 03      | AF000060 | 73191 | UOU | 0359 | 0397 | 0015 | 0015 | 73225 | KER |     | UNK | 070 | A   | 0046910235  |
| 04      | AF000060 | 73203 | KER | 0404 | 1213 | 0007 | 0007 | 74080 | KUM |     |     | FBA | F   | 0003323197  |
| 05      | AF000060 | 74212 | KUM | 1214 | 1236 | 0001 | 0001 | 74234 | DMN |     | 799 | 246 | A   | 0984005689  |
| 06      | AF000060 | 76224 | DMN | 1301 | 1343 | 0065 | 0065 | 77286 |     | U   | 958 | FBA | F   | 2116551825  |
| 07      | AF000060 | 76192 |     | 1660 |      | 0317 | 0317 | 78208 |     |     |     |     |     |             |
| 08      | AF000060 | 79033 | TIN | 1821 | 1850 | 1821 | 1821 | 79059 |     |     |     |     |     |             |
| 01      | AF000061 | 74227 | DMN | 0101 | 0140 |      |      | 74269 | TIN |     | 607 | 086 | K   | 1940602651  |
| 01      | AF000062 | 73501 | DMN | 0365 | 0396 | 0000 | 0000 | 74058 | TIN |     | 958 | DBN | F   | 3470402308  |
| 02      | AF000062 | 74259 | MTL | 0720 | 0753 | 0132 | 0132 | 74277 | KUM |     | 652 | 799 | B   | 2382424176  |
| 03      | AF000062 | 76240 | ENG | 1427 | 1475 | 0074 | 0074 | 76270 | ENG | U   | 656 | 799 | B   | 2316001360  |
| 04      | AF000062 | 77252 |     | 1877 | 1922 | 0402 | 0402 | 77260 |     |     | UNK | ADG | C   | ND 350 TAG  |
| 05      | AF000062 | 78305 |     | 2336 | 2368 | 0414 | 0414 | 78307 |     |     |     |     |     |             |
| 01      | AF000063 | 72249 | DMN | 0120 | 0153 | 0000 | 0000 | 72263 | ENG |     |     |     |     |             |
| 02      | AF000063 | 76004 | ENG | 0661 | 0622 | 0208 | 0208 | 76116 | EOL |     | UNK | F8F | F   | ND 350 TAG  |
| 03      | AF000063 | 76343 | EOL | 1023 | 1072 | 0201 | 0201 | 77005 | TIN |     | 958 | 246 | A   | 3341102295  |

PAGE 15

PLN N114007

CAN # 11055

MAY 1982  
K-E-P-U-K-T  
AFJ PREPARED  
LIST RT-73

PREPARED 02 MAY 20

| AF<br>CY | PLAT-SN | DATE<br>RECD | PLAS<br>E | RTI<br>IN | OUT  | MKS  | SHIPD<br>ATE | BAS<br>EOM<br>IP | W-U<br>H | 350<br>H | 612<br>H | 612<br>A | YAG        |
|----------|---------|--------------|-----------|-----------|------|------|--------------|------------------|----------|----------|----------|----------|------------|
| 01       | AF00004 | 72314        | NEL       | 0222      | 0276 | 0000 | 72350        | TIN              |          |          | 374      | K        | 2864750118 |
| 02       | AF00004 | 73264        | DMR       | 0335      | 0377 | 0063 | 73325        | DMN              |          | 654      | 799      | B        | 2700426906 |
| 03       | AF00004 | 74114        | DMN       | 0524      | 0574 | 0147 | 74158        | TIN              |          |          | 246      | A        | 0980463825 |
| 04       | AF00004 | 74227        | MTL       | 0575      | 0577 | 0001 | 74263        | ENG              |          | 242      | 799      | B        | 1971512967 |
| 05       | AF00004 | 75237        | ENG       | 0827      | 0875 | 0250 | 75254        | BUC              | U        | 652      | 051      | G        | 2100511422 |
| 06       | AF00005 | 72276        | EGL       | 0122      | 0157 | 0000 | 72290        | TIN              |          |          | 374      | F        | 2452503359 |
| 07       | AF00005 | 72327        | TIN       | 0162      | 0184 | 0005 | 72333        | KUR              |          |          |          |          |            |
| 08       | AF00005 | 73254        | KUR       | 0777      | 0826 | 0593 | 73282        | NEL              |          | 958      | 246      | A        | 2262979872 |
| 09       | AF00005 | 75079        | BUC       | 1295      | 1333 | 0469 | 75114        | MTL              | U        | 037      | 799      | B        | 0670505696 |
| 10       | AF00005 | 75209        | MTL       | 1351      | 1408 | 0018 | 75259        | KIR              | U        | 657      | FBA      | F        | 1702818707 |
| 11       | AF00005 | 76261        | TIN       | 1218      | 1259 | 0110 | 76303        | MTL              |          | UNK      | NSE      | G        | NU 350 YAG |
| 12       | AF00005 | 73225        | EGL       | 0299      | 0334 | 0000 | 74038        | DMN              |          | 255      | FUA      | F        | 2171252690 |
| 13       | AF00006 | 74092        | DMN       | 0368      | 0409 | 0034 | 74112        | TIN              |          |          | CAN      | G        | 0800553844 |
| 14       | AF00007 | 73093        | LIV       | 0212      | 0348 | 0000 | 73214        | KUR              |          |          | 246      | A        | 2331500406 |
| 15       | AF00007 | 73254        | KUR       | 0355      | 0378 | 0007 | 73283        | KUR              |          | UNK      | 246      | A        | 2331500406 |
| 16       | AF00007 | 73334        | KUR       | 0405      | 0451 | 0007 | 74003        | KUR              |          |          | 799      | B        | 2920908496 |
| 17       | AF00007 | 74077        | KUR       | 0453      | 0499 | 0002 | 74091        | KUR              |          |          | 246      | A        | 0264105741 |
| 18       | AF00007 | 74134        | KUR       | 0507      | 0545 | 0018 | 74218        | ENG              |          | UNK      | 051      | G        | 1150644495 |
| 19       | AF00007 | 74357        | LHG       | 0560      | 0606 | 0015 | 75027        | ENG              |          | 607      | C50      | G        | 2490084243 |
| 20       | AF00007 | 75065        | ENG       | 0677      | 0706 | 0001 | 75090        | MTL              | Y        | 037      | 799      | B        | 0492261462 |
| 21       | AF00007 | 77064        | DES       | 0618      | 0660 | 0512 | 77129        | EOM              | U        | 561      | F80      | F        | 0740006907 |
| 22       | AF00007 | 77265        | EOM       | 0776      | 0830 | 0116 | 77272        |                  | D        | 242      | AAQ      | G        | 2447518200 |

PCN N114607

PAGE 16

PREPARED 02 MAY 20

MASTER LIST 8-1-73 K-F-P-U-W-I

K-F-P-U-W-I (AF) PREPARED MAY 1982

| AF<br>CU | PLAT-3N | DATE<br>RECU | WAS<br>E<br>K | LT<br>IN | FT<br>OUT | MKS  | SMPO<br>ATE | W-U | 350<br>H<br>H | 612<br>H<br>H | 612<br>A<br>T | TAG        |
|----------|---------|--------------|---------------|----------|-----------|------|-------------|-----|---------------|---------------|---------------|------------|
| 10       | AF00007 | 78132        | WLS           | 0931     | 1025      | 0101 | 78179       |     |               | 799           | B             | 3354765285 |
| 11       | AF00008 | 78230        | WLS           | 0317     | 0506      | 0000 | 73071       |     | 655           | XUM           | G             | 3030825179 |
| 12       | AF00009 | 78312        | MTL           | 0615     | 0648      | 0213 | 74010       |     | UNK           | N5D           | G             | NL 350 TAG |
| 13       | AF00010 | 78216        | PIT           | 0129     | 0106      |      | 76247       |     |               |               |               |            |
| 14       | AF00011 | 77020        | EOL           | 0203     | 0250      | 0017 | 77028       | F   | 958           | 246           | A             | 0047122364 |
| 15       | AF00012 | 77152        | SUU           | 0206     | 0339      | 0036 | 77164       | F   | 290           | 246           | A             | 1193361260 |
| 16       | AF00013 | 77236        | PIT           | 0437     | 0450      | 0058 | 77243       | U   | 656           | 799           | B             | 1984052904 |
| 17       | AF00014 | 78072        | MTL           | 0638     |           | 0240 | 78081       |     |               |               |               |            |
| 18       | AF00015 | 78137        |               | 0745     | 0802      | 0745 | 78166       |     |               |               |               |            |
| 19       | AF00016 | 78332        | TIN           | 0883     |           | 0081 | 78363       |     |               |               |               |            |
| 20       | AF00017 | 78053        |               | 0845     |           |      |             |     | 127           | 000           | F             | 3537502279 |
| 21       | AF00018 | 78092        | ENG           | 0122     | 0156      |      | 78056       |     | 169           | 599           | G             | 0343250737 |
| 22       | AF00019 | 78133        | MTL           | 0251     | 0309      | 0095 | 78160       | A   | 657           | 086           | K             | 1242427287 |
| 23       | AF00020 | 78287        | MTL           | 0415     | 0437      | 0106 | 78321       | U   | 657           | 799           | B             | 2792459613 |
| 24       | AF00021 | 78072        | KIK           | 0396     |           | 0459 | 78145       |     |               |               |               |            |
| 25       | AF00022 | 78016        | ENG           | 0704     | 0801      |      | 78031       | U   | 255           | 799           | B             | 3560027708 |
| 26       | AF00023 | 78182        | KIK           | 0292     | 0307      |      | 78243       | U   | 958           | 060           | F             | NU 350 TAG |
| 27       | AF00024 | 78016        | KIC           | 0707     | 0748      | 0340 | 78030       | U   | 037           | 799           | B             | 3567506123 |
| 28       | AF00025 | 78201        |               | 0826     |           | 0078 | 78216       |     |               |               |               |            |
| 29       | AF00026 | 77066        | PIT           | 0365     | 0485      |      | 77116       | U   | 037           | N80           | F             | 0504025290 |
| 30       | AF00027 | 77137        | ENG           | 0496     | 0601      | 0011 | 77182       | Y   | 799           | N8A           | F             | 1303315783 |
| 31       | AF00028 | 77315        | PIT           | 0881     | 0725      | 0080 | 77325       | U   | 037           | 799           | B             | 2944076012 |

PLN N114007

PAGE 17



[illegible]





APPENDIX C

K051 LOGISTIC SUPPORT COST BREAKDOWN

Explanation. The appendix contains extracts from the K051 Logistic Support Cost Breakdown for the A-7D MDS and WUC 73FAO (first column). The cost data (presented in dollars) represent quarterly totals for the quarter indicated by the "as of" date in the top left corner of each page. The data for trouble-shooting costs were found by locating the WUC 73FAO in column 1, verified by the noun "Unit Inertial M" in column 2, and looking under the column labeled "Field Maint." Transportation costs were found in the same way under the column labeled "Pack-Ship Cost." The entries used are identified by an "X" in the left-hand margin of each page.

FTI WEAPON SYSTEM A0070 OALC  
AFN 65-110/66-1 DATA AS OF 81 SEP  
LOGISTIC SUPPORT COST RANKING  
LSC BREAKDOWN  
LOG-LOG(0)753  
Q-K051-FM-10-102  
DATE PROCESSED

| LINE  | NAME            | FIELD<br>MAINT | QUARTERLY VALUES    |                   |       | CONSERVATION<br>COST |
|-------|-----------------|----------------|---------------------|-------------------|-------|----------------------|
|       |                 |                | SPEC REPAIR<br>COST | PACK-SHIP<br>COST |       |                      |
| 73ECP | ASSY ANALOG OUT | \$250          | \$672               | \$2               | \$0   | \$0                  |
| 73ECP | ASSY ANALOG IN  | \$67           | \$532               | \$3               | \$0   | \$0                  |
| 73ECP | ASSY RATE-DEFL  | \$67           | \$240               | \$1               | \$0   | \$0                  |
| 73ECP | ASSY FUNCTION C | \$67           | \$0                 | \$0               | \$0   | \$0                  |
| 73ECP | ASSY CLOCK JUNK | \$701          | \$672               | \$3               | \$0   | \$0                  |
| 73ECP | IN ELECT EQUIP  | \$603          | \$0                 | \$0               | \$0   | \$0                  |
| 73ECP | ASSY FAN        | \$605          | \$0                 | \$0               | \$0   | \$0                  |
| 73ECP | WIRING COMB PI  | \$1,063        | \$0                 | \$0               | \$0   | \$0                  |
| 73ECP |                 | \$132,213      | \$42,650            | \$1,459           | \$430 |                      |
| 73F00 | INERTIAL REURCH | \$50,021       | \$0                 | \$0               | \$0   | \$0                  |
| 73F00 | INERTIAL M      | \$101,357      | \$239,626           | \$2,041           | \$0   | \$0                  |
| 73F00 | INERTIAL M      | \$54           | \$0                 | \$0               | \$0   | \$0                  |
| 73F00 | CORD CARI       | \$920          | \$13,499            | \$71              | \$0   | \$0                  |
| 73F00 | MODULE GINER L  | \$172          | \$3,072             | \$11              | \$0   | \$0                  |
| 73F00 | MODULE RIR SUP  | \$315          | \$3,163             | \$9               | \$0   | \$0                  |
| 73F00 | MODULE TIDE SH  | \$220          | \$1,715             | \$3               | \$0   | \$0                  |
| 73F00 | ACCELER K-Y     | \$12           | \$0                 | \$0               | \$0   | \$0                  |
| 73F00 | BACK FLEC EQUIP | \$1,356        | \$0                 | \$0               | \$0   | \$0                  |
| 73F00 | CONTROLLER IHS  | \$2,073        | \$178               | \$4               | \$0   | \$0                  |
| 73F00 | EC              | \$20           | \$0                 | \$0               | \$0   | \$0                  |
| 73F00 | ASSY RECON-MCAL | \$12           | \$0                 | \$0               | \$0   | \$0                  |
| 73F00 | RIGHT PHEL      | \$173          | \$0                 | \$0               | \$0   | \$0                  |
| 73F00 | ALPHA PIR SP LS | \$56,216       | \$30,670            | \$675             | \$0   | \$0                  |
| 73F00 | PIR             | \$56           | \$0                 | \$0               | \$0   | \$0                  |
| 73F00 | CARD SEQUENCER  | \$433          | \$595               | \$3               | \$0   | \$0                  |
| 73F00 | CARD SEQUENCER  | \$114          | \$296               | \$3               | \$0   | \$0                  |
| 73F00 | MODULE R00 J2   | \$106          | \$21                | \$2               | \$0   | \$0                  |
| 73F00 | MODULE HEAD REP | \$3,972        | \$6,203             | \$102             | \$0   | \$0                  |
| 73F00 | MODULE RELAY DR | \$5            | \$0                 | \$0               | \$0   | \$0                  |
| 73F00 | CARD RELAY DRIV | \$153          | \$500               | \$3               | \$0   | \$0                  |
| 73F00 | CARD RELAY DRIV | \$261          | \$722               | \$0               | \$0   | \$0                  |
| 73F00 | MODULE ROL-PTIC | \$273          | \$0                 | \$0               | \$0   | \$0                  |
| 73F00 | PRIMER ATTACHE  | \$120          | \$0                 | \$0               | \$0   | \$0                  |
| 73F00 | POWER SUPPLY    | \$143          | \$0                 | \$13              | \$0   | \$0                  |
| 73F00 | CARD PIR SUPPLY | \$2,052        | \$1,166             | \$0               | \$0   | \$0                  |
| 73F00 | CARD PIR SUPPLY | \$1,300        | \$1,750             | \$14              | \$0   | \$0                  |
| 73F00 | PIR PIR SUPPLY  | \$1,300        | \$1,750             | \$14              | \$0   | \$0                  |

WEATHER SYSTEM: A1170; CIAL: JUN 65-1101A-1 DATA AS OF 01 JUN 65

### QUARTERLY VALUES

HTT  
 WEAPON SYSTEM    A007D    OALC  
 AFM 65-110/66-1 DATA AS OF 81 MAR  
 LOGISTIC SUPPORT COST RANKING  
 LSC BREAKDOWN  
 LOG-LO(0)7953  
 a. P(0)51--PRG--LO-M/L  
 DATE PROCESSED

| WUC   | NOUN              | FIELD     | QUARTERLY VALUES |           |       | CONDENSED COST |
|-------|-------------------|-----------|------------------|-----------|-------|----------------|
|       |                   |           | SPEC RETAIN      | PACK-SHIP | COST  |                |
| 736C1 | ASSY CORE PLANE   | \$140     | \$171            | \$1       | \$0   |                |
| 736C2 | ASSY ANALOG OUT   | \$73      | \$801            | \$2       | \$0   |                |
| 736C3 | ASSY ANALOG IN    | \$36      | \$280            | \$1       | \$0   |                |
| 736C4 | ASSY RATE-DEFL    | \$70      | \$0              | \$0       | \$0   |                |
| 736C5 | ASSY FUNCTION C   | \$56      | \$223            | \$1       | \$0   |                |
| 736C6 | ASSY CLOCK CHCK   | \$138     | \$444            | \$1       | \$0   |                |
| 736C7 | ASSY PROGRAM C    | \$73      | \$270            | \$1       | \$0   |                |
| 736C8 | PIR SUPPLY LOU    | \$80      | \$0              | \$0       | \$0   |                |
| 736C9 | PIR SUPPLY EQUIP  | \$143     | \$0              | \$0       | \$0   |                |
| 736CA | ASSY FCR          | \$709     | \$0              | \$0       | \$0   |                |
| 736D0 | HINDING COUS P1   | \$1,114   | \$0              | \$0       | \$0   |                |
| 736X  |                   | \$126,502 | \$72,831         | \$2,697   | \$0   |                |
| 736D0 | INERTIAL INSURIN  | \$50,573  | \$0              | \$0       | \$0   |                |
| 736A0 | UNIT INERTIAL H   | \$95,230  | P \$161,777      | \$1,951   | P \$0 |                |
| 736F9 | ROC               | \$269     | \$0              | \$0       | \$0   |                |
| 736F0 | FORWARD CANN      | \$1,016   | \$11,099         | \$9       | \$0   |                |
| 736F1 | MIDDLE GUN L      | \$230     | \$8,232          | \$16      | \$0   |                |
| 736F2 | MIDDLE PIR SUP    | \$50      | \$1,424          | \$5       | \$0   |                |
| 736F3 | MIDDLE CODE SW    | \$276     | P \$2,861        | \$5       | P \$0 |                |
| 736F4 | BACK ELEC EQUIP   | \$702     | \$0              | \$0       | \$0   |                |
| 736F5 | CONTROLLER INS    | \$1,995   | \$504            | \$9       | \$0   |                |
| 736F6 | ROC               | \$157     | \$0              | \$0       | \$0   |                |
| 736F7 | FRONT PANEL       | \$201     | \$0              | \$0       | \$0   |                |
| 736F8 | FORWARD PIR SP LS | \$70,698  | \$10,969         | \$213     | \$0   |                |
| 736F9 | ROC               | \$51      | \$0              | \$0       | \$0   |                |
| 736D9 | CARD SEQUENCER    | \$342     | \$919            | \$6       | \$0   |                |
| 736D0 | CARD SEQUENCER    | \$620     | \$1,166          | \$7       | \$0   |                |
| 736D1 | MODULE 800 HZ     | \$113     | \$877            | \$2       | \$0   |                |
| 736D2 | MODULE HEAD REP   | \$2,597   | \$843            | \$16      | \$0   |                |
| 736D3 | MODULE RELAY DR   | \$24      | \$0              | \$0       | \$0   |                |
| 736D4 | CARD RELAY DR     | \$334     | \$535            | \$1       | \$0   |                |
| 736D5 | CARD RELAY RELV   | \$77      | \$744            | \$2       | \$0   |                |
| 736D6 | MODULE REL-PITC   | \$409     | \$0              | \$0       | \$0   |                |
| 736D7 | RELIVER ATTACHE   | \$194     | \$0              | \$0       | \$0   |                |
| 736D8 | POWER SUPPLY      | \$41      | \$178            | \$7       | \$0   |                |
| 736D9 | CARD PIR SUPPLY   | \$473     | \$1,072          | \$16      | \$0   |                |
| 736E0 | CARD PIR SUPPLY   | \$424     | \$445            | \$7       | \$0   |                |



# LOGISTIC SUPPORT UNIT WORKING

USC (REPAIR) 100 150407 74

| NO   | NAME             | FIELD MAINT | SPEC REPAIR COST | QUARTERLY VALUE |                  |
|------|------------------|-------------|------------------|-----------------|------------------|
|      |                  |             |                  | PACK-SHIP COST  | INFORMATION COST |
| 73E0 | INS UNIT HEADSU  | \$20,075    | \$118,032        | \$4,397         | \$0              |
| 73E1 | NOC              | \$31        | \$0              | \$0             | \$0              |
| 73E2 | PHONE OPTICAL    | \$61        | \$0              | \$0             | \$0              |
| 73E3 | ASSY COMBINER    | \$19        | \$0              | \$0             | \$0              |
| 73E4 | ASSY CONTROL PA  | \$274       | \$0              | \$0             | \$0              |
| 73E5 | ASSY TUBE UNIT   | \$521       | \$3,792          | \$24            | \$0              |
| 73E6 | ASSY CATHODE RA  | \$109       | \$1,264          | \$8             | \$0              |
| 73E7 | ASSY CRT MATCHI  | \$17        | \$115            | \$0             | \$0              |
| 73E8 | FOR SUPPLY HIGH  | \$782       | \$1,080          | \$20            | \$5,500          |
| 73E9 | AMPLIFIER DEFLEC | \$516       | \$424            | \$3             | \$0              |
| 73EA | ASSY VIDEO       | \$232       | \$555            | \$2             | \$0              |
| 73EB | ASSY BITE        | \$308       | \$562            | \$6             | \$0              |
| 73EC | PHR SUPPLY LOW V | \$7,429     | \$0              | \$0             | \$0              |
| 73ED | PRINT CIR BRD IN | \$988       | \$1,471          | \$14            | \$0              |
| 73EE | CIR BRD CR AMP/  | \$373       | \$1,086          | \$4             | \$0              |
| 73EF | CIR BRD OUTPUT R | \$760       | \$1,200          | \$16            | \$0              |
| 73EG | ASSY ELECTRONIC  | \$63        | \$0              | \$0             | \$0              |
| 73EH | ASSY RECTIFIER B | \$281       | \$252            | \$0             | \$0              |
| 73EI | SIGNAL DATA PRO  | \$21,989    | \$4,902          | \$95            | \$0              |
| 73EJ | ASSY DATA INPUT  | \$128       | \$140            | \$1             | \$0              |
| 73EK | ASSY ADDER/HOMO  | \$97        | \$0              | \$0             | \$0              |
| 73EL | ASSY PROCESSOR C | \$109       | \$202            | \$2             | \$0              |
| 73EM | ASSY DISCRETE I  | \$24        | \$121            | \$1             | \$0              |
| 73EN | ASSY INSTRUCTION | \$48        | \$0              | \$0             | \$0              |
| 73EO | ASSY STR CONT P  | \$86        | \$0              | \$0             | \$0              |
| 73EP |                  | \$135,571   | \$137,876        | \$4,007         | \$1,242          |
| 73EQ | INERTIA MOUNTING | \$69,401    | \$0              | \$0             | \$0              |
| 73ER | UNIT INERTIAL M  | \$124,926   | \$256,431        | \$2,848         | \$0              |
| 73ES | NOC              | \$12        | \$0              | \$0             | \$0              |
| 73ET | BOARD CAPOT      | \$307       | \$1,482          | \$1             | \$0              |

K11  
 WEAPON SYSTEM '007D O'ALC  
 AFM 55-110/66-1 DATA AS OF 10 JUN  
 LOGISTIC SUPPORT COST RANKING  
 LSC BREAKDOWN  
 LOG-LO(Q)7953  
 0-1051-PH4-LQ-P  
 DATE PROCESSED

| QUARTERLY VALUES |                  |                |                     |                   |                      |
|------------------|------------------|----------------|---------------------|-------------------|----------------------|
| WUC              | NOUN             | FIELD<br>MAINT | SPEC REPAIR<br>COST | PACK-SHIP<br>COST | CONDEMNATION<br>COST |
|                  |                  |                |                     |                   |                      |
| 73EDH            | ASSY INSTRUCTION | \$12           | \$0                 | \$0               | \$0                  |
| 73EDJ            | ASSY STR CONT R  | \$128          | \$0                 | \$0               | \$0                  |
| 73EDK            | ASSY DRIVE TRAN  | \$82           | \$181               | P                 | \$0                  |
| 73EDL            | ASSY STORE CONT  | \$72           | \$586               | \$1               | \$0                  |
| 73EDP            | ASSY ANALOG OUT  | \$104          | \$1764              | \$5               | \$0                  |
| 73EDQ            | ASSY ANALOG INP  | \$36           | \$252               | \$1               | \$0                  |
| 73EDR            | ASSY RATE-DEFL   | \$61           | \$0                 | \$0               | \$0                  |
| 73EDS            | ASSY OVERFLOW R  | \$41           | \$146               | \$1               | \$0                  |
| 73EDT            | ASSY FUNCTION C  | \$48           | \$0                 | \$0               | \$0                  |
| 73EDU            | ASSY CLOCK CHCK  | \$456          | \$360               | \$1               | \$0                  |
| 73EDV            | ASSY PARAMETR C  | \$61           | \$0                 | \$0               | \$0                  |
| 73EDZ            | PWR SUPPLY LON   | \$92           | \$0                 | \$0               | \$0                  |
| 73ECU            | HI ELEC EQUIPM   | \$1            | \$0                 | \$0               | \$0                  |
| 73ECA            | ASSY FAN         | \$48           | \$0                 | \$0               | \$0                  |
| 73ED0            | WIRING CONNS PL  | \$526          | \$0                 | \$0               | \$0                  |
| 73EXX            |                  | \$148,829      | \$127,349           | \$3,608           | \$8                  |
| 73F00            | INERTIAL MSURMN  | \$84,573       | \$0                 | \$0               | \$0                  |
| 73FA0            | INIT INERTIAL M  | \$132,477      | \$273,409           | \$3,134           | \$0                  |
| 73FA2            | MOC              | \$162          | \$0                 | \$0               | \$0                  |
| 73FAD            | BOARD CAPRI      | \$624          | \$888               | \$1               | \$0                  |
| 73FAE            | MODULE GICBAL L  | \$293          | \$4,263             | \$9               | \$0                  |
| 73FAF            | MODULE PWR SUP   | \$279          | \$1,340             | \$5               | \$0                  |
| 73FAG            | MODULE MODE SHI  | \$291          | \$2,259             | \$0               | \$0                  |
| 73FEO            | PACK ELEC EQUIP  | \$1,273        | \$0                 | \$0               | \$0                  |
| 73FEO            | CONTROLLER IMS   | \$3,171        | \$1,630             | \$20              | \$0                  |
| 73FEB            | FRONT PANEL      | \$424          | \$0                 | \$0               | \$0                  |
| 73FEO            | ADPTR PWR SP LS  | \$92,867       | \$28,477            | \$491             | \$0                  |
| 73F02            | MOC              | \$259          | \$0                 | \$0               | \$0                  |
| 73FDA            | MODULE SEQUENCE  | \$12           | \$233               | \$1               | \$0                  |
| 73F08            | CARD SEQUENCER   | \$257          | \$749               | \$5               | \$0                  |
| 73F0C            | CARD SEQUENCER   | \$505          | \$913               | \$6               | \$0                  |
| 73F06            | MODULE PWD HZ    | \$79           | \$240               | \$2               | \$0                  |
| 73FDE            | MODULE HEAD REP  | \$8,344        | \$6,462             | \$94              | \$1,334              |
| 73F0F            | MODULE RELAY CR  | \$43           | \$359               | \$5               | \$0                  |
| 73F0J            | CARD RELAY DRV   | \$406          | \$1,070             | \$6               | \$0                  |
| 73F0H            | CARD RELAY DRV   | \$421          | \$1,573             | \$5               | \$0                  |
| 73F0I            | DRIVER AMPLIFIE  | \$91           | \$0                 | \$0               | \$0                  |

| WEAPON SYSTEM |                  | AFM 65-110/66-1 DATA AS OF 80 MAR |                     | LOGISTIC SUPPORT COST RANKING         |                      | Q-KG51.-P/11.-Q-KGZ |  |
|---------------|------------------|-----------------------------------|---------------------|---------------------------------------|----------------------|---------------------|--|
| A007D         |                  | OCALC                             |                     | LSC BREAKDOWN                         |                      | DATE PROCESSED      |  |
| 73EXX         |                  | 73EXX                             |                     | LOG-LO(Q)7953                         |                      |                     |  |
| NUC           | NOUN             | FIELD<br>MAINT                    | SPEC REPAIR<br>COST | QUARTERLY VALUES<br>PACK-SHIP<br>COST | CONDENIATION<br>COST |                     |  |
| 73EBP         | ASSY ANALOG OUT  | \$122                             | \$256               | \$1                                   | \$0                  |                     |  |
| 73EBQ         | ASSY ANALOG INP  | \$66                              | \$0                 | \$0                                   | \$0                  |                     |  |
| 73EBR         | ASSY RATE-DEFL   | \$99                              | \$42                | \$2                                   | \$0                  |                     |  |
| 73EBS         | ASSY OVERFLOW R  | \$32                              | \$146               | \$1                                   | \$0                  |                     |  |
| 73EBT         | ASSY FUCTION C   | \$4                               | \$0                 | \$0                                   | \$0                  |                     |  |
| 73EBU         | ASSY CLOCK CHEK  | \$131                             | \$499               | \$3                                   | \$0                  |                     |  |
| 73EBV         | ASSY PARAMETR C  | \$16                              | \$0                 | \$0                                   | \$0                  |                     |  |
| 73EBZ         | PWR SUPPLY LOW   | \$66                              | \$0                 | \$0                                   | \$0                  |                     |  |
| 73ECO         | MT ELECT EQUIPM  | \$483                             | \$0                 | \$0                                   | \$0                  |                     |  |
| 73ECA         | ASSY FAN         | \$476                             | \$0                 | \$0                                   | \$0                  |                     |  |
| 73EDO         | WIRING CONNS PI  | \$438                             | \$0                 | \$0                                   | \$0                  |                     |  |
| 73EXX         |                  | \$106,822                         | \$130,776           | \$5,071                               | \$674                |                     |  |
| 73FOO         | INERTIAL MSURMN  | \$46,749                          | \$4,660             | \$36                                  | \$0                  |                     |  |
| 73FAO         | UNIT INERTIAL M  | \$85,000                          | \$245,980           | \$4,531                               | \$0                  |                     |  |
| 73FAD         | BOARD CAPRI      | \$368                             | \$14,175            | \$598                                 | \$0                  |                     |  |
| 73FAE         | MODULE GIMBAL L  | \$128                             | \$6,604             | \$95                                  | \$0                  |                     |  |
| 73FAF         | MODULE PWR SUP   | \$144                             | \$3,324             | \$13                                  | \$0                  |                     |  |
| 73FAG         | MODULE MODE SHI  | \$146                             | \$3,915             | \$12                                  | \$0                  |                     |  |
| 73FAA         | GYROSCOPE 2 AXIS | \$16                              | \$0                 | \$0                                   | \$0                  |                     |  |
| 73FAV         | CLSTR CONT THPT  | \$16                              | \$23                | \$1                                   | \$0                  |                     |  |
| 73FEO         | RACK ELEC EQUIP  | \$690                             | \$0                 | \$0                                   | \$0                  |                     |  |
| 73FCO         | CONTROLLER IMS   | \$2,205                           | \$1,595             | \$32                                  | \$0                  |                     |  |
| 73FC9         | NOC              | \$30                              | \$0                 | \$0                                   | \$0                  |                     |  |
| 73FDD         | ADPTR PWR SP LS  | \$50,101                          | \$35,090            | \$790                                 | \$0                  |                     |  |
| 73FD9         | NOC              | \$250                             | \$0                 | \$0                                   | \$0                  |                     |  |
| 73FDB         | CARD SEQUENCER   | \$102                             | \$505               | \$2                                   | \$0                  |                     |  |
| 73FDC         | CARD SEQUENCER   | \$128                             | \$2,242             | \$42                                  | \$0                  |                     |  |
| 73FDD         | MODULE 800 HZ    | \$77                              | \$240               | \$3                                   | \$0                  |                     |  |
| 73FDE         | MODULE HEAD REP  | \$3,604                           | \$5,967             | \$111                                 | \$0                  |                     |  |
| 73FDG         | CARD RELAY DRIV  | \$139                             | \$672               | \$6                                   | \$0                  |                     |  |
| 73FDH         | CARD RELAY DRIV  | \$23                              | \$426               | \$20                                  | \$0                  |                     |  |
| 73FDJ         | MODULE ROL-PITC  | \$113                             | \$0                 | \$0                                   | \$0                  |                     |  |
| 73FDK         | DRIVER AMPLIFIE  | \$61                              | \$0                 | \$0                                   | \$0                  |                     |  |
| 73FDM         | CARD PWR SUPPLY  | \$115                             | \$839               | \$18                                  | \$0                  |                     |  |
| 73FDN         | CARD PWR SUPPLY  | \$54                              | \$605               | \$11                                  | \$0                  |                     |  |
| 73FDQ         | CARD PWR SUPPLY  | \$859                             | \$924               | \$19                                  | \$0                  |                     |  |
| 73FEC         | CARD PWR SUPPLY  | \$25                              | \$238               | \$4                                   | \$0                  |                     |  |

DTI  
 WEAPON SYSTEM A007D OALC  
 APP 6-110766-1 DATA AS OF 79 DEC  
 LOGISTIC SUPPORT COST RANKING  
 LSC BREAKDOWN  
 LOG-LO(Q)7953  
 Q-K051--PN4-LQ-PQ2  
 DATE PROCESSED

| WUC   | NOUN             | QUARTERLY VALUES |                  |                | CONDEMNATION COST |
|-------|------------------|------------------|------------------|----------------|-------------------|
|       |                  | FIELD MAINT      | SPEC REPAIR COST | PACK-SHIP COST |                   |
| 73EAV | CIR DRD ER AMP/  | \$384            | \$2,033          | \$9            | \$41              |
| 73EAM | CIR BRD OUTPT R  | \$580            | \$1,372          | \$17           | \$100             |
| 73EBD | SIGNAL DATA PRO  | \$17,087         | \$6,975          | \$182          | \$0               |
| 73EB9 | NOC              | \$33             | \$0              | \$0            | \$0               |
| 73EBA | ASSY DATA INPUT  | \$21             | \$296            | \$2            | \$0               |
| 73EBB | ASSY ADDER/MEMO  | \$172            | \$0              | \$0            | \$0               |
| 73EBC | ASSY PROCESOR C  | \$16             | \$202            | \$3            | \$0               |
| 73EDE | ASSY DISCRETE I  | \$16             | \$121            | \$2            | \$0               |
| 73EBH | ASSY INSTRUCTION | \$181            | \$525            | \$3            | \$0               |
| 73EDJ | ASSY STR CONT R  | \$82             | \$0              | \$0            | \$0               |
| 73EDL | ASSY STORE CONT  | \$16             | \$0              | \$0            | \$0               |
| 73EBP | ASSY ANALOG OUT  | \$7              | \$568            | \$2            | \$0               |
| 73EBQ | ASSY ANALOG INP  | \$92             | \$246            | \$5            | \$0               |
| 73EBR | ASSY RATE-DEFL   | \$13             | \$324            | \$3            | \$0               |
| 73EBS | ASSY OVERFLOW R  | \$41             | \$0              | \$1            | \$0               |
| 73EDT | ASSY FUNCTION C  | \$33             | \$134            | \$1            | \$0               |
| 73EDU | ASSY CLOCK CHEK  | \$114            | \$684            | \$2            | \$0               |
| 73EBV | ASSY PARAMETR C  | \$8              | \$135            | \$1            | \$0               |
| 73ECO | MT ELEC EQUIPM   | \$866            | \$0              | \$0            | \$0               |
| 73ECA | ASSY FAN         | \$57             | \$0              | \$0            | \$0               |
| 73EEO | WIRING CONNS PI  | \$565            | \$0              | \$0            | \$0               |
| 73EXX |                  | \$109,909        | \$172,860        | \$6,785        | \$1,264           |
| 73FDD | INERTIAL MSURN   | \$53,750         | \$2,213          | \$66           | \$0               |
| 73FAD | UNIT INERTIAL M  | \$65,264         | \$154,714        | \$2,822        | \$0               |
| 73FAD | BOARD CAPRI      | \$362            | \$6,398          | \$88           | \$0               |
| 73FAE | MODULE GIBBAL L  | \$238            | \$2,006          | \$9            | \$0               |
| 73FAF | MODULE PWR SUP   | \$662            | \$4,560          | \$17           | \$0               |
| 73FAG | MODULE MODE SWI  | \$431            | \$2,325          | \$7            | \$0               |
| 73FAD | GYROSCOPE 2 AXIS | \$230            | \$0              | \$0            | \$0               |
| 73FAU | AUX IMP CONT AM  | \$13             | \$0              | \$0            | \$0               |
| 73FAV | CLSTR CONT TMPT  | \$16             | \$0              | \$0            | \$0               |
| 73FBD | BACK ELEC EQUIP  | \$701            | \$0              | \$0            | \$0               |
| 73FCD | CONTROLLER IMS   | \$1,123          | \$331            | \$6            | \$0               |
| 73FCA | FRONT PANEL      | \$453            | \$0              | \$0            | \$0               |
| 73FDD | ADPTR PWR SP LS  | \$61,505         | \$27,287         | \$541          | \$0               |
| 73.09 | NOC              | \$41             | \$0              | \$0            | \$0               |
| 73FDB | CARD SEQUENCER   | \$110            | \$530            | \$5            | \$0               |

| WEAPON SYSTEM   |                   | ADDTD             | OCALC            | LOGISTIC SUPPORT COST RANVING |   | QUARTERLY VALUES |  | DATE PROCESSED |       |
|-----------------|-------------------|-------------------|------------------|-------------------------------|---|------------------|--|----------------|-------|
| AFM 45-110/66-1 |                   | DATA AS OF 79 SEP |                  | LSC BREAKDOWN                 |   | PACK-SHIP COST   |  |                |       |
| MUC             | NGUIN             | FIELD MAINT       | SPEC REPAIR COST | CONDENATION COST              |   |                  |  |                |       |
| 73EAS           | ASSY RTE          | \$369             | \$4,157          | \$0                           |   |                  |  |                |       |
| 73EAT           | PWR SUPPLY LOW V  | \$4,016           | \$1,120          | \$158                         |   |                  |  |                | \$28  |
| 73EAD           | PRNT CIR BPD IN   | \$317             | \$842            | \$12                          |   |                  |  |                | \$114 |
| 73EAV           | CIR BRD ER AMP/   | \$305             | \$1,418          | \$7                           |   |                  |  |                | \$44  |
| 73EAW           | CIR BRD OUTPT R   | \$190             | \$980            | \$11                          |   |                  |  |                | \$142 |
| 73EAY           | SENSOR AUTO BRI   | \$66              | \$0              | \$0                           |   |                  |  |                | \$0   |
| 73EBQ           | SIGNAL DATA PRO   | \$24,680          | \$5,648          | \$145                         |   |                  |  |                | \$0   |
| 73EBT           | CIRCUIT BOARD R   | \$107             | \$146            | \$1                           |   |                  |  |                | \$0   |
| 73EB4           | ASSY RECTIFIER B  | \$8               | \$0              | \$0                           | P |                  |  |                | \$0   |
| 73EBA           | ASSY DATA INPUT   | \$45              | \$151            | \$0                           | P |                  |  |                | \$0   |
| 73EBB           | ASSY ADDER/MEMO   | \$126             | \$596            | \$2                           | P |                  |  |                | \$0   |
| 73EBC           | ASSY PROCESOR C   | \$54              | \$404            | \$6                           |   |                  |  |                | \$0   |
| 73ECE           | ASSY DISCRETE I   | \$16              | \$122            | \$2                           |   |                  |  |                | \$0   |
| 73EBH           | ASSY INSTRUCTION  | \$61              | \$652            | \$4                           |   |                  |  |                | \$0   |
| 73EBJ           | ASSY STR CONT R   | \$172             | \$127            | \$1                           | P |                  |  |                | \$0   |
| 73EBK           | ASSY DRIVER TRAN  | \$60              | \$784            | \$4                           |   |                  |  |                | \$0   |
| 73EBL           | ASSY STORE CONT   | \$54              | \$858            | \$3                           |   |                  |  |                | \$0   |
| 73EBM           | ASSY CORE PLANE   | \$24              | \$117            | \$1                           |   |                  |  |                | \$0   |
| 73EBP           | ASSY ANALOG OUT   | \$414             | \$2,556          | \$10                          |   |                  |  |                | \$517 |
| 73EBQ           | ASSY ANALOG INP   | \$163             | \$2,765          | \$3                           |   |                  |  |                | \$0   |
| 73EBR           | ASSY RATE-DEFL    | \$567             | \$2,716          | \$4                           | P |                  |  |                | \$0   |
| 73EBS           | ASSY OVERFLOW R   | \$76              | \$669            | \$3                           |   |                  |  |                | \$0   |
| 73EBT           | ASSY FUNCTION C   | \$71              | \$134            | \$1                           |   |                  |  |                | \$0   |
| 73EBU           | ASSY CLOCK REF    | \$26              | \$518            | \$3                           |   |                  |  |                | \$0   |
| 73EBV           | ASSY PARAMETR C   | \$24              | \$0              | \$0                           |   |                  |  |                | \$0   |
| 73ECO           | MT ELECT EQUIPH   | \$711             | \$0              | \$0                           |   |                  |  |                | \$0   |
| 73ECA           | ASSY FAN          | \$117             | \$0              | \$0                           |   |                  |  |                | \$0   |
| 73ECG           | WIRING CONNS CI   | \$325             | \$2,157          | \$44                          |   |                  |  |                | \$0   |
| 73EY            |                   | \$116,180         | \$175,019        | \$6,110                       |   |                  |  |                | \$889 |
| 73ECC           | INERTIAL MOUNTING | \$63,432          | \$2,157          | \$44                          | P |                  |  |                | \$0   |
| 73EAD           | UNIT INERTIAL M   | \$97,117          | \$286,560        | \$5,129                       |   |                  |  |                | \$0   |
| 73EAG           | NOG               | \$56              | \$0              | \$0                           |   |                  |  |                | \$0   |
| 73EAF           | BOARD CAPRI       | \$287             | \$5,355          | \$5                           |   |                  |  |                | \$0   |
| 73EAF           | MODULE CTRBAT I   | \$425             | \$6,966          | \$29                          |   |                  |  |                | \$0   |
| 73EAF           | MODULE PWR SUP    | \$238             | \$3,432          | \$11                          |   |                  |  |                | \$0   |
| 73EAG           | MODULE MODE CUI   | \$169             | \$2,574          | \$7                           |   |                  |  |                | \$0   |
| 73EAF           | ACCUMTER 2 AXIS   | \$41              | \$0              | \$0                           |   |                  |  |                | \$0   |

C11  
 WEAPON SYSTEM A0070 OALC  
 AFM 65-110766-1 DATA AS OF 79 JUN  
 LOGISTIC SUPPORT COST RANKING  
 CURRENT QUARTER COMPUTATION  
 2-K051-PNC-LQ-M02  
 DATE PROCESSED

| MUC   | NOUN             | FIELD<br>MAINT | QUARTERLY VALUES     |                   |         | CONDEMNATION<br>COST |
|-------|------------------|----------------|----------------------|-------------------|---------|----------------------|
|       |                  |                | SPEC. REPAIR<br>COST | PACK-SHIP<br>COST |         |                      |
| 73EBC | ASSY PROCESOR C  | \$8            | \$208                | \$3               | \$0     | \$0                  |
| 73EBE | ASSY DISCRETE I  | \$10           | \$93                 | \$2               | \$122   | \$0                  |
| 73EBH | ASSY INSTRUCTION | \$94           | \$360                | \$2               | \$0     | \$0                  |
| 73EBJ | ASSY STR COP R   | \$304          | \$128                | \$1               | \$0     | \$0                  |
| 73EBK | ASSY DRIVER TRAN | \$115          | \$921                | \$4               | \$0     | \$0                  |
| 73EBL | ASSY STORE CONT  | \$181          | \$873                | \$3               | \$0     | \$0                  |
| 73EBM | ASSY CORE PLANE  | \$149          | \$329                | \$3               | \$1,714 | \$0                  |
| 73EBP | ASSY ANALOG OUT  | \$312          | \$2,166              | \$7               | \$0     | \$0                  |
| 73EBQ | ASSY ANALOG INP  | \$140          | \$528                | \$2               | \$0     | \$0                  |
| 73EBR | ASSY RATE-DEFL   | \$25           | \$666                | \$2               | \$0     | \$0                  |
| 73EBT | ASSY FUNCTION C  | \$49           | \$0                  | \$2               | \$0     | \$0                  |
| 73EBU | ASSY CLOCK CHEK  | \$115          | \$378                | \$2               | \$0     | \$0                  |
| 73EBX | PHR SUPPLY 5 VOL | \$112          | \$0                  | \$0               | \$0     | \$0                  |
| 73EBZ | PHR SUPPLY LOW   | \$8            | \$242                | \$5               | \$0     | \$0                  |
| 73ECD | MT ELECT EQUIPM  | \$1,450        | \$0                  | \$0               | \$0     | \$0                  |
| 73ECA | ASSY FAN         | \$230          | \$0                  | \$0               | \$0     | \$0                  |
| 73EEO | WIPIG CONNS PI   | \$1,832        | \$0                  | \$0               | \$0     | \$0                  |
| 73EXX |                  | \$110,283      | \$120,190            | \$5,976           | \$2,337 |                      |
| 73F00 | INERTIAL MSURMH  | \$58,631       | \$0                  | \$0               | \$0     | \$0                  |
| 73F0A | UNIT INERTIAL M  | \$69,190       | \$184,295            | \$3,505           | \$0     | \$0                  |
| 73F09 | NOC              | \$54           | \$0                  | \$0               | \$0     | \$0                  |
| 73F0D | BOARD CAPRI      | \$125          | \$1,750              | \$2               | \$0     | \$0                  |
| 73F0E | MODULE GIMBAL L  | \$218          | \$2,113              | \$10              | \$0     | \$0                  |
| 73F0F | MODULE PNP SUP   | \$22           | \$666                | \$6               | \$0     | \$0                  |
| 73F0G | MODULE MODE SWI  | \$74           | \$1,492              | \$4               | \$0     | \$0                  |
| 73F0H | RACK ELEC EQUIP  | \$796          | \$0                  | \$0               | \$0     | \$0                  |
| 73F0I | CONTROLLER IMS   | \$2,639        | \$812                | \$13              | \$0     | \$0                  |
| 73F0J | NOC              | \$148          | \$0                  | \$0               | \$0     | \$0                  |
| 73F0B | FRONT PANEL      | \$110          | \$0                  | \$0               | \$0     | \$0                  |
| 73F0N | ADPTR PMR SP LS  | \$47,539       | \$11,024             | \$351             | \$0     | \$0                  |
| 73F09 | NOC              | \$450          | \$0                  | \$0               | \$0     | \$0                  |
| 73F0B | CARD SEQUENCER   | \$274          | \$417                | \$3               | \$0     | \$0                  |
| 73F0C | CARD SEQUENCER   | \$413          | \$904                | \$6               | \$0     | \$0                  |
| 73F0D | MODULE 800 HZ    | \$523          | \$530                | \$8               | \$0     | \$0                  |
| 73F0E | MODULE HEAD REP  | \$4,665        | \$6,982              | \$145             | \$0     | \$0                  |
| 73F0G | CARD RELAY DRIV  | \$53           | \$372                | \$1               | \$0     | \$0                  |
| 73F0H | CARD RELAY DRIV  | \$50           | \$150                | \$1               | \$0     | \$0                  |
| 73F0I | DENSE SUPPLY     | \$82           | \$0                  | \$0               | \$0     | \$0                  |

C11  
 WEAPON SYSTEM A007D OCALC K051.PN44  
 AFM 65-110/66-1 DATA AS OF 78 DEC DATE PROCESSED

LOGISTIC SUPPORT COST RANKING  
 CURRENT QUARTER COMPUTATION

| HUC   | NOUN             | FIELD<br>MAINT | QUARTERLY VALUES    |                   |          | CONDENSATION<br>COST |
|-------|------------------|----------------|---------------------|-------------------|----------|----------------------|
|       |                  |                | SPEC REPAIR<br>COST | PACK-SHIP<br>COST |          |                      |
| 73EDL | ASSY STORE CONT  | \$85           | \$1,460             | \$5               | \$0      |                      |
| 73EBM | ASSY CORE PLANE  | \$56           | \$348               | \$5               | \$2,720  |                      |
| 73EDP | ASSY ANALOG C/JT |                | \$2,504             | \$9               | \$0      |                      |
| 73EDQ | ASSY ANALOG INP  |                | \$1,064             | P                 | \$0      |                      |
| 73EDR | ASSY RATE-DEFL   | \$300          | \$1,998             | \$0               | \$0      |                      |
| 73EDS | ASSY OVERFLOW R  |                | \$57                | \$2               | \$0      |                      |
| 73EBT | ASSY FUNCTION C  | \$57           | \$129               | \$1               | \$0      |                      |
| 73EDU | ASSY CLOCK CHEK  | \$93           | \$1,330             | \$1               | \$0      |                      |
| 73EDX | PWR SUPPLY 5 VOL | \$49           | \$398               | \$11              | \$0      |                      |
| 73EDZ | PWR SUPPLY LON   | \$66           | \$244               | \$5               | \$0      |                      |
| 73ECO | MT ELEC EQUIPM   | \$1,162        | \$0                 | \$0               | \$0      |                      |
| 73ECA | ASSY FAN         | \$138          | \$0                 | \$0               | \$0      |                      |
| 73EDQ | WIRING CONNS PI  | \$120          | \$0                 | \$0               | \$0      |                      |
| 73EXX |                  | \$137,712      | \$210,294           | \$5,725           | \$16,019 |                      |
| 73FDO | INERTIAL MSURMN  | \$52,836       | \$0                 | \$0               | \$0      |                      |
| 73FAO | UNIT INERTIAL M  | \$94,732       | \$206,724           | \$3,932           | \$0      |                      |
| 73FA9 | NOC              | \$155          | \$0                 | \$0               | \$0      |                      |
| 73FAD | BOARD CAPRI      | \$134          | \$4,542             | \$0               | \$0      |                      |
| 73FAE | MODULE GIMBAL L  | \$216          | \$3,598             | \$21              | \$0      |                      |
| 73FAF | MODULE PWR SUP   | \$139          | \$3,327             | \$21              | \$0      |                      |
| 73FAG | MODULE MODE SWI  | \$121          | \$1,605             | \$5               | \$0      |                      |
| 73FAP | GYROSCOPE X-Y AX | \$36           | \$0                 | \$0               | \$0      |                      |
| 73FBO | RACK ELEC EQUIP  | \$889          | \$1,047             | \$44              | P        |                      |
| 73FCO | CONTROLLER IMS   | \$2,804        | \$2,802             | \$38              | \$0      |                      |
| 73FC9 | NOC              | \$5            | \$0                 | \$0               | \$0      |                      |
| 73FCB | FRONT PANEL      | \$131          | \$0                 | \$0               | \$0      |                      |
| 73FDO | ADPTR PWR SP LS  | \$58,723       | \$8,756             | \$352             | \$0      |                      |
| 73FD9 | NOC              | \$273          | \$0                 | \$0               | \$0      |                      |
| 73FDB | CARD SEQUENCER   | \$115          | \$1,088             | \$9               | \$0      |                      |
| 73FDC | CARD SEQUENCER   | \$122          | \$1,078             | \$7               | \$0      |                      |
| 73FDD | MODULE 800 HZ    | \$118          | \$395               | \$4               | \$0      |                      |
| 73FDE | MODULE HEAD REP  | \$4,627        | \$9,828             | \$180             | \$0      |                      |
| 73FDG | CARD RELAY DRIV  | \$126          | \$1,103             | \$12              | \$0      |                      |
| 73FDH | CARD RELAY DRIV  | \$29           | \$830               | \$5               | \$0      |                      |
| 73FDK | DRIVER AMPLIFIE  | \$24           | \$468               | \$9               | P        |                      |
| 73FDM | CARD PWR SUPPLY  | \$133          | \$4,836             | \$36              | \$0      |                      |
| 73FDN | CARD PWR SUPPLY  | \$13           | \$95                | \$2               | \$0      |                      |
| 73FDP | CARD PWR SUPPLY  | \$31           | \$270               | \$9               | \$0      |                      |

G11  
WEAPON SYSTEM A007D OALC  
AFM 65-110/66-1 DATA AS OF 78 SEP

K051.PNLM  
DATE PROCESSED

LOGISTIC SUPPORT COST RANKING  
CURRENT QUARTER COMPUTATION

| MUC     | MOUN             | FIELD<br>MAINT | QUARTERLY VALUES    |                   |   | CONDENATION<br>COST |
|---------|------------------|----------------|---------------------|-------------------|---|---------------------|
|         |                  |                | SPEC REPAIR<br>COST | PACK-SHIP<br>COST |   |                     |
| 73EBU   | ASSY CLOCK CHEK  | \$1,503        | P                   | \$1,779           | P | \$14                |
| 73EBV   | ASSY PARAMETR C  | \$22           |                     | \$146             |   | \$0                 |
| 73EBX   | PHR SUPPLY 5 VOL | \$107          |                     | \$0               |   | \$0                 |
| 73EBZ   | PHR SUPPLY LOW   | \$16           |                     | \$0               |   | \$0                 |
| 73EC0   | MT ELECT EQUIPM  | \$1,184        |                     | \$0               |   | \$0                 |
| 73ECA   | ASSY FAN         | \$373          |                     | \$0               |   | \$0                 |
| 73ED0   | WIRING CONNS PI  | \$670          |                     | \$0               |   | \$0                 |
| 73EXX   |                  | \$146,171      | \$141,953           | \$4,635           |   | \$6,704             |
| 73F00   | INERTIAL MSURN   | \$61,925       |                     | \$6,455           |   | \$0                 |
| X 73FA0 | UNIT INERTIAL M  | \$98,908       |                     | \$280,665         |   | \$0                 |
| 73FA9   | NOC              | \$57           |                     | \$0               |   | \$0                 |
| 73FAD   | BOARD CAPRI      | \$306          |                     | \$3,414           |   | \$0                 |
| 73FAE   | MODULE GIMBAL L  | \$178          |                     | \$1,072           |   | \$0                 |
| 73FAF   | MODULE PHR SUP   | \$85           |                     | \$2,562           |   | \$0                 |
| 73FAG   | MODULE MODE SHI  | \$118          |                     | \$1,360           |   | \$0                 |
| 73FBO   | RACK ELEC EQUIP  | \$864          |                     | \$0               |   | \$0                 |
| 73FC0   | CONTROLLER IMS   | \$2,716        |                     | \$1,386           |   | \$0                 |
| 73FC9   | NOC              | \$123          |                     | \$0               |   | \$0                 |
| 73FCB   | FRONT PANEL      | \$159          |                     | \$0               |   | \$0                 |
| 73FDO   | ADPTR PHR SP LS  | \$63,985       |                     | \$19,726          |   | \$0                 |
| 73FD9   | NOC              | \$488          |                     | \$144             |   | \$0                 |
| 73FDB   | CARD SEQUENCER   | \$152          |                     | \$810             |   | \$0                 |
| 73FDC   | CARD SEQUENCER   | \$273          | P                   | \$2,090           | P | \$0                 |
| 73FDD   | MODULE 800 HZ    | \$127          |                     | \$2,099           |   | \$0                 |
| 73FDE   | MODULE HEAD REP  | \$4,598        | P                   | \$10,715          | P | \$0                 |
| 73FDF   | MODULE RELAY DR  | \$16           | P                   | \$460             | P | \$0                 |
| 73FDG   | CARD RELAY DRIV  | \$196          |                     | \$1,322           |   | \$0                 |
| 73FDH   | CARD RELAY DRIV  | \$170          |                     | \$1,835           |   | \$0                 |
| 73FDJ   | MODULE ROL-PTC   | \$381          |                     | \$0               |   | \$0                 |
| 73FDK   | DRIVER AMPLIFIE  | \$105          |                     | \$0               |   | \$0                 |
| 73FDM   | CARD PHR SUPPLY  | \$282          |                     | \$2,016           |   | \$0                 |
| 73FDM   | CARD PHR SUPPLY  | \$57           |                     | \$312             |   | \$0                 |
| 73FDP   | CARD PHR SUPPLY  | \$65           |                     | \$222             |   | \$0                 |
| 73FDQ   | CARD PHR SUPPLY  | \$250          |                     | \$2,576           |   | \$0                 |
| 73FDR   | CARD PHR SUPPLY  | \$29           |                     | \$95              |   | \$0                 |
| 73FDT   | FOTHER BOARD CL  | \$16           |                     | \$65              |   | \$0                 |
| 73FDU   | FOTHER BOARD MO  | \$115          |                     | \$144             |   | \$0                 |
| 73FEO   | MOUNT ADPT/PS    | \$209          |                     | \$0               |   | \$0                 |
| 73FF0   | BATTERY PACK IM  | \$255          |                     | \$0               |   | \$0                 |

WEAPON SYSTEM    A0070    OALC    LOGISTIC SUPPORT COST RANKING    K051.PM4M  
 AFM 65-110/66-1 DATA AS OF 78 JUN    CURRENT QUARTER COMPUTATION    DATE PROCESSED

| MUC   | NOUN             | FIELD<br>MAINT | QUARTERLY VALUES    |                   |     | DEMATION<br>COST |
|-------|------------------|----------------|---------------------|-------------------|-----|------------------|
|       |                  |                | SPEC REPAIR<br>COST | PACK-SHIP<br>COST |     |                  |
| 73ED0 | WIRING CONNS PI  | \$245          | \$0                 | \$0               | \$0 | \$0              |
| 73EXX |                  | \$86,843       | \$115,230           | \$2,625           |     | \$4,407          |
| 73F00 | INERTIAL MSURMN  | \$56,783       | \$0                 | \$0               |     | \$0              |
| 73FAD | UNIT INERTIAL M  | \$72,248       | \$271,526           | \$3,096           |     | \$0              |
| 73FAD | BOARD CAPRI      | \$235          | \$6,567             | \$0               |     | \$0              |
| 73FKE | MODULE GYMICAL L | \$175          | \$2,065             | \$11              |     | \$0              |
| 73FAF | MODULE PNR SUP   | \$258          | \$2,659             | \$13              |     | \$0              |
| 73FAG | MODULE MODE SNI  | \$18           | \$222               | \$1               |     | \$0              |
| 73FAK | PLENUM           | \$21           | \$177               | \$2               |     | \$0              |
| 73FAR | ACCLMTR ELECTRM  | \$14           | \$0                 | \$0               |     | \$0              |
| 73FAT | GMLE TNP CONT    | \$18           | \$0                 | \$0               |     | \$0              |
| 73FNO | RACK ELEC EQUIP  | \$923          | \$0                 | \$0               |     | \$0              |
| 73FC0 | CONTROLLER IMS   | \$1,700        | \$796               | \$10              |     | \$0              |
| 73FC9 | HOC              | \$14           | \$0                 | \$0               |     | \$0              |
| 73FC0 | FRONT PANEL      | \$56           | \$0                 | \$0               |     | \$0              |
| 73FD0 | ADPTR PNR SP LS  | \$41,742       | \$14,928            | \$396             | P   | \$0              |
| 73FD9 | MOC              | \$179          | \$0                 | \$0               |     | \$0              |
| 73FDA | MODULE SEQUENCE  | \$63           | \$0                 | \$0               |     | \$0              |
| 73FDD | CARD SEQUENCER   | \$119          | \$798               | \$5               |     | \$0              |
| 73FDC | CARD SEQUENCER   | \$111          | \$1,032             | \$5               |     | \$0              |
| 73FDB | MODULE 800 HZ    | \$174          | \$832               | \$4               |     | \$0              |
| 73FDE | MODULE HEAD REP  | \$1,297        | \$5,746             | \$84              |     | \$0              |
| 73FDF | MODULE RELAY DR  | \$108          | \$0                 | \$0               |     | \$0              |
| 73FDG | CARD RELAY DRIV  | \$329          | \$1,373             | \$10              |     | \$0              |
| 73FDH | CARD RELAY DRIV  | \$81           | \$665               | \$4               |     | \$0              |
| 73FDL | POWER SUPPLY     | \$29           | \$804               | \$1               |     | \$0              |
| 73FDH | CARD PNR SUPPLY  | \$102          | \$1,099             | \$17              |     | \$0              |
| 73FDN | CARD PNR SUPPLY  | \$27           | \$333               | \$5               |     | \$0              |
| 73FDP | CARD PNR SUPPLY  | \$28           | \$137               | \$3               |     | \$0              |
| 73FDB | CARD PNR SUPPLY  | \$111          | \$1,261             | \$16              |     | \$0              |
| 73FDR | CARD PNR SUPPLY  | \$14           | \$97                | \$2               |     | \$0              |
| 73FDS | MODULE BITE      | \$25           | \$240               | \$2               |     | \$0              |
| 73FDO | MOTHER BOARD HO  | \$28           | \$0                 | \$0               |     | \$0              |
| 73FEO | MOUNT ADPT/PS    | \$67           | \$0                 | \$0               |     | \$0              |
| 73FFD | BATTERY PACK IM  | \$126          | \$0                 | \$0               |     | \$0              |
| 73F60 | WTR REMOTE COM   | \$2,335        | \$286               | \$8               |     | \$0              |
| 73FMO | WIRING CONNS PI  | \$3,907        | \$0                 | \$0               |     | \$0              |

P 11  
 WEAPON SYSTEM A007D OALC LOGISTIC SUPPORT COST BREAKDOWN KCS LOG-MMO(Q)7213(3) KCS1.PN4L  
 AFM 65-110/66-1 DATA AS OF 78 MAR CURRENT QUARTER COMPUTATION DATE PROCESSED

| WUC   | HCJN             | FIELD<br>MAINT | QUARTERLY VALUES    |                   |         | COMPLETION |
|-------|------------------|----------------|---------------------|-------------------|---------|------------|
|       |                  |                | SPEC REPAIR<br>COST | PACK-SHIP<br>COST |         |            |
| 73EAW | CIR BRD QUIPT R  | \$337          | \$2,777             | \$20              | \$0     | \$0        |
| 73EAY | SENSOR AUTO BRI  | \$14           | \$0                 | \$0               | \$0     | \$0        |
| 73EAO | SIGNAL DATA PRO  | \$24,238       | \$16,293            | \$164             | \$3,055 | \$0        |
| 73EO1 | CIRCUIT BOARD R  | \$7            | \$0                 | \$0               | \$0     | \$0        |
| 73EO9 | MOC              | \$189          | \$0                 | \$0               | \$0     | \$0        |
| 73EDA | ASSY DATA INPUT  | \$112          | \$137               | \$1               | \$0     | \$0        |
| 73EDB | ASSY ADDR/DIEMO  | \$62           | \$146               | P                 | \$1     | \$0        |
| 73EDC | ASSY PROCESSOR C | \$84           | \$104               | \$5               | \$0     | \$0        |
| 73EDH | ASSY INSTRUCTION | \$175          | \$342               | \$2               | \$0     | \$0        |
| 73EDJ | ASSY SIR CONT R  | \$197          | \$133               | P                 | \$1     | \$0        |
| 73EDK | ASSY DRIVR TRAN  | \$221          | \$170               | \$1               | \$0     | \$0        |
| 73EDL | ASSY STORE CONT  | \$68           | \$508               | \$2               | \$0     | \$0        |
| 73EDN | ASSY CORE PLANE  | \$200          | \$503               | \$4               | \$1,475 | \$0        |
| 73EBP | ASSY ANALOG OUT  | \$448          | \$6,256             | \$17              | \$304   | \$0        |
| 73EBQ | ASSY ANALOG INP  | \$237          | \$3,020             | \$8               | \$0     | \$0        |
| 73EBR | ASSY RATE-DEEL   | \$112          | \$900               | \$2               | \$0     | \$0        |
| 73EBS | ASSY OVERFLON R  | \$68           | \$350               | \$1               | \$0     | \$0        |
| 73EDT | ASSY FUNCTION C  | \$14           | \$117               | \$1               | \$0     | \$0        |
| 73EDU | ASSY CLOCK CUEK  | \$238          | \$342               | \$2               | \$0     | \$0        |
| 73EDV | ASSY PARAFETR C  | \$28           | \$101               | \$1               | \$0     | \$0        |
| 73EDX | PUR SUPPLY S VOL | \$70           | \$895               | \$20              | \$0     | \$0        |
| 73ERY | ASSY TRANSF/MEA  | \$7            | \$179               | \$1               | \$0     | \$0        |
| 73EBZ | PHR SUPPLY LOH   | \$158          | \$660               | \$12              | \$0     | \$0        |
| 73ECO | MT ELECT EQUIPH  | \$587          | \$0                 | \$0               | \$0     | \$0        |
| 73EL9 | MOC              | \$15           | \$0                 | \$0               | \$0     | \$0        |
| 73ECA | ASSY FAN         | \$81           | \$0                 | \$0               | \$0     | \$0        |
| 73EDO | WIRING CONNS PI  | \$942          | \$0                 | \$0               | \$0     | \$0        |
| 73EXX |                  | \$101,048      | \$161,401           | \$4,655           | \$5,402 | \$0        |
| 73FDO | INERTIAL MSU2MM  | \$45,990       | \$0                 | \$0               | \$0     | \$0        |
| 73FAO | UNIT INERTIAL M  | \$69,022       | \$220,202           | \$2,961           | \$0     | \$0        |
| 73FA9 | MOC              | \$161          | \$0                 | \$0               | \$0     | \$0        |
| 73FAD | BOARD CAPRI      | \$339          | \$8,357             | \$69              | \$0     | \$0        |
| 73FAE | MODULE GIMBAL L  | \$112          | \$2,184             | \$13              | \$0     | \$0        |
| 73FAF | MODULE PHR SUP   | \$128          | \$3,064             | \$13              | \$0     | \$0        |
| 73FAG | MODULE MODE SHI  | \$154          | \$216               | \$13              | \$0     | \$0        |
| 73FED | RACK ELEC EQUIP  | \$1,045        | \$0                 | \$0               | \$0     | \$0        |
| 73FCO | CONTROLLER IHS   | \$1,388        | \$457               | \$5               | \$0     | \$0        |
| 73FEO | MOC              | \$24           | \$0                 | \$0               | \$0     | \$0        |
| 73FEX |                  | \$24           | \$0                 | \$0               | \$0     | \$0        |

P 11  
 WEAPON SYSTEM ANU70 OALC LOGISTIC SUPPORT COST BREAKDOWN RCS LOG-MMO(9)/213(3)  
 AFM 65-110/AA-1 DATA AS OF 77 DEC. CURRENT QUARTER COMPUTATION  
 KUST, PH4L  
 DATE PROCESSED

| WUC   | NOUN             | FIELD<br>MAINT | QUARTERLY VALUES    |                   |  | CONDEMNATION<br>COST |
|-------|------------------|----------------|---------------------|-------------------|--|----------------------|
|       |                  |                | SPEC REPAIR<br>COST | PACK-SHIP<br>COST |  |                      |
| 73EBU | ASSY OVERFLOW R  | \$4            | \$0                 | \$0               |  | \$0                  |
| 73EBV | ASSY CLOCX CHCK  | \$125          | \$1,072             | \$5               |  | \$0                  |
| 73EBW | ASSY PARAMETR C  | \$56           | \$0                 | \$0               |  | \$0                  |
| 73EBX | PWR SUPPLY 5 VUL | \$7            | \$179               | \$4               |  | \$0                  |
| 73EC0 | MT ELECT EQUIPM  | \$564          | \$0                 | \$0               |  | \$0                  |
| 73ECA | ASSY FAN         | \$151          | \$0                 | \$0               |  | \$0                  |
| 73ED0 | WIRING CONNS PT  | \$56           | \$0                 | \$0               |  | \$0                  |
| 73EXX |                  | \$91,540       | \$160,598           | \$4,619           |  | \$0                  |
| 73F00 | INERTIAL MSURMN  | \$43,813       | \$0                 | \$0               |  | \$0                  |
| 73FAU | UNIT INERTIAL M  | \$63,424       | \$166,811           | \$2,546           |  | \$0                  |
| 73FA9 | NOC              | \$81           | \$0                 | \$0               |  | \$0                  |
| 73FAD | BOARD CAPRI      | \$196          | \$3,000             | \$4               |  | \$0                  |
| 73FAE | MODULE GIMBAL I  | \$322          | \$3,710             | \$23              |  | \$0                  |
| 73FAF | MODULE PWR SUP   | \$210          | \$3,258             | \$14              |  | \$0                  |
| 73FAG | MODULE MODE SWI  | \$165          | \$2,052             | \$10              |  | \$0                  |
| 73FAS | GYROSCOPE ELECT  | \$1,085        | \$0                 | \$0               |  | \$0                  |
| 73FBU | RACK ELEC EQUIP  | \$1,179        | \$0                 | \$0               |  | \$0                  |
| 73FBU | CONTROLLER IMS   | \$2,043        | \$1,308             | \$14              |  | \$0                  |
| 73FCB | FRONT PANEL      | \$78           | \$0                 | \$0               |  | \$0                  |
| 73FDO | ADPTR PWR SP LS  | \$38,209       | \$10,619            | \$231             |  | \$0                  |
| 73FD9 | NOC              | \$116          | \$0                 | \$0               |  | \$0                  |
| 73FDB | CARD SEQUENCER   | \$178          | \$1,904             | \$11              |  | \$0                  |
| 73FDC | CARD SEQUENCER   | \$167          | \$1,008             | \$9               |  | \$0                  |
| 73FDD | MODULE 800 HZ    | \$671          | \$428               | \$4               |  | \$0                  |
| 73FDE | MODULE HEAD REP  | \$2,366        | \$6,783             | \$109             |  | \$0                  |
| 73FDF | MODULE RELAY DR  | \$14           | \$362               | \$2               |  | \$0                  |
| 73FDG | CARD RELAY DRIV  | \$354          | \$1,988             | \$11              |  | \$0                  |
| 73FDH | CARD RELAY DRIV  | \$67           | \$950               | \$4               |  | \$0                  |
| 73FDL | POWER SUPPLY     | \$14           | \$102               | \$4               |  | \$0                  |
| 73FDM | CARD PWR SUPPLY  | \$97           | \$1,971             | \$22              |  | \$0                  |
| 73FDN | CARD PWR SUPPLY  | \$46           | \$438               | \$5               |  | \$0                  |
| 73FDP | CARD PWR SUPPLY  | \$35           | \$456               | \$10              |  | \$0                  |
| 73FDQ | CARD PWR SUPPLY  | \$155          | \$3,812             | \$55              |  | \$0                  |
| 73FDP | CARD PWR SUPPLY  | \$81           | \$887               | \$9               |  | \$0                  |
| 73FDS | MODULE EITE      | \$7            | \$123               | \$1               |  | \$0                  |
| 73FDT | MOTHER BOARD CL  | \$62           | \$454               | \$32              |  | \$0                  |
| 73FDU | MOTHER BOARD MO  | \$7            | \$91                | \$0               |  | \$0                  |
| 73FDV | WTR REMOTE COM   | \$806          | \$444               | \$12              |  | \$0                  |
| 73FDW | WIRING CONNS PT  | \$5,637        | \$0                 | \$1               |  | \$0                  |

C 11  
 WEAPON SYSTEM A007D OALC LOGISTIC SUPPORT COST BREAKDOWN RCS LOG-MMO(Q)7213(3)  
 AFM 65-110/66-1 DATA AS OF 77 SEP CURRENT QUARTER COMPUTATION K051.PN4L  
 DATE PROCESSED

| MUC   | NOUN             | FIELD<br>MAINT | QUARTERLY VALUES    |                   |          | CONDENATION<br>COST |
|-------|------------------|----------------|---------------------|-------------------|----------|---------------------|
|       |                  |                | SPEC REPAIR<br>COST | PACK-SHIP<br>COST |          |                     |
| 73EAM | MODULE HIGH VOL  | \$182          | \$1,862             | \$8               | \$0      | \$0                 |
| 73EAP | PRINTED WIRE BD  | \$25           | \$1,794             | \$2               | \$0      | \$0                 |
| 73EAP | AMPLIFIER DEFLEC | \$98           | \$1,640             | \$8               | \$0      | \$0                 |
| 73EAR | ASSY VIDEO       | \$374          | \$2,817             | \$8               | \$0      | \$0                 |
| 73EAS | ASSY BITE        | \$372          | \$2,555             | \$13              | \$0      | \$0                 |
| 73EAT | PUR SUPPLY LOW V | \$2,974        | \$3,404             | \$19              | \$0      | \$0                 |
| 73EAU | PRINT CIR BRD IN | \$349          | \$1,314             | \$4               | \$0      | \$0                 |
| 73EAV | CIR BRD CR AMP/  | \$407          | \$1,380             | \$5               | \$0      | \$0                 |
| 73EAW | CIR BRD OUTPT R  | \$594          | \$4,898             | \$29              | \$15     | \$15                |
| 73EAX | ASSY RECTIFIER B | \$18           | \$0                 | \$0               | \$0      | \$0                 |
| 73EBO | SIGNAL DATA PRO  | \$21,762       | \$11,743            | \$138             | \$28     | \$28                |
| 73EB3 | CHASIS ELECTRMIC | \$14           | \$0                 | \$0               | \$131    | \$131               |
| 73EB9 | HOC              | \$14           | \$0                 | \$0               | \$0      | \$0                 |
| 73EBA | ASSY DATA INPUT  | \$63           | \$264               | \$2               | \$0      | \$0                 |
| 73EBD | ASSY ADDER/MEMO  | \$28           | \$0                 | \$0               | \$0      | \$0                 |
| 73EBC | ASSY PROCESOR C  | \$24           | \$460               | \$6               | \$0      | \$0                 |
| 73EBH | ASSY INSTRUCTION | \$120          | \$1,026             | \$5               | \$0      | \$0                 |
| 73EBJ | ASSY STR CONT R  | \$60           | \$0                 | \$0               | \$0      | \$0                 |
| 73EBK | ASSY DRIVER TRAN | \$59           | \$473               | \$3               | \$0      | \$0                 |
| 73EBL | ASSY STORE CONT  | \$70           | \$0                 | \$0               | \$0      | \$0                 |
| 73EBM | ASSY CORE PLANE  | \$70           | \$222               | \$0               | \$490    | \$490               |
| 73EBP | ASSY ANALOG OUT  | \$287          | \$2,717             | \$5               | \$166    | \$166               |
| 73EBQ | ASSY ANALOG INP  | \$295          | \$3,182             | \$7               | \$0      | \$0                 |
| 73EBR | ASSY RATE-DEFL   | \$7            | \$284               | \$1               | \$0      | \$0                 |
| 73EBT | ASSY FUNCTION C  | \$74           | \$204               | \$2               | \$0      | \$0                 |
| 73EBU | ASSY CLOCK CHEK  | \$204          | \$312               | \$2               | \$0      | \$0                 |
| 73EBV | ASSY PARAMETR C  | \$21           | \$101               | \$1               | \$0      | \$0                 |
| 73EBX | PWR SUPPLY 5 VOL | \$4            | \$179               | \$4               | \$0      | \$0                 |
| 73EBZ | PWR SUPPLY LOW   | \$42           | \$220               | \$4               | \$0      | \$0                 |
| 73ECO | MT ELECT EQUIPM  | \$2,297        | \$141               | \$6               | \$16     | \$16                |
| 73EDO | WIRING COUINS PI | \$32           | \$0                 | \$0               | \$0      | \$0                 |
| 73EXX |                  | \$108,982      | \$188,335           | \$4,938           | \$34,318 |                     |
| 73F00 | INERTIAL MSURMN  | \$69,275       | \$0                 | \$0               | \$0      | \$0                 |
| 73FA0 | UNIT INERTIAL M  | \$69,613       | \$217,833           | \$3,543           | \$0      | \$0                 |
| 73FA9 | HOC              | \$196          | \$0                 | \$0               | \$0      | \$0                 |
| 73FAD | BOARD CAPRI      | \$466          | \$7,337             | \$9               | \$0      | \$0                 |
| 73FAE | MODULE GIRDAL L  | \$573          | \$6,600             | \$40              | \$0      | \$0                 |
| 73FAF | MODULE PWR SUP   | \$266          | \$2,148             | \$13              | \$0      | \$0                 |

| F 11          |                  | LOGISTIC SUPPORT COST BREAKDOWN RCS LOG-MHO(Q)7213(3) |                  |                |                   | K051.PN4L      |  |
|---------------|------------------|-------------------------------------------------------|------------------|----------------|-------------------|----------------|--|
| WEAPON SYSTEM |                  | AFM 65-110/66-1 DATA AS OF 77 JUN                     |                  |                |                   | DATE PROCESSED |  |
|               |                  | CURRENT QUARTER COMPUTATION                           |                  |                |                   |                |  |
|               |                  | QUARTERLY VALUES                                      |                  |                |                   |                |  |
|               |                  | FIELD MAINT                                           | SPEC REPAIR COST | PACK-SHIP COST | CONDEMNATION COST |                |  |
| WUC           | NOUN             |                                                       |                  |                |                   |                |  |
| 73EXX         |                  | \$113,882                                             | \$129,306        | \$2,971        | \$1,551           |                |  |
| 73F00         | INERTIAL MSURMN  | \$58,282                                              | \$0              | \$0            | \$0               |                |  |
| 73FA0         | UNIT INERTIAL M  | \$66,644                                              | \$105,654        | \$3,761        | \$0               |                |  |
| 73FAE         | BOARD CAPRI      | \$375                                                 | \$11,172         | \$134          | \$0               |                |  |
| 73FAF         | MODULE GTHBAL L  | \$270                                                 | \$1,624          | \$21           | \$0               |                |  |
| 73FAG         | MODULE PHR SUP   | \$315                                                 | \$2,366          | \$21           | \$0               |                |  |
| 73FAM         | MODULE MODE SWI  | \$78                                                  | \$508            | \$1            | \$0               |                |  |
| 73FAN         | ACCLMETER X-Y    | \$0                                                   | \$0              | \$0            | \$0               |                |  |
| 73FAP         | ACCLMETER Z AXIS | \$0                                                   | \$0              | \$0            | \$0               |                |  |
| 73FAQ         | GYROSCOPE X-Y AX | \$0                                                   | \$0              | \$0            | \$0               |                |  |
| 73FAR         | GYROSCOPE Z AXIS | \$14                                                  | \$49             | \$1            | \$0               |                |  |
| 73FAS         | ACCLMTR ELECTRN  | \$0                                                   | \$0              | \$0            | \$100,068         |                |  |
| 73FAT         | GYROSCOPE ELECTR | \$0                                                   | \$0              | \$0            | \$0               |                |  |
| 73FAU         | GIDLE THP CONT   | \$0                                                   | \$0              | \$0            | \$0               |                |  |
| 73FAV         | AUX TMP CONT AM  | \$0                                                   | \$0              | \$0            | \$0               |                |  |
| 73FAM         | CLSTR CONT THPT  | \$0                                                   | \$0              | \$0            | \$0               |                |  |
| 73FBO         | COMPSATION BOAR  | \$7                                                   | \$537            | \$2            | \$0               |                |  |
| 73FDO         | RACK ELEC EQUIP  | \$694                                                 | \$0              | \$0            | \$0               |                |  |
| 73FC0         | CONTROLLER IMS   | \$1,574                                               | \$452            | \$10           | \$0               |                |  |
| 73FCB         | FRONT PANEL      | \$91                                                  | \$0              | \$0            | \$0               |                |  |
| 73FDO         | ADPTR PHR SP LS  | \$45,304                                              | \$12,473         | \$397          | \$0               |                |  |
| 73FDA         | MODULE SEQUENCE  | \$45                                                  | \$155            | \$3            | \$0               |                |  |
| 73FDB         | CARD SEQUENCER   | \$170                                                 | \$637            | \$10           | \$0               |                |  |
| 73FDC         | CARD SEQUENCER   | \$127                                                 | \$620            | \$8            | \$0               |                |  |
| 73FDD         | MODULE 800 HZ    | \$245                                                 | \$720            | \$10           | \$0               |                |  |
| 73FDE         | MODULE HEAD REP  | \$2,741                                               | \$8,316          | \$174          | \$0               |                |  |
| 73FDF         | MODULE RELAY DR  | \$112                                                 | \$0              | \$0            | \$0               |                |  |
| 73FDG         | CARD RELAY DRIV  | \$153                                                 | \$710            | \$8            | \$0               |                |  |
| 73FDH         | CARD RELAY DRIV  | \$165                                                 | \$656            | \$6            | \$0               |                |  |
| 73FDK         | DRIVER AMPLIFIE  | \$24                                                  | \$0              | \$0            | \$467             |                |  |
| 73FDL         | POWER SUPPLY     | \$28                                                  | \$161            | \$4            | \$0               |                |  |
| 73FDM         | CARD PHR SUPPLY  | \$273                                                 | \$1,887          | \$41           | \$0               |                |  |
| 73FDM         | CARD PHR SUPPLY  | \$112                                                 | \$721            | \$11           | \$0               |                |  |
| 73FDP         | CARD PHR SUPPLY  | \$6                                                   | \$73             | \$3            | \$0               |                |  |
| 73FDO         | CARD PHR SUPPLY  | \$154                                                 | \$2,561          | \$31           | \$0               |                |  |
| 73FDB         | CARD PHR SUPPLY  | \$115                                                 | \$760            | \$14           | \$0               |                |  |
| 73FDS         | MODULE BITE      | \$49                                                  | \$168            | \$2            | \$0               |                |  |
| 73FDT         | MOTHER BOARD CL  | \$112                                                 | \$0              | \$0            | \$0               |                |  |
| 73FDO         | MOTHER BOARD MO  | \$27                                                  | \$0              | \$0            | \$0               |                |  |
| 73FEO         | MOUNT ADPT/PS    | \$102                                                 | \$27             | \$0            | \$0               |                |  |
| 73FEO         | BATTERY PACK IM  | \$35                                                  | \$0              | \$0            | \$0               |                |  |

WEAPON SYSTEM A007D OALC LOGISTIC SUPPORT COST BREAKDOWN RCS LOG-HMO(Q)7213(3) K051.PN4L  
 AFM 65-110/66-1 DATA AS OF 77 MAR CURRENT QUARTER COMPUTATION DATE PROCESSED

| MUC   | MOUN             | FIELD<br>MAINT | SPEC REPAIR<br>COST | QUARTERLY VALUES  |   | CONDEMNATION<br>COST |
|-------|------------------|----------------|---------------------|-------------------|---|----------------------|
|       |                  |                |                     | PACK-SHIP<br>COST |   |                      |
| 73EBA | ASSY DATA INPUT  | \$57           | \$110               | \$1               |   | \$0                  |
| 73EBB | ASSY ADDR/MEMO   | \$31           | \$119               | \$1               |   | \$0                  |
| 73EBC | ASSY PROCESOR C  | \$95           | \$148               | \$2               | P | \$0                  |
| 73EDE | ASSY DISCRETE I  | \$136          | \$324               | \$5               |   | \$14                 |
| 73EDH | ASSY INSTRUCTION | \$71           | \$513               | \$2               |   | \$0                  |
| 73EBF | ASSY STR CONT R  | \$164          | \$928               | \$3               | P | \$0                  |
| 73EDK | ASSY DRIVER TRAM | \$77           | \$861               | \$5               |   | \$0                  |
| 73EDL | ASSY STORE CONT  | \$65           | \$711               | \$4               |   | \$18                 |
| 73EBH | ASSY CORE PLANE  | \$150          | \$1,391             | \$9               |   | \$2,022              |
| 73EDP | ASSY ANALOG OUT  | \$343          | \$2,658             | \$12              | P | \$208                |
| 73EDQ | ASSY ANALOG IMP  | \$112          | \$2,590             | \$4               |   | \$0                  |
| 73EDS | ASSY OVERFLOW R  | \$4            | \$0                 | \$0               |   | \$0                  |
| 73EDT | ASSY FUNCTION C  | \$51           | \$194               | \$2               |   | \$0                  |
| 73EBU | ASSY CLOCK CHECK | \$134          | \$584               | \$3               |   | \$0                  |
| 73EDX | PHR SUPPLY 5 VOL | \$39           | \$143               | \$4               |   | \$0                  |
| 73EDY | ASSY TRANSF/HEA  | \$14           | \$0                 | \$0               |   | \$0                  |
| 73EDZ | PHR SUPPLY LOW   | \$35           | \$354               | \$8               |   | \$0                  |
| 73EC0 | MT ELECT EQUIPM  | \$557          | \$139               | \$6               |   | \$16                 |
| 73EC9 | HOC              | \$17           | \$0                 | \$0               |   | \$0                  |
| 73ECA | ASSY FAN         | \$280          | \$0                 | \$0               |   | \$0                  |
| 73ED0 | WIRING CONNS PI  | \$141          | \$0                 | \$0               |   | \$0                  |
| 73EXX |                  | \$127,948      | \$184,153           | \$6,001           |   | \$3,163              |
| 73F00 | INERTIAL MSURMN  | \$62,069       | \$0                 | \$0               |   | \$0                  |
| 73FA0 | UNIT INERTIAL M  | \$66,932       | \$117,998           | \$2,304           | P | \$0                  |
| 73FAD | BOARD CAPRI      | \$235          | \$3,840             | \$6               |   | \$0                  |
| 73FAE | MODULE GINBAL L  | \$465          | \$1,677             | \$23              |   | \$0                  |
| 73FAF | MODULE PHR SUP   | \$447          | \$1,690             | \$16              |   | \$0                  |
| 73FAG | MODULE MODE S/H  | \$182          | \$1,143             | \$7               |   | \$0                  |
| 73FAH | ACCLORMETER X-Y  | \$0            | \$0                 | \$0               |   | \$0                  |
| 73FAI | ACCLMTER Z AXIS  | \$0            | \$0                 | \$0               |   | \$0                  |
| 73FAP | GYROSCPE X-Y AX  | \$0            | \$0                 | \$0               |   | \$0                  |
| 73FAQ | GYROSCPE Z AXIS  | \$0            | \$0                 | \$0               |   | \$0                  |
| 73FAR | ACCLMTR ELECTRM  | \$0            | \$0                 | \$0               |   | \$108,150            |
| 73FAS | GYROSCPE ELECTR  | \$0            | \$0                 | \$0               |   | \$100,068            |
| 73FAT | GMBLE TMP CONT   | \$0            | \$0                 | \$0               |   | \$0                  |
| 73FAU | AUX TMP CONT AM  | \$0            | \$0                 | \$0               |   | \$0                  |
| 73FAV | CLSTR CONT THPT  | \$0            | \$0                 | \$0               |   | \$0                  |
| 73FAW | COMPASATION BOAR | \$0            | \$0                 | \$0               |   | \$0                  |
| 73F00 | RACK ELEC EQUIP  | \$2,005        | \$0                 | \$0               |   | \$0                  |
| 73F00 | CONTROLLER INS   | \$2,764        | \$2,484             | \$21              |   | \$0                  |

D 11  
 WEAPON SYSTEM A007D OALC LOGISTIC SUPPORT COST BREAKDOWN RCS LOG-MMO(0)7213(3)  
 AFM 65-110/66-1 DATA AS OF 76 DEC CURRENT QUARTER COMPUTATION K011.PN4L  
 DATE PROCESSED

| WUC   | NOUN             | FIELD<br>MAINT | SPEC REPAIR<br>COST | QUARTERLY VALUES  |   | CONDEMNATION<br>COST |
|-------|------------------|----------------|---------------------|-------------------|---|----------------------|
|       |                  |                |                     | PACK-SHIP<br>COST |   |                      |
| 73F00 | INERTIAL NSURMN  | \$63,981       | \$0                 | \$0               |   | \$0                  |
| 73FA0 | UNIT INERTIAL M  | \$64,854       |                     | \$3,154           | P | \$0                  |
| 73FA9 | HOC              | \$528          | \$156,114           |                   |   | \$0                  |
| 73FAD | DRARD CAPAI      | \$486          | \$4,320             | \$7               | P | \$0                  |
| 73FAE | MODULE GIMBAL L  | \$281          | \$1,972             | \$27              | P | \$0                  |
| 73FAF | MODULE PHR SUP   | \$199          | \$1,859             | \$18              | P | \$0                  |
| 73FAG | MODULE MODE SWI  | \$224          | \$1,889             | \$6               | P | \$0                  |
| 73FAM | ACCLORHETER X-Y  | \$0            | \$0                 | \$0               |   | \$0                  |
| 73FAN | ACCLTR 2 AXIS    | \$0            | \$0                 | \$0               |   | \$0                  |
| 73FAP | GYROSCOPE X-Y AX | \$0            | \$0                 | \$0               |   | \$0                  |
| 73FAQ | GYROSCOPE 2 AXIS | \$0            | \$0                 | \$0               |   | \$0                  |
| 73FAR | ACCLTRA ELECTRN  | \$10           | \$452               | \$2               | P | \$54,075             |
| 73FAS | GYROSCOPE ELECTR | \$0            | \$0                 | \$0               |   | \$50,034             |
| 73FAT | GIBLE TNP CONT   | \$10           | \$0                 | \$0               |   | \$0                  |
| 73FAU | AUX TNP CONT AM  | \$0            | \$0                 | \$0               |   | \$0                  |
| 73FAV | CLSTR CONT THPT  | \$0            | \$0                 | \$0               |   | \$0                  |
| 73FAW | COMPASATION BOMR | \$0            | \$0                 | \$0               |   | \$0                  |
| 73FDC | RACK ELEC EQUIP  | \$1,172        | \$0                 | \$0               |   | \$0                  |
| 73FC0 | CONTROLLER IMS   | \$1,528        | \$678               | \$14              | P | \$0                  |
| 73FC9 | HOC              | \$406          | \$0                 | \$0               |   | \$0                  |
| 73FCD | FRONT PANEL      | \$71           | \$0                 | \$4               |   | \$0                  |
| 73FDD | ADPTR PHR SP LS  | \$50,200       | \$11,920            | \$431             | P | \$0                  |
| 73FDB | HOC              | \$15           | \$0                 | \$0               |   | \$0                  |
| 73FDB | CARD SEQUENCER   | \$137          | \$441               | \$0               |   | \$0                  |
| 73FDC | CARD SEQUENCER   | \$93           | \$354               | \$5               | P | \$0                  |
| 73FDD | MODULE 800 M2    | \$92           | \$382               | \$5               | P | \$0                  |
| 73FDE | MODULE HEAD REP  | \$2,975        | \$6,160             | \$129             | P | \$0                  |
| 73FDG | CARD RELAY DRIV  | \$152          | \$710               | \$8               | P | \$0                  |
| 73FDH | CARD RELAY DRIV  | \$190          | \$902               | \$9               | P | \$0                  |
| 73FDJ | MODULE ENL-PITC  | \$108          | \$0                 | \$0               |   | \$0                  |
| 73FDK | DRIVER AMPLIFIE  | \$18           | \$0                 | \$0               |   | \$0                  |
| 73FDL | POWER SUPPLY     | \$118          | \$0                 | \$0               |   | \$0                  |
| 73FDM | CARD PHR SUPPLY  | \$199          | \$1,554             | \$34              | P | \$0                  |
| 73FDM | CARD PHR SUPPLY  | \$144          | \$721               | \$11              | P | \$0                  |
| 73FDP | CARD PHR SUPPLY  | \$193          | \$219               | \$10              | P | \$0                  |
| 73FDP | CARD PHR SUPPLY  | \$182          | \$1,970             | \$24              | P | \$0                  |
| 73FDR | CARD PHR SUPPLY  | \$52           | \$380               | \$6               | P | \$0                  |
| 73FDS | MODULE BITE      | \$7            | \$56                | \$1               | P | \$0                  |
| 73FDT | MOTHER BOARD CL  | \$4            | \$0                 | \$0               |   | \$0                  |
| 73FEO | MOUNT ADPT/PS    | \$216          | \$0                 | \$0               |   | \$0                  |
| 73F60 | X-TR REMOTE COM  | \$1,145        | \$165               | \$4               | P | \$0                  |
| 73F60 | X-TR REMOTE COM  | \$2,147        | \$0                 | \$0               |   | \$0                  |

F 11  
 WEAPON SYSTEM A007D OALC LOGISTIC SUPPORT COST BREAKDOWN RCS LOG-MMO(0)7213(3) K051.PN4L  
 AFM 65-110/66-1 DATA AS OF 76 SEP CURRENT QUARTER COMPUTATION DATE PROCESSED

| MUC   | NOUN             | FIELD<br>MAINT | QUARTERLY VALUES    |                   |   | CONDENMATION<br>COST |
|-------|------------------|----------------|---------------------|-------------------|---|----------------------|
|       |                  |                | SPEC REPAIR<br>COST | PACK-SHIP<br>COST |   |                      |
| 73EAE | ASSY TUBE UNIT   | \$517          | \$11,492            | \$82              | P | \$0                  |
| 73EAF | ASSY CATHODE RA  | \$419          | \$9,464             | \$68              | P | \$0                  |
| 73EAG | ASSY CRT MATCHI  | \$141          | \$1                 | \$1               | P | \$0                  |
| 73EAM | PWR SUPPLY HIGH  | \$776          | \$2,898             | \$28              | P | \$0                  |
| 73EAP | MODULE HIGH VOL  | \$7            | \$0                 | \$0               | P | \$0                  |
| 73EAP | PRINTED WIRE BD  | \$152          | \$1,166             | \$2               | P | \$0                  |
| 73EAP | AMPLIFIER DEF'EC | \$131          | \$1,216             | \$6               | P | \$0                  |
| 73EAR | ASSY VIDEO       | \$250          | \$15,934            | \$26              | P | \$0                  |
| 73EAS | ASSY BITE        | \$771          | \$3,407             | \$21              | P | \$543                |
| 73EAT | PWR SUPPLY LOW V | \$3,017        | \$1,500             | \$15              | P | \$195                |
| 73EAV | PRINT CIR BRD IN | \$222          | \$2,067             | \$20              | P | \$0                  |
| 73EAV | CIR BRD ER AMP/  | \$450          | \$1,694             | \$15              | P | \$0                  |
| 73EAW | CIR BRD OUTPT R  | \$426          | \$7,338             | \$21              | P | \$0                  |
| 73EAX | ASSY RECTIFIER B | \$7            | \$0                 | \$0               | P | \$0                  |
| 73EBO | SIGNAL DATA PRO  | \$42,522       | \$7,916             | \$111             | P | \$218                |
| 73EB9 | NOC              | \$354          | \$0                 | \$0               | P | \$109                |
| 73EBA | DATA INPUT       | \$120          | \$880               | \$6               | P | \$0                  |
| 73EBB | ASSY ADDER/MEMO  | \$148          | \$3                 | \$2               | P | \$0                  |
| 73EBC | ASSY PROCESOR C  | \$95           | \$554               | \$0               | P | \$0                  |
| 73EBE | ASSY DISCRETE I  | \$66           | \$357               | \$5               | P | \$0                  |
| 73EBH | ASSY INSTRUCTION | \$64           | \$681               | \$3               | P | \$0                  |
| 73EBJ | ASSY STR CONT R  | \$119          | \$696               | \$2               | P | \$0                  |
| 73EBK | ASSY DRIVER TRAH | \$118          | \$504               | \$3               | P | \$0                  |
| 73EBL | ASSY STORE CONT  | \$262          | \$2,746             | \$15              | P | \$0                  |
| 73EBM | ASSY CORE PLANE  | \$143          | \$822               | \$5               | P | \$0                  |
| 73EBP | ASSY ANALOG OUT  | \$519          | \$21,564            | \$31              | P | \$0                  |
| 73EBQ | ASSY ANALOG INP  | \$228          | \$9,984             | \$16              | P | \$855                |
| 73EBR | ASSY RATE-DEFL   | \$67           | \$1,547             | \$6               | P | \$0                  |
| 73EBT | ASSY FUNCTION C  | \$71           | \$1,222             | \$1               | P | \$0                  |
| 73EBU | ASSY CLOCK CHEK  | \$276          | \$2,788             | \$23              | P | \$0                  |
| 73EBV | ASSY PARAMETR C  | \$14           | \$0                 | \$0               | P | \$0                  |
| 73EDX | PWR SUPPLY 5 VOL | \$28           | \$286               | \$8               | P | \$0                  |
| 73EBZ | PWR SUPPLY LOW   | \$53           | \$354               | \$8               | P | \$0                  |
| 73ECO | MT ELECT EQUIPM  | \$515          | \$0                 | \$0               | P | \$0                  |
| 73ECA | ASSY FAN         | \$102          | \$0                 | \$0               | P | \$0                  |
| 73EDD | WIRING CONNS PI  | \$321          | \$0                 | \$0               | P | \$0                  |
| 73EXX |                  | \$168,406      | \$248,212           | \$6,929           |   | \$1,920              |
| 73F00 | INERTIAL MSURMM  | \$75,870       | \$0                 | \$0               |   | \$0                  |
| 73FAD | UNIT INERTIAL M  | \$88,377       | \$215,606           | \$4,313           | P | \$0                  |
| 73FAD | CDC              | \$66           | \$0                 | \$0               | P | \$0                  |
| 73FAD | GUARD CAPRI      | \$231          | \$2,212             | \$4               | P | \$0                  |
| 73FAD |                  | \$231          | \$2,212             | \$39              | P | \$0                  |

U 10  
WEAPON SYSTEM A0070 G/LAL LOGISTIC SUPPORT COST BREAKDOWN RCS LOG-MMG(6)7213(3) K051.PN4L  
AFM 65-110/66-1 DATA AS OF 76 JUN CURRENT QUARTER COMPUTATION DATE PROCESSED

|       |                   | QUARTERLY VALUES |                     |                   |                      |         |
|-------|-------------------|------------------|---------------------|-------------------|----------------------|---------|
|       |                   | FIELD<br>MAINT   | SPEC REPAIR<br>COST | PACK-SHIP<br>COST | CONDEMNATION<br>COST |         |
| MUC   | NOUN              |                  |                     |                   |                      |         |
| 73EBU | ASSY CLOCK CHEK   | \$298            | P \$3,416           | \$18              | P                    | \$0     |
| 73EBV | ASSY PARAMETR C   | \$35             | \$0                 | \$0               |                      | \$0     |
| 73EBX | PHR SUPPLY 5 VOL  | \$10             | \$0                 | \$0               |                      | \$0     |
| 73FBZ | PHR SUPPLY LOW    | \$42             | P \$372             | \$8               | P                    | \$0     |
| 73ECU | MT ELECT EQUIPM   | \$1,475          | \$0                 | \$0               |                      | \$0     |
| 73ECA | ASSY FAN          | \$15             | \$0                 | \$0               |                      | \$0     |
| 73EDD | WIRING CONNS PI   | \$172            | \$0                 | \$0               |                      | \$0     |
| 73EXX |                   | \$130,497        | \$140,172           | \$5,487           |                      | \$2,161 |
| 73F00 | INERTIAL MSURHM   | \$76,487         | \$0                 | \$0               |                      | \$0     |
| 73FA0 | UNIT INERTIAL M   | \$78,458         | \$41,832            | \$5,402           |                      | \$0     |
| 73FA9 | NOC               | \$35             | \$0                 | \$0               |                      | \$0     |
| 73FAD | BOARD CAPRI       | \$256            | \$1,506             | \$5               |                      | \$0     |
| 73FAE | MODULE GIMBAL L   | \$379            | \$1,616             | \$28              |                      | \$0     |
| 73FAF | MODULE PHR SUP    | \$343            | \$1,452             | \$18              |                      | \$0     |
| 73FAG | MODULE MODE SWI   | \$169            | \$1,724             | \$8               |                      | \$0     |
| 73FAM | ACCLMETER X-Y     | \$0              | \$0                 | \$0               |                      | \$0     |
| 73FAN | ACCLMETER Z AXIS  | \$0              | \$0                 | \$0               |                      | \$0     |
| 73FAP | GYROSCOPE X-Y AX  | \$0              | \$0                 | \$0               |                      | \$0     |
| 73FAQ | GYROSCOPE Z AXIS  | \$0              | \$0                 | \$0               |                      | \$0     |
| 73FAR | ACCLMTR ELECTRN   | \$0              | \$0                 | \$0               |                      | \$0     |
| 73FAS | GYROSCOPE ELECT R | \$0              | \$0                 | \$0               |                      | \$0     |
| 73FAT | GMBLE TMP CONT    | \$0              | \$0                 | \$0               |                      | \$0     |
| 73FAU | AUX TMP CONT AM   | \$0              | \$0                 | \$0               |                      | \$0     |
| 73FAV | CLSTR CONT TMPT   | \$0              | \$0                 | \$0               |                      | \$0     |
| 73FAM | COMPASATION BOAR  | \$0              | \$0                 | \$0               |                      | \$0     |
| 73FBO | RACK ELEC EQUIP   | \$2,592          | P \$0               | \$4               | P                    | \$1,113 |
| 73FC0 | CONTROLLER IMS    | \$1,935          | \$1,888             | \$39              |                      | \$0     |
| 73FC9 | FRONT PANEL       | \$41             | \$0                 | \$0               |                      | \$0     |
| 73FD0 | ADPTR PHR SP LS   | \$55,652         | \$2,925             | \$99              |                      | \$0     |
| 73FD9 | NOC               | \$214            | \$0                 | \$0               |                      | \$0     |
| 73FDB | CARD SEQUENCER    | \$269            | \$1,770             | \$12              |                      | \$0     |
| 73FDC | CARD SEQUENCER    | \$291            | \$1,050             | \$8               |                      | \$0     |
| 73FDD | MODULE 800 HZ     | \$279            | \$745               | \$12              |                      | \$0     |
| 73FDE | MODULE HEAD REP   | \$2,397          | \$9,867             | \$212             |                      | \$0     |
| 73FDF | MODULE RELAY DR   | \$3              | \$0                 | \$0               |                      | \$0     |
| 73FDG | CARD RELAY DRIV   | \$172            | P \$489             | \$5               | P                    | \$0     |
| 73FDM | CARD RELAY DRIV   | \$43             | \$216               | \$3               |                      | \$0     |
| 73FOL | POWER SUPPLY      | \$45             | \$86                | \$8               | P                    | \$0     |
| 73FOW | each phr supply   | 1234             | \$2,226             | \$14              |                      | \$0     |

US JN40  
DATE RELEASED

WREATH SYSTEM AUDIT LOGISTICS SUPPORT LOST BREAKDOWN RCS LOG-MMO(1)7211(3)  
AUG 65-110/66-1 DATA AS OF 76 MAR CURRENT QUARTER COMPUTATION

| ML    | MOON             | FIELD MAINT | QUARTERLY VALUES |           |             | CONSUMPTION | LOST |
|-------|------------------|-------------|------------------|-----------|-------------|-------------|------|
|       |                  |             | SPEC REPAIR      | PAID-SHIP | CONSUMPTION |             |      |
| 73EAK | ASSY CRT MATING  | \$45        | \$80             | \$1       | \$1         | \$0         | \$0  |
| 73EAM | PWR SUPPLY HIGH  | \$497       | \$294            | \$12      | \$12        | \$0         | \$0  |
| 73EAN | MODULE HIGH VOL  | \$21        | \$131            | \$4       | \$4         | \$883       | \$0  |
| 73EAP | PRINTED WIRE BD  | \$75        | \$999            | \$5       | \$5         | \$0         | \$0  |
| 73EAP | AMPLIFIER DEFEC  | \$197       | \$700            | \$4       | \$4         | \$0         | \$0  |
| 73EAP | ASSY VIDEO       | \$481       | \$3,483          | \$21      | \$21        | \$0         | \$0  |
| 73EAS | ASSY BITE        | \$430       | \$1,610          | \$23      | \$23        | \$407       | \$0  |
| 73EAT | PWR SUPPLY LOW V | \$3,685     | \$0              | \$0       | \$0         | \$0         | \$0  |
| 73EAU | PANT CIR BRD IN  | \$270       | \$392            | \$17      | \$17        | \$0         | \$0  |
| 73EAV | CIR PRD ER AMF   | \$227       | \$2,248          | \$10      | \$10        | \$0         | \$0  |
| 73EAV | CIR BRD OUTPT K  | \$453       | \$2,664          | \$32      | \$32        | \$0         | \$0  |
| 73EAX | ASSY ELECTRONIC  | \$59        | \$0              | \$0       | \$0         | \$0         | \$0  |
| 73EAX | ASSY RECTIFIER B | \$64        | \$264            | \$2       | \$2         | \$0         | \$0  |
| 73EBO | SIGNAL DATA PRD  | \$31,272    | \$2,810          | \$139     | \$139       | \$0         | \$0  |
| 73EB3 | CHASIS ELECTRIC  | \$81        | \$0              | \$0       | \$0         | \$0         | \$0  |
| 73EB5 | MOD              | \$155       | \$0              | \$2       | \$2         | \$137       | \$0  |
| 73EFA | ASSY DATA INPUT  | \$14        | \$333            | \$1       | \$1         | \$0         | \$0  |
| 73EBB | ASSY ADDER/MEMO  | \$144       | \$1              | \$1       | \$1         | \$0         | \$0  |
| 73EBL | ASSY PROCESSOR C | \$17        | \$182            | \$5       | \$5         | \$0         | \$0  |
| 73EBE | ASSY DISCRETE I  | \$21        | \$1              | \$2       | \$2         | \$0         | \$0  |
| 73EBH | ASSY INSTRUCTION | \$19        | \$666            | \$2       | \$2         | \$0         | \$0  |
| 73EBJ | ASSY STR CONT K  | \$56        | \$0              | \$0       | \$0         | \$0         | \$0  |
| 73EBK | ASSY DRIVE TRAN  | \$82        | \$660            | \$4       | \$4         | \$0         | \$0  |
| 73EBL | ASSY STORE CONT  | \$24        | \$0              | \$0       | \$0         | \$0         | \$0  |
| 73EBM | ASSY CORE PLANE  | \$100       | \$976            | \$6       | \$6         | \$0         | \$0  |
| 73ESF | ASSY ANALOG OUT  | \$466       | \$2,394          | \$17      | \$17        | \$0         | \$0  |
| 73EBY | ASSY ANALOG IMP  | \$241       | \$1,313          | \$10      | \$10        | \$513       | \$0  |
| 73EBW | ASSY RATE-DEFL   | \$46        | \$3              | \$2       | \$2         | \$0         | \$0  |
| 73EBU | ASSY CLOCK CHIF  | \$194       | \$1,743          | \$13      | \$13        | \$0         | \$0  |
| 73ELX | PWR SUPPLY 5 VOL | \$35        | \$533            | \$4       | \$4         | \$0         | \$0  |
| 73EBZ | PWR SUPPLY LOW   | \$67        | \$744            | \$16      | \$16        | \$0         | \$0  |
| 73ELU | MT ELECT EQUIPM  | \$789       | \$0              | \$0       | \$0         | \$0         | \$0  |
| 73ELA | ASSY FAN         | \$165       | \$0              | \$0       | \$0         | \$0         | \$0  |
| 73EUD | WIRING CONNG FI  | \$409       | \$0              | \$0       | \$0         | \$0         | \$0  |
| 73EXA |                  | \$141,502   | \$176,104        | \$7,291   | \$7,291     | \$1,940     | \$0  |
| 73F00 | INERTIAL MEASRMN | \$77,998    | \$0              | \$0       | \$0         | \$0         | \$0  |
| 73F00 | UNIT INERTIAL M  | \$75,966    | \$166,012        | \$2,877   | \$2,877     | \$0         | \$0  |
| 73F09 | MOD              | \$203       | \$0              | \$0       | \$0         | \$0         | \$0  |
| 73F0A | P-220 CASET      | \$319       | \$6,510          | \$74      | \$74        | \$0         | \$0  |

WEAPON SYSTEM AX1070  
AFM 65-110/66-1 DATA AS OF 75 DEC

LOGISTIC SUPPORT COST BREAKDOWN RCS LOG-PMO(0)7213(3)  
CURRENT QUARTER COMPUTATION

W051.PM4L  
DATE PROCESSED

| MOC   | NOUN             | FIELD<br>MAINT | SPEC REPAIR<br>COST | QUARTERLY VALUES  |                     |      | BASE MATERIAL<br>COST |
|-------|------------------|----------------|---------------------|-------------------|---------------------|------|-----------------------|
|       |                  |                |                     | PACK-SHIP<br>COST | CONDORATION<br>COST | COST |                       |
| 73EAK | ASSY CRT MATCH   | 332            | \$0                 | \$1               |                     | \$0  | COST                  |
| 73EAT | PR SUPPLY HIGH   | \$417          | \$294               | \$12              |                     | \$0  | COST                  |
| 73EAD | MODULE HIGH VCA  | \$18           | \$0                 | \$4               |                     | \$0  | COST                  |
| 73EAP | PRINTED WIRE BO  | \$32           | \$333               | \$1               |                     | \$0  | COST                  |
| 73EAG | AMPLIFIER DEFLEC | \$228          | \$1,820             | \$10              |                     | \$0  | COST                  |
| 73EAR | ASSY VIDEO       | \$659          | \$2,979             | \$19              |                     | \$0  | COST                  |
| 73EAS | ASSY BITE        | \$591          | \$1,932             | \$25              | \$475               | \$0  | COST                  |
| 73EAT | PR SUPPLY LOW V  | \$1,510        | \$616               | \$1               | \$0                 | \$0  | COST                  |
| 73EAD | PRNT CIR BRG IN  | \$119          | \$5                 | \$9               | \$0                 | \$0  | COST                  |
| 73EAT | CIR BRG ER AMP   | \$236          | \$1,881             | \$16              | \$0                 | \$0  | COST                  |
| 73EAM | CIR BRG OUTFT R  | \$93           | \$396               | \$6               | \$493               | \$0  | COST                  |
| 73EAT | ASSY RECTIFIER B | \$28           | \$0                 | \$1               | \$0                 | \$0  | COST                  |
| 73EAD | SIGNAL DATA FRQ  | \$20,623       | \$8,430             | \$41              | \$0                 | \$0  | COST                  |
| 73EB9 | NOC              | \$71           | \$0                 | \$0               | \$0                 | \$0  | COST                  |
| 73EBA | ASSY DATA INFT   | \$32           | \$666               | \$2               | \$0                 | \$0  | COST                  |
| 73EBB | ASSY ADDER/MEMO  | \$150          | \$4                 | \$4               | \$0                 | \$0  | COST                  |
| 73EBF | ASSY DISCRETE I  | \$28           | \$2                 | \$3               | \$0                 | \$0  | COST                  |
| 73EBH | ASSY INSTRUCTION | \$28           | \$999               | \$2               | \$0                 | \$0  | COST                  |
| 73EBK | ASSY DRIVER TRAN | \$52           | \$0                 | \$2               | \$0                 | \$0  | COST                  |
| 73EBL | ASSY STORE CONT  | \$133          | \$976               | \$7               | \$0                 | \$0  | COST                  |
| 73EBM | ASSY CORE PLANE  | \$52           | \$488               | \$3               | \$0                 | \$0  | COST                  |
| 73EBP | ASSY ANALOG OUT  | \$189          | \$1,824             | \$15              | \$0                 | \$0  | COST                  |
| 73EGH | ASSY ANALOG INP  | \$304          | \$1,860             | \$14              | \$472               | \$0  | COST                  |
| 73EBR | ASSY RATE-DEFL   | \$119          | \$8                 | \$36              | \$0                 | \$0  | COST                  |
| 73EBI | ASSY FUNCTION C  | \$25           | \$891               | \$0               | \$0                 | \$0  | COST                  |
| 73EBU | ASSY CLUTCH MEK  | \$134          | \$186               | \$7               | \$0                 | \$0  | COST                  |
| 73EBZ | PR SUPPLY LOW    | \$10           | \$0                 | \$0               | \$0                 | \$0  | COST                  |
| 73EC0 | MT ELEFT EQUIPM  | \$489          | \$0                 | \$0               | \$0                 | \$0  | COST                  |
| 73EC9 | NOC              | \$3            | \$0                 | \$0               | \$0                 | \$0  | COST                  |
| 73ECA | ASSY FAN         | \$28           | \$0                 | \$0               | \$0                 | \$0  | COST                  |
| 73EEO | VIRING CONNS P1  | \$28           | \$0                 | \$0               | \$0                 | \$0  | COST                  |
| 73EEX |                  | \$103,804      | \$184,186           | \$5,533           | \$1,445             |      | COST                  |
| 73EFA | INERTIAL MEASRM  | \$61,266       | \$3,498             | \$4               | \$0                 | \$0  | COST                  |
| 73EAD | UNIT INERTIAL M  | \$57,697       | \$165,393           | \$2,970           | \$0                 | \$0  | COST                  |
| 73EAG | NOC              | \$17           | \$0                 | \$0               | \$0                 | \$0  | COST                  |
| 73EAB | ROUND CAPMT      | \$612          | \$1,757             | \$4               | \$0                 | \$0  | COST                  |
| 73EAC |                  | \$13           | \$0                 | \$0               | \$0                 | \$0  | COST                  |

AD-A123 025

A STUDY TO DEMONSTRATE THE APPLICATION OF A GRAPHICAL  
METHOD TO DETERMINE..(U) AIR FORCE INST OF TECH  
WRIGHT-PATTERSON AFB OH SCHOOL OF SYST..

3/3

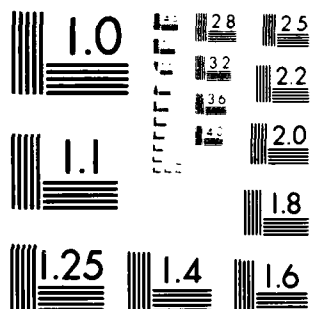
UNCLASSIFIED

D C BECKWITH ET AL. SEP 82 AFIT-LSSR-60-82 F/G 5/1

NL

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

END  
DATE  
FILMED  
\* B1  
DTIC



MICROCOPY RESOLUTION TEST CHART  
NATIONAL BUREAU OF STANDARDS-1963-A

4 11  
 WEAPON SYSTEM AC070 OCALC LOGISTIC SUPPORT COST BREAKDOWN FCS LOG-MMO(0)7213(3) K051.PM44  
 AFM AS-110/66-1 DATA AS OF 75 SEP CURRENT QUARTER COMPUTATION DATE PROCESSED

| WUC     | NOUN              | FIELD<br>PAINT | SPEC. REPAIR<br>COST | QUARTERLY VALUES  |                      |      | BASE MATERIAL<br>COST |
|---------|-------------------|----------------|----------------------|-------------------|----------------------|------|-----------------------|
|         |                   |                |                      | PACK-SHIP<br>COST | CONDEMNATION<br>COST |      |                       |
| 73EXX   |                   | \$120,710      | \$158,975            | \$4,656           | \$606                | COST |                       |
| 73FOU   | INERTIAL MSURPM   | \$69,212       | \$0                  | \$0               | \$0                  | COST |                       |
| X 73FAO | UNIT INERTIAL M   | \$75,126       | P \$191,786          | \$3,942           | \$0                  | COST |                       |
| 73FA9   | HOC               | \$38           | \$0                  | \$0               | \$0                  | COST |                       |
| 73FAD   | BOARD CAPRI       | \$544          | \$5,282              | \$15              | \$0                  | COST |                       |
| 73FAE   | MODULE GIMBAL L   | \$681          | \$4,675              | \$53              | \$0                  | COST |                       |
| 73FAF   | MODULE PWR SUP    | \$291          | \$3,828              | \$34              | \$0                  | COST |                       |
| 73FAG   | MODULE MODE SWI   | \$312          | \$3,017              | \$6               | \$0                  | COST |                       |
| 73FAM   | ACCELEROMETER X-Y | \$0            | \$0                  | \$0               | \$0                  | COST |                       |
| 73FAN   | ACCLMTER 2 AXIS   | \$7            | \$0                  | \$0               | \$0                  | COST |                       |
| 73FAP   | GYROSCOPE X-Y AX  | \$0            | \$0                  | \$0               | \$0                  | COST |                       |
| 73FAQ   | GYROSCOPE 2 AXIS  | \$0            | \$0                  | \$0               | \$0                  | COST |                       |
| 73FAR   | ACCLMTR ELECTRN   | \$0            | \$0                  | \$0               | \$0                  | COST |                       |
| 73FAS   | GYROSCOPE ELECTR  | \$0            | \$0                  | \$0               | \$0                  | COST |                       |
| 73FAT   | GBLE TYP CONT     | \$0            | \$0                  | \$0               | \$0                  | COST |                       |
| 73FAU   | AUX TYP CONT AM   | \$0            | \$0                  | \$0               | \$0                  | COST |                       |
| 73FAV   | CLSTR CONT TMPT   | \$0            | \$0                  | \$0               | \$0                  | COST |                       |
| 73FAM   | COMPASSION BOAR   | \$0            | \$0                  | \$0               | \$0                  | COST |                       |
| 73FBO   | RACK ELEC EQUIP   | \$1,011        | \$0                  | \$0               | \$0                  | COST |                       |
| 73FCO   | CONTROLLER IMS    | \$1,578        | \$824                | \$19              | \$0                  | COST |                       |
| 73FC9   | NOC               | \$64           | \$0                  | \$0               | \$0                  | COST |                       |
| 73FCB   | FRONT PANEL       | \$45           | \$0                  | \$0               | \$0                  | COST |                       |
| 73FDO   | ADPTR PWR SP LS   | \$50,685       | \$0                  | \$0               | \$0                  | COST |                       |
| 73FD9   | NOC               | \$441          | \$0                  | \$0               | \$0                  | COST |                       |
| 73FDB   | CARD SEQUENCER    | \$204          | \$380                | \$8               | \$0                  | COST |                       |
| 73FDC   | CARD SEQUENCER    | \$164          | \$385                | \$4               | \$0                  | COST |                       |
| 73FDD   | MODULE 600 HZ     | \$28           | \$54                 | \$2               | \$0                  | COST |                       |
| 73FDE   | MODULE HEAD REP   | \$1,257        | \$2,912              | \$103             | \$0                  | COST |                       |
| 73FDF   | MODULE RELAY DR   | \$4            | \$0                  | \$0               | \$0                  | COST |                       |
| 73FDG   | CARD RELAY DRIV   | \$176          | \$448                | \$6               | \$0                  | COST |                       |
| 73FDH   | CARD RELAY DRIV   | \$15           | \$720                | \$7               | \$0                  | COST |                       |
| 73FDL   | POWER SUPPLY      | \$00           | \$280                | \$16              | \$0                  | COST |                       |
| 73FDN   | CARD PWR SUPPLY   | \$494          | \$4,216              | \$75              | \$0                  | COST |                       |
| 73FDN   | CARD PWR SUPPLY   | \$91           | \$440                | \$13              | \$0                  | COST |                       |
| 73FDN   | CARD PWR SUPPLY   | \$50           | \$650                | \$16              | \$0                  | COST |                       |
| 73FDQ   | CARD PWR SUPPLY   | \$276          | \$2,800              | \$39              | \$0                  | COST |                       |
| 73END   | PWR SUP CLIP V    | \$82           | \$147                | \$5               | \$0                  | COST |                       |

Q 111  
 WEAPON SYSTEM A0070 OALC LOGISTIC SUPPORT COST BREAKDOWN RCS:LOG-M40(0)7213(3) K051.PN6L  
 APM 65-110/66-1 DATA AS OF 75 JUN CURRENT QUARTER COMPUTATION DATE PROCESSED

| NRC   | NO/M              | FIELD MAINT | SPEC REPAIR COST | QUARTERLY VALUES |                  |       | BASE MATERIAL COST |
|-------|-------------------|-------------|------------------|------------------|------------------|-------|--------------------|
|       |                   |             |                  | PACK/SHIP COST   | CONDENATION COST |       |                    |
| 73EBZ | PHR SUPPLY LOW    | \$15        | \$372            | \$8              | \$0              | \$0   | \$0                |
| 73EB0 | SIGNAL DATA PRO   | \$34,933    | \$5,620          | \$277            | \$0              | \$0   | \$0                |
| 73EB9 | MOC               | \$227       | \$0              | \$0              | P                | \$484 | \$0                |
| 73ETA | ASSY FAN          | \$346       | \$0              | \$0              | \$0              | \$0   | \$0                |
| 73ECU | MT ELEC EQ/1PM    | \$556       | \$0              | \$0              | \$0              | \$0   | \$0                |
| 73ED0 | DIS SYS HEADSUP   | \$10,766    | \$0              | \$0              | \$0              | \$0   | \$0                |
| 73EXX |                   | \$133,278   | \$161,788        | \$5,048          | \$1,090          | \$0   | \$0                |
| 73FAP | BOARD CAPRI       | \$553       | \$876            | \$10             | \$0              | \$0   | \$0                |
| 73FAE | MODULE GIMBAL L   | \$707       | \$1,972          | \$55             | \$0              | \$0   | \$0                |
| 73FAF | MODULE PHR SUP    | \$446       | \$1,375          | \$42             | P                | \$0   | \$0                |
| 73FAG | MODULE MOUE SWI   | \$270       | \$531            | \$9              | P                | \$0   | \$0                |
| 73FAM | ACCLORIMETER X-Y  | \$0         | \$0              | \$0              | \$0              | \$0   | \$0                |
| 73FAN | ACCLIMETER Z AXIS | \$0         | \$0              | \$0              | \$0              | \$0   | \$0                |
| 73FAP | GYROSCOPE X-Y AX  | \$0         | \$0              | \$0              | \$0              | \$0   | \$0                |
| 73FAQ | GYROSCOPE Z AXIS  | \$28        | \$0              | \$0              | \$0              | \$0   | \$0                |
| 73FAT | GYBLE TMP CONT    | \$0         | \$0              | \$0              | \$0              | \$0   | \$0                |
| 73FAU | AUX TMP CONT AM   | \$0         | \$0              | \$0              | \$0              | \$0   | \$0                |
| 73FAH | COMPASITION BOAR  | \$11        | \$0              | \$0              | \$0              | \$0   | \$0                |
| 73FAO | UNIT INERTIAL M   | \$79,169    | \$119,377        | \$5,926          | \$0              | \$0   | \$0                |
| 73FBO | RACK ELEC EQUIP   | \$942       | \$0              | \$0              | \$0              | \$0   | \$0                |
| 73FCB | FRONT PANEL       | \$66        | \$0              | \$0              | \$0              | \$0   | \$0                |
| 73FCO | CONTROLLER IMS    | \$1,783     | \$370            | \$12             | \$0              | \$0   | \$0                |
| 73FC9 | MOC               | \$45        | \$0              | \$0              | \$0              | \$0   | \$0                |
| 73FDB | CARD SEQUENCER    | \$171       | \$1,330          | \$11             | \$0              | \$0   | \$0                |
| 73FDC | CARD SEQUENCER    | \$143       | \$814            | \$9              | \$0              | \$0   | \$0                |
| 73FDO | MODULE 800 MZ     | \$119       | \$606            | \$9              | \$0              | \$0   | \$0                |
| 73FDE | MODULE HEAD REP   | \$1,656     | \$1,560          | \$167            | \$0              | \$0   | \$0                |
| 73FDG | CARD RELAY DRIV   | \$35        | \$0              | \$0              | \$0              | \$0   | \$0                |
| 73FDH | CARD RELAY DRIV   | \$111       | \$410            | \$8              | \$0              | \$0   | \$0                |
| 73FDK | DRIVER AMPLIFIE   | \$43        | \$153            | \$2              | P                | \$0   | \$0                |
| 73FDL | POWER SUPPLY      | \$76        | \$0              | \$6              | \$0              | \$0   | \$0                |
| 73FDM | CARD PHR SUPPLY   | \$7         | \$0              | \$0              | \$0              | \$0   | \$0                |
| 73FDN | CARD PHR SUPPLY   | \$478       | \$2,100          | \$72             | \$0              | \$0   | \$0                |
| 73FDN | CARD PHR SUPPLY   | \$220       | \$980            | \$23             | \$0              | \$0   | \$0                |
| 73FDN | CARD PHR SUPPLY   | \$211       | \$660            | \$35             | \$0              | \$0   | \$0                |
| 73FDQ | CARD PHR SUPPLY   | \$783       | \$2,380          | \$82             | \$0              | \$0   | \$0                |
| 73FDQ | CARD PHR SUPPLY   | \$181       | \$2,272          | \$18             | \$0              | \$0   | \$0                |

A 10  
 WEAPON SYSTEM A0070 OALC LOGISTIC SUPPORT COST BREAKDOWN 765:LOG-WO(0)7213(3)  
 APR 65-110/66-1 DATA AS OF 75 MAR CURRENT QUARTER COMPUTATION K031.PW21  
 DATE PROCESSED

| JAC   | MODL             | FIELD<br>MOUNT | QUARTERLY VALUES    |                   |   | CONDEMNATION<br>COST | BASE MATERIAL<br>COST |
|-------|------------------|----------------|---------------------|-------------------|---|----------------------|-----------------------|
|       |                  |                | SPEC REPAIR<br>COST | PACK/SHIP<br>COST |   |                      |                       |
| 735A0 | AMPLIFIER DEFLEC | \$155          | \$420               | \$2               |   | \$0                  | \$0                   |
| 735A1 | ASSY VIDEO       | \$167          | \$1,719             | \$10              |   | \$0                  | \$0                   |
| 735A2 | ASSY OITE        | \$354          | \$752               | \$11              |   | \$0                  | \$0                   |
| 735A3 | FOR SUPPLY LOW V | \$2,284        | \$924               | \$14              |   | \$0                  | \$0                   |
| 735A4 | FOR CIR DRD IN   | \$178          | \$3                 | \$3               |   | \$0                  | \$0                   |
| 735A5 | CIR DRD ER NPI   | \$232          | \$1,463             | \$3               |   | \$0                  | \$0                   |
| 735A6 | CIR DRD OUTPT R  | \$273          | \$393               | \$12              | P | \$0                  | \$0                   |
| 735A7 | ASSY ELECTRONIC  | \$14           | \$0                 | \$0               |   | \$0                  | \$0                   |
| 735A8 | ASSY RECTIFIER D | \$43           | \$0                 | \$0               |   | \$0                  | \$0                   |
| 735A9 | DIS UNIT HEADSU  | \$80,262       | \$193,461           | \$0               |   | \$0                  | \$0                   |
| 735A1 | ASSY TESTUAL D   | \$28           | \$0                 | \$0               |   | \$0                  | \$0                   |
| 735A2 | SETTOR AUTO BRI  | \$3            | \$0                 | \$0               |   | \$0                  | \$0                   |
| 735A3 | FOR              | \$522          | \$0                 | \$0               |   | \$0                  | \$0                   |
| 735A4 | ASSY DATA INPUT  | \$141          | \$333               | \$1               |   | \$0                  | \$0                   |
| 735A5 | ASSY ADDER/7220  | \$357          | \$1                 | \$1               | P | \$0                  | \$0                   |
| 735A6 | ASSY PROCESSOR C | \$119          | \$515               | \$4               |   | \$0                  | \$0                   |
| 735A7 | ASSY DISCRETE I  | \$30           | \$0                 | \$0               |   | \$0                  | \$0                   |
| 735A8 | ASSY INSTRUCTION | \$32           | \$445               | \$2               |   | \$0                  | \$0                   |
| 735A9 | ASSY STR CONT R  | \$43           | \$111               | \$1               |   | \$0                  | \$0                   |
| 735A1 | ASSY DRIVE TOSH  | \$31           | \$331               | \$2               |   | \$0                  | \$0                   |
| 735A2 | ASSY STORE CONT  | \$30           | \$241               | \$2               |   | \$0                  | \$0                   |
| 735A3 | ASSY CORE PLATE  | \$339          | \$1,223             | \$2               |   | \$0                  | \$0                   |
| 735A4 | ASSY ANALOG OUT  | \$477          | \$3,153             | \$2               |   | \$0                  | \$0                   |
| 735A5 |                  |                | \$215,372           | \$7,040           |   | \$1,320              | \$0                   |
| 735A6 | DRIVE MOTOR      | \$303          | \$376               | \$10              |   | \$0                  | \$0                   |
| 735A7 | MECHANICAL L     | \$303          | \$1,160             | \$12              |   | \$0                  | \$0                   |
| 735A8 | MECHANICAL CUP   | \$303          | \$1,160             | \$13              | P | \$0                  | \$0                   |
| 735A9 | MECHANICAL FWA   | \$303          | \$1,160             | \$13              |   | \$0                  | \$0                   |
| 735A1 | UNIT INITIAL H   | \$87,078       | \$205,451           | \$3,733           |   | \$0                  | \$0                   |
| 735A2 | MECH ELEC EQUIP  | \$920          | \$0                 | \$0               |   | \$0                  | \$0                   |
| 735A3 | FRONT PANEL      | \$7            | \$0                 | \$0               |   | \$0                  | \$0                   |

LOGS, PM-L  
DATE PROCESSED

LOGISTIC SUPPORT COST BREAKDOWN RCS, LOG-WMD-0-7813-3  
CURRENT QUARTER COMPUTATION

WEAPON SYSTEM A0070 DCALC  
07H 08-110/08-1 DATA AS OF 74 DEC

| NAVC  | NOUN             | FIELD<br>MAINT | SPEC REPAIR<br>COST | QUARTERLY VALUES |                   |   | CONDEMNATION<br>COST | BASE MATERIAL<br>COST |
|-------|------------------|----------------|---------------------|------------------|-------------------|---|----------------------|-----------------------|
|       |                  |                |                     |                  | PACK/SHIP<br>COST |   |                      |                       |
| 73EBA | ASSY DATA INPUT  | 956            | 90                  |                  | 90                |   | 90                   | 90                    |
| 73EBB | ASSY ADDR/MEMO   | 9131           | 90                  |                  | 90                |   | 90                   | 90                    |
| 73EBC | ASSY PROCURER C  | 929            | 9182                | P                | 95                | P | 90                   | 90                    |
| 73EBD | ASSY DISCRETE I  | 9112           | 92                  |                  | 93                |   | 90                   | 90                    |
| 73EBE | ASSY INSTRUCTION | 914            | 9333                |                  | 91                |   | 90                   | 90                    |
| 73EBF | ASSY DRIVER TRAN | 950            | 90                  | P                | 92                |   | 90                   | 90                    |
| 73EBG | ASSY STORE CONT  | 947            | 9398                |                  | 93                |   | 90                   | 90                    |
| 73EBH | ASSY CORE PLANE  | 9241           | 91,268              |                  | 910               |   | 90                   | 90                    |
| 73EBI | ASSY ANALOG OUT  | 9833           | 95,130              | P                | 964               | P | 90                   | 90                    |
| 73EBJ | ASSY ANALOG INP  | 980            | 9458                |                  | 93                |   | 90                   | 90                    |
| 73EBK | ASSY RATE-DEFL   | 9120           | 97                  |                  | 96                |   | 90                   | 90                    |
| 73EBL | ASSY FUNCTION C  | 921            | 9122                |                  | 91                |   | 90                   | 90                    |
| 73EBM | ASSY CLOCK CKCH  | 971            | 9372                |                  | 92                |   | 90                   | 90                    |
| 73EBN | ASSY PARAMETR C  | 935            | 90                  | P                | 91                |   | 90                   | 90                    |
| 73EBO | SIGNAL DATA PRD  | 940,023        | 92,810              |                  | 9137              |   | 90                   | 90                    |
| 73EBS | CHAMIS ELECTRIC  | 924            | 920                 | P                | 92                | P | 90                   | 90                    |
| 73EBT | NOC              | 9119           | 90                  | P                | 95                | P | 90                   | 90                    |
| 73ECA | ASSY FAN         | 9189           | 90                  |                  | 90                |   | 90                   | 90                    |
| 73ECO | MT ELECT EQUIPM  | 9117           | 90                  |                  | 90                |   | 90                   | 90                    |
| 73EC9 | NOC              | 915            | 90                  |                  | 90                |   | 90                   | 90                    |
| 73E00 | D18 SYS HEADSUP  | 98,382         | 90                  |                  | 90                |   | 90                   | 90                    |
| 73EXX |                  | 9125,333       | 9187,625            |                  | 96,035            |   | 9108                 | 90                    |
| 73FA0 | BOARD CAPRI      | 9245           | 9730                |                  | 98                |   | 90                   | 90                    |
| 73FAE | MODULE GIMBAL L  | 9274           | 9838                |                  | 918               |   | 90                   | 90                    |
| 73FAF | MODULE PAR SUP   | 9198           | 9550                |                  | 916               |   | 90                   | 90                    |
| 73FAG | MODULE MODE SWI  | 9102           | 9472                |                  | 96                |   | 90                   | 90                    |
| 73FA0 | UNIT INERTIAL M  | 959,528        | 9123,444            |                  | 93,476            |   | 90                   | 90                    |
| 73FAS | NOC              | 9118           | 90                  |                  | 90                |   | 90                   | 90                    |
| 73FBO | RACK ELEC EQUIP  | 9916           | 90                  |                  | 90                |   | 90                   | 90                    |
| 73FCB | FRONT PANEL      | 9129           | 90                  |                  | 90                |   | 90                   | 90                    |
| 73FC0 | CONTROLLER INS   | 92,238         | 9381                |                  | 97                |   | 90                   | 90                    |
| 73FC9 | NOC              | 980            | 90                  |                  | 90                |   | 90                   | 90                    |
| 73FDB | CARD SEQUENCER   | 9108           | 9780                |                  | 96                |   | 90                   | 90                    |
| 73FDC | CARD SEQUENCER   | 9140           | 91,143              |                  | 97                |   | 90                   | 90                    |
| 73FDD | MODULE 800 M2    | 9293           | 9507                |                  | 97                |   | 90                   | 90                    |
| 73FDF | MODULE 800 M2    | 91,482         | 92,990              |                  | 9181              |   | 90                   | 90                    |

WEAPON SYSTEM 40070 DCALC LOGISTIC SUPPORT COST BREAKDOWN ACS-LOG-REQ-0-7813-3- 10001, PM-4  
 07M 00-110000-1 DATA AS OF 74 SEP CURRENT QUARTER COMPUTATION DATE PROCESSED

| NA'S  | MODM               | FIELD<br>MAINT | QUANTITATIVELY VALUES |                   |                      | BASE MATERIAL<br>COST |
|-------|--------------------|----------------|-----------------------|-------------------|----------------------|-----------------------|
|       |                    |                | SPEC REPAIR<br>COST   | PACK/SHIP<br>COST | COORDINATION<br>COST |                       |
| 7200A | ASSY DRIVER TRAM   | 000            | 00                    | 04                | 00                   | 00                    |
| 7200B | ASSY STONE CONT    | 000            | 0122                  | 01                | 00                   | 00                    |
| 7200C | ASSY CORE PLANE    | 0100           | 0244                  | 02                | 00                   | 00                    |
| 7200D | ASSY ANALOG OUT    | 0140           | 02,000                | 020               | 00                   | 00                    |
| 7200E | ASSY ANALOG IMP    | 0144           | 01,000                | 07                | 00                   | 00                    |
| 7200F | ASSY RATE-DEFL     | 0374           | 01                    | 01                | 00                   | 00                    |
| 7200G | ASSY ENVELOPE R    | 000            | 0333                  | 01                | 00                   | 00                    |
| 7200H | ASSY FUNCTION C    | 002            | 0122                  | 01                | 00                   | 00                    |
| 7200I | ASSY CLOCK OVER    | 0110           | 0100                  | 02                | 00                   | 00                    |
| 7200J | ASSY PARAMETER C   | 07             | 00                    | 01                | 00                   | 00                    |
| 7200K | PUR SUPPLY B VOL   | 000            | 0333                  | 04                | 00                   | 00                    |
| 7200L | PUR SUPPLY LOW     | 0119           | 0100                  | 04                | 00                   | 00                    |
| 7200M | SIGNAL DATA PRO    | 042,000        | 00,100                | 0305              | 00                   | 00                    |
| 7200N | MAGNETIC ASSY      | 000            | 00                    | 00                | 00                   | 00                    |
| 7200O | CHASSIS ELECTRONIC | 07             | 00                    | 00                | 00                   | 00                    |
| 7200P | NOX                | 004            | 00                    | 00                | 00                   | 00                    |
| 7200Q | ASSY FAN           | 000            | 00                    | 00                | 00                   | 00                    |
| 7200R | MT ELECT EQUIPM    | 0030           | 00                    | 00                | 00                   | 00                    |
| 7200S | D10 SYS HEADUP     | 00,700         | 00                    | 00                | 00                   | 00                    |
| 7200T |                    | 0130,393       | 0149,101              | 04,000            | 0310                 | 00                    |
| 7200U | BOMB CAPRI         | 0005           | 03,524                | 070               | 00                   | 00                    |
| 7200V | MODULE GIMBAL L    | 0070           | 02,370                | 000               | 00                   | 00                    |
| 7200W | MODULE PAR SUP     | 0044           | 01,705                | 050               | 00                   | 00                    |
| 7200X | MODULE MODE SWI    | 0391           | 01,100                | 010               | 00                   | 00                    |
| 7200Y | FAN                | 07             | 00                    | 00                | 00                   | 00                    |
| 7200Z | UNIT INERTIAL M    | 070,344        | 0130,403              | 03,000            | 00                   | 00                    |
| 7201A | NOX                | 035            | 00                    | 00                | 00                   | 00                    |
| 7201B | PACK ELEC EQUIP    | 0410           | 00                    | 00                | 00                   | 00                    |
| 7201C | FRONT PANEL        | 021            | 00                    | 00                | 00                   | 00                    |
| 7201D | CONTROLLER INS     | 01,400         | 0500                  | 010               | 00                   | 00                    |
| 7201E | MODULE SEQUENCE    | 001            | 00                    | 00                | 00                   | 00                    |
| 7201F | CARD SEQUENCER     | 0175           | 0700                  | 00                | 00                   | 00                    |
| 7201G | CARD SEQUENCER     | 0190           | 01,397                | 00                | 00                   | 00                    |
| 7201H | MODULE 000 ME      | 0343           | 0037                  | 010               | 00                   | 00                    |
| 7201I | MODULE HEAD REP    | 0071           | 01,024                | 0103              | 00                   | 00                    |

LOGS, PM-4  
DATE PROCESSED

LOGISTIC SUPPORT COST BREAKDOWN MCS, LOG-MOD-9-7213-3-  
CURRENT QUARTER COMPUTATION

LEADON SYSTEM 40070 DEALC  
APR 68-110/68-1 DATA AS OF 74 JUN

| MUC  | MOD               | FIELD<br>MAINT | QUARTERLY VALUES    |                   |                      | BASE MATERIAL<br>COST |
|------|-------------------|----------------|---------------------|-------------------|----------------------|-----------------------|
|      |                   |                | SPEC REPAIR<br>COST | PACK/SHIP<br>COST | CONDEMNATION<br>COST |                       |
| 752H |                   | 903,243        | 9129,110            | 92,725            | 91,954               | 90                    |
| 752A | BOARD CAPRI       | 983            | 9057                | 95                | 90                   | 90                    |
| 752E | MODULE CIRCUL L   | 9538           | 91,180              | 923               | 90                   | 90                    |
| 752F | MODULE PUR SUP    | 9374           | 91,155              | 924               | 90                   | 90                    |
| 752G | MODULE MODE SWI   | 9213           | 91,003              | 910               | 90                   | 90                    |
| 752P | GYROSCOPE X-Y AX  | 937            | 90                  | 90                | 90                   | 90                    |
| 752B | UNIT INERTIAL M   | 955,584        | 9281,415            | 93,858            | 90                   | 90                    |
| 752A | MOD               | 92             | 90                  | 90                | 90                   | 90                    |
| 752B | RACK ELEC EQUIP   | 9567           | 90                  | 90                | 90                   | 90                    |
| 752C | FRONT PANEL       | 962            | 90                  | 90                | 90                   | 90                    |
| 752C | CONTROLLER IMB    | 91,677         | 9404                | 97                | 90                   | 90                    |
| 752C | MOD               | 92             | 90                  | 90                | 90                   | 90                    |
| 752A | MODULE SEQUENCE   | 95             | 90                  | 90                | 90                   | 90                    |
| 752B | CARD SEQUENCER    | 9137           | 9725                | 98                | 90                   | 90                    |
| 752C | CARD SEQUENCER    | 9108           | 9908                | 95                | 90                   | 90                    |
| 752D | MODULE 800 M2     | 9384           | 9456                | 98                | 90                   | 90                    |
| 752E | MODULE HEAD REP   | 91,343         | 92,180              | 9112              | 90                   | 90                    |
| 752F | MODULE RELAY DR   | 954            | 90                  | 90                | 90                   | 90                    |
| 752G | CARD RELAY DRIV   | 9120           | 9561                | 98                | 90                   | 90                    |
| 752H | CARD RELAY DRIV   | 961            | 9295                | 93                | 90                   | 90                    |
| 752H | DRIVER AMPLIFIE   | 95             | 90                  | 90                | 90                   | 90                    |
| 752H | CARD PUR SUPPLY   | 9398           | 91,808              | 942               | 90                   | 90                    |
| 752H | CARD PUR SUPPLY   | 9132           | 9784                | 99                | 90                   | 90                    |
| 752P | CARD PUR SUPPLY   | 9103           | 9201                | 97                | 90                   | 90                    |
| 752B | CARD PUR SUPPLY   | 9380           | 91,800              | 942               | 90                   | 90                    |
| 752H | CARD PUR SUPPLY   | 9128           | 9488                | 910               | 90                   | 90                    |
| 752B | MODULE SITE       | 958            | 9370                | 93                | 90                   | 90                    |
| 752B | MOTHER BOARD MD   | 954            | 90                  | 90                | 90                   | 90                    |
| 752B | ADPTR PUR SP LS   | 942,389        | 92,004              | 972               | 90                   | 90                    |
| 752B | MOD               | 9225           | 90                  | 90                | 90                   | 90                    |
| 752B | MODIT ADPT/PS     | 9188           | 90                  | 90                | 90                   | 90                    |
| 752A | BATTERY CHARGER   | 9283           | 90                  | 90                | 9105                 | 90                    |
| 752B | CHARGER PC BD     | 95             | 90                  | 90                | 90                   | 90                    |
| 752C | BATTERY MTER ADDY | 93,215         | 929                 | 9101              | 90                   | 90                    |
| 752B | BATTERY PACK IM   | 92,837         | 93,200              | 928               | 90                   | 90                    |
| 752B | MOD               | 948            | 90                  | 90                | 90                   | 90                    |
| 752B | INTR REMOTE CON   | 9274           | 90                  | 90                | 90                   | 90                    |
| 752B | INERTIAL MEASUR   | 948,952        | 90                  | 90                | 90                   | 90                    |

WEAPON SYSTEM A0070 DCAMA KOSI. NA.  
AFN 65-110/65-1 DATA AS OF 74 MAR DATE PROCESS

LOGISTIC SUPPORT COST BREAKDOWN RCS:LOG-MMO-0-7213-3-  
CURRENT QUARTER COMPUTATION

| WUC   | NOUN              | FIELD<br>MAINT | SPEC REPAIR<br>COST | QUARTERLY VALUES  |                      |    | BASE MATERIAL<br>COST |
|-------|-------------------|----------------|---------------------|-------------------|----------------------|----|-----------------------|
|       |                   |                |                     | PACK/SHIP<br>COST | CONDEMNATION<br>COST |    |                       |
| 73E00 | DIS SYS HEADSUP   | 95,537         | 90                  | 90                | 90                   | 90 |                       |
| 73E1X |                   | 972,233        | 9125,950            | 92,971            | 91,643               | 90 |                       |
| 73FA0 | BOARD CAPRI       | 9195           | 9360                | 93                | 90                   | 90 |                       |
| 73FAE | MODULE GIMBAL L   | 9355           | 9754                | 915               | 90                   | 90 |                       |
| 73FAF | MODULE PUR SUP    | 9269           | 9324                | 97                | 90                   | 90 |                       |
| 73FAG | MODULE MODE SWI   | 977            | 9406                | 94                | 90                   | 90 |                       |
| 73FAM | ACCELEROMETER X-Y | 938            | 90                  | 90                | 90                   | 90 |                       |
| 73FAN | ACCLMTR ELECTRON  | 921            | 90                  | 90                | 90                   | 90 |                       |
| 73FAO | UNIT INERTIAL M   | 943,003        | 9192,489            | 92,711            | 90                   | 90 |                       |
| 73FA9 | NOC               | 94             | 90                  | 90                | 90                   | 90 |                       |
| 73FB0 | RACK ELEC EQUIP   | 9278           | 90                  | 90                | 90                   | 90 |                       |
| 73FBC | FRONT PANEL       | 9104           | 90                  | 90                | 90                   | 90 |                       |
| 73FC0 | CONTROLLER IMS    | 9736           | 90                  | 90                | 90                   | 90 |                       |
| 73FDB | CARD SEQUENCER    | 9108           | 9385                | 93                | 90                   | 90 |                       |
| 73FDC | CARD SEQUENCER    | 9103           | 9400                | 92                | 90                   | 90 |                       |
| 73FDD | MODULE 800 MZ     | 959            | 9211                | 93                | 90                   | 90 |                       |
| 73FDE | MODULE HEAD REP   | 9728           | 91,068              | 921               | 90                   | 90 |                       |
| 73FDF | MODULE RELAY DR   | 928            | 950                 | 91                | 90                   | 90 |                       |
| 73FDG | CARD RELAY DRIV   | 949            | 9150                | 92                | 90                   | 90 |                       |
| 73FDM | CARD RELAY DRIV   | 983            | 9232                | 92                | 90                   | 90 |                       |
| 73FDJ | MODULE MOL-PTTC   | 998            | 90                  | 90                | 90                   | 90 |                       |
| 73FDK | DRIVER AMPLIFIE   | 97             | 90                  | 91                | 90                   | 90 |                       |
| 73FDM | CARD PUR SUPPLY   | 9115           | 9098                | 93                | 90                   | 90 |                       |
| 73FDM | CARD PUR SUPPLY   | 989            | 9388                | 95                | 90                   | 90 |                       |
| 73FDP | CARD PUR SUPPLY   | 947            | 9198                | 97                | 90                   | 90 |                       |
| 73FDG | CARD PUR SUPPLY   | 9160           | 9518                | 912               | 90                   | 90 |                       |
| 73FDR | CARD PUR SUPPLY   | 989            | 9156                | 94                | 90                   | 90 |                       |
| 73FDS | MODULE SITE       | 918            | 974                 | 91                | 90                   | 90 |                       |
| 73FDU | MOTHER BOARD MD   | 95             | 90                  | 90                | 90                   | 90 |                       |
| 73FDO | ADPTR PUR SP LS   | 928,594        | 90                  | 90                | 90                   | 90 |                       |
| 73FDS | NOC               | 9784           | 90                  | 90                | 90                   | 90 |                       |
| 73FEO | MOJMT ADPT/PS     | 9277           | 90                  | 90                | 90                   | 90 |                       |
| 73FFA | BATTERY CHARGER   | 9345           | 90                  | 94                | 90                   | 90 |                       |
| 73FFC | BATRY MTR ASSY    | 95,457         | 919                 | 988               | 90                   | 90 |                       |
| 73FFO | BATTERY PACK IM   | 92,298         | 9800                | 97                | 90                   | 90 |                       |
| 73FCO | MTR REMOTE COM    | 9898           | 90                  | 90                | 90                   | 90 |                       |

WEAPON SYSTEM A007D DCANA LOGISTIC SUPPORT COST BREAKDOWN RCB,LOG-MNO-Q-7213-3-  
 AFM 00-110/00-1 DATA AS OF 73 DEC

NO51.FM44  
 DATE PROCESSED

CURRENT QUARTER COMPUTATION

| MAC   | NOUN              | FIELD<br>MAINT | QUARTERLY VALUES    |                   |   | CONDENSATION<br>COST | BASE MATERIAL<br>COST |
|-------|-------------------|----------------|---------------------|-------------------|---|----------------------|-----------------------|
|       |                   |                | SPEC REPAIR<br>COST | PACK/SHIP<br>COST |   |                      |                       |
| 72E8K | ASSY DRIVE TRAN   | 918            | 90                  | 90                |   | 90                   | 90                    |
| 72E8L | ASSY STORE CONT   | 915            | P                   | 90                |   | 90                   | 90                    |
| 72E8M | ASSY CORE PLANE   | 930            | P                   | 95                |   | 90                   | 90                    |
| 72E8P | ASSY ANALOG OUT   | 9114           | P                   | 97                |   | 90                   | 90                    |
| 72E8R | ASSY RATE-DEFL    | 9127           | P                   | 916               |   | 90                   | 90                    |
| 72E8S | ASSY OVERFLOW R   | 918            |                     | 93                |   | 90                   | 90                    |
| 72E8T | ASSY FUNCTION C   | 93             | P                   | 90                |   | 90                   | 90                    |
| 72E8U | ASSY CLOCK CHCK   | 929            | P                   | 92                |   | 90                   | 90                    |
| 72E8V | ASSY PARAMETER C  | 95             |                     | 90                |   | 90                   | 90                    |
| 72E8Z | PUR SUPPLY LOW    | 93             | P                   | 93                |   | 90                   | 90                    |
| 72E90 | SIGNAL DATA PRO   | 914,577        | P                   | 920               |   | 90                   | 90                    |
| 72E91 | CIRCUIT BOARD R   | 97             |                     | 90                |   | 90                   | 90                    |
| 72E93 | CHARGE ELECTRONIC | 932            | P                   | 92                | P | 9239                 | 90                    |
| 72E94 | ASSY RECTIFIER B  | 97             |                     | 90                |   | 90                   | 90                    |
| 72E95 | MOD               | 9134           |                     | 90                |   | 90                   | 90                    |
| 72E9A | ASSY FAN          | 960            |                     | 90                |   | 90                   | 90                    |
| 72E9C | MT ELECT EQUIPM   | 9157           |                     | 90                |   | 90                   | 90                    |
| 72E9D | OIS SYS MEASUR    | 90,481         |                     | 90                |   | 90                   | 90                    |
| 72E9H |                   | 988,360        | 97                  | 92,599            |   | 9239                 | 90                    |
| 72FAD | BOARD CAPR        | 9303           | 93,848              | 95                |   | 90                   | 90                    |
| 72FAC | MODULE GINER L    | 9288           | 92,338              | 918               |   | 90                   | 90                    |
| 72FAD | MODULE PUR SUP    | 9203           | 91,520              | 912               |   | 90                   | 90                    |
| 72FAG | MODULE MODS SWI   | 9384           | 92,040              | 99                |   | 90                   | 90                    |
| 72FAO | UNIT INERTIAL M   | 940,731        | 9150,398            | 92,659            |   | 90                   | 90                    |
| 72FBO | PACK ELEC EQUIP   | 9780           | 90                  | 90                |   | 90                   | 90                    |
| 72FCA | ASSY MECHANICAL   | 93             | 90                  | 90                |   | 90                   | 90                    |
| 72FCB | FRONT PANEL       | 977            | 90                  | 90                |   | 90                   | 90                    |
| 72FCO | CONTROLLER INS    | 91,231         | 9400                | 97                |   | 90                   | 90                    |
| 72FC9 | MOD               | 98             | 90                  | 90                |   | 90                   | 90                    |
| 72FDB | CARD SEQUENCER    | 972            | 9398                | 93                |   | 90                   | 90                    |
| 72FDC | CARD SEQUENCER    | 988            | 9400                | 92                |   | 90                   | 90                    |
| 72FDD | MODULE 900 MZ     | 988            | 9211                | 93                |   | 90                   | 90                    |
| 72FDE | MODULE HEAD REP   | 91,003         | 91,299              | 927               |   | 90                   | 90                    |
| 72FDF | MODULE RELAY DR   | 99             | 90                  | 90                |   | 90                   | 90                    |
| 72FDS | CARD RELAY DRIV   | 932            | 9100                | 91                |   | 90                   | 90                    |

LOGSTIC SUPPORT COST BREAKDOWN  
CURRENT QUARTER COMPUTATION

AFN 68-110/88-1 DATA AS OF 73 SEP

LOGSTIC SUPPORT COST BREAKDOWN  
CURRENT QUARTER COMPUTATION

AFN 68-110/88-1 DATA AS OF 73 SEP

LOGSTIC SUPPORT COST BREAKDOWN  
CURRENT QUARTER COMPUTATION

| AC   | NOUN               | FIELD<br>MAINT | SPEC REPAIR<br>COST | QUARTERLY VALUES  |                       |    | BASE MATERIAL<br>COST |
|------|--------------------|----------------|---------------------|-------------------|-----------------------|----|-----------------------|
|      |                    |                |                     | PACK/SHIP<br>COST | CONCENTRATION<br>COST |    |                       |
| 72BT | ASSY FUNCTION C    | 940            | P 90                | 91                | P 90                  | 90 |                       |
| 72BU | ASSY CLOCK CHCK    | 9121           | P 90                | 95                | P 90                  | 90 |                       |
| 72BV | ASSY PARAMETR C    | 95             | 90                  | 90                | 90                    | 90 |                       |
| 72BW | PUR SUPPLY S VOL   | 913            | 90                  | 90                | 90                    | 90 |                       |
| 72BX | PUR SUPPLY LOW     | 93             | P 90                | 93                | 90                    | 90 |                       |
| 72BY | SIGNAL DATA PRO    | 928,936        | P 90                | 9280              | 90                    | 90 |                       |
| 72BZ | CHASSIS ELECTRONIC | 9127           | 90                  | 90                | 90                    | 90 |                       |
| 72C1 | MOD                | 9242           | 90                  | 90                | 90                    | 90 |                       |
| 72C2 | ASSY FAN           | 9294           | 90                  | 90                | 90                    | 90 |                       |
| 72C3 | MT ELECT EQUIPM    | 9249           | 90                  | 90                | 90                    | 90 |                       |
| 72C4 | DIB SYS HEADSUP    | 913,448        | 90                  | 90                | 90                    | 90 |                       |
| 72C5 |                    | 9103,238       | 924                 | 93,634            | 94,166                | 90 |                       |
| 72C6 | BOARD CAPRI        | 9262           | 91,872              | 92                |                       | 90 |                       |
| 72C7 | MODULE GINGAL L    | 9375           | 9588                | 90                |                       | 90 |                       |
| 72C8 | MODULE PUR SUP     | 9182           | P 93,428            | 97                |                       | 90 |                       |
| 72C9 | MODULE MODE SWI    | 9127           | 91,080              | 92                |                       | 90 |                       |
| 72CA | ACCELEROMETER X-Y  | 92             | 90                  | 90                |                       | 90 |                       |
| 72CB | UNIT INERTIAL M    | 944,250        | 9215,084            | 93,173            |                       | 90 |                       |
| 72CC | RACK ELEC EQUIP    | 9101           | 90                  | 90                |                       | 90 |                       |
| 72CD | FRONT/PANEL        | 925            | 90                  | 90                |                       | 90 |                       |
| 72CE | CONTROLLER INS     | 91,197         | 9300                | 95                |                       | 90 |                       |
| 72CF | MOD                | 919            | 90                  | 90                |                       | 90 |                       |
| 72CG | MODULE SEQUENCE    | 93             | 90                  | 90                |                       | 90 |                       |
| 72CH | CARD SEQUENCER     | 9171           | 9184                | 91                |                       | 90 |                       |
| 72CI | CARD SEQUENCER     | 9127           | 9100                | 91                |                       | 90 |                       |
| 72CJ | MODULE 800 HZ      | 928            | 9118                | 91                |                       | 90 |                       |
| 72CK | MODULE HEAD REP    | 9831           | 91,248              | 924               |                       | 90 |                       |
| 72CL | MODULE RELAY DR    | 93             | 90                  | 90                |                       | 90 |                       |
| 72CM | CARD RELAY DRIV    | 979            | 9150                | 92                |                       | 90 |                       |
| 72CN | CARD RELAY DRIV    | 959            | 9174                | 92                |                       | 90 |                       |
| 72CO | MODULE ROL-PITC    | 918            | 90                  | 90                |                       | 90 |                       |
| 72CP | CARD PUR SUPPLY    | 9290           | 91,378              | 919               |                       | 90 |                       |
| 72CQ | CARD PUR SUPPLY    | 979            | 9291                | 94                |                       | 90 |                       |
| 72CR | CARD PUR SUPPLY    | 9110           | 9138                | 97                |                       | 90 |                       |
| 72CS | CARD PUR SUPPLY    | 9201           | 9808                | 918               |                       | 90 |                       |
| 72CT | CARD PUR SUPPLY    | 987            | 9104                | 91                |                       | 90 |                       |
| 72CU | MODULE F SITE      | 988            | 9000                | 91                |                       | 90 |                       |

LEAPON SYSTEM A0070 OCAMA LOGISTIC SUPPORT COST BREAKDOWN RCS.L0G-MMD-0-7213-3- K051.PWAL  
 07M 00-110/00-1 DATA AS OF 73 JUN CURRENT QUARTER COMPUTATION DATE PROCESSED

| WAC   | NOUN              | FIELD<br>MAINT | QUARTERLY VALUES    |                   |                     | BASE MATERIAL<br>COST |
|-------|-------------------|----------------|---------------------|-------------------|---------------------|-----------------------|
|       |                   |                | SPEC REPAIR<br>COST | PACK/SHIP<br>COST | CONDENATION<br>COST |                       |
| 73ECA | AGSY PAN          | 071            | 00                  | 00                | 00                  | 00                    |
| 73ECO | MT ELECT EQUIPM   | 0345           | 00                  | 00                | 00                  | 00                    |
| 73E00 | D18 SYS HEADSUP   | 010,501        | 00                  | 00                | 00                  | 00                    |
| 73E0X |                   | 0120,363       | 019                 | 02,281            | 00                  | 00                    |
| 73FA0 | BOARD CAPRI       | 0143           | 071                 | 01                | 00                  | 00                    |
| 73FAE | MODULE GIMBAL L   | 0307           | 067                 | 00                | 00                  | 00                    |
| 73FAF | MODULE PAR SUP    | 0269           | 0424                | 00                | 00                  | 00                    |
| 73FAG | MODULE MODE SWI   | 0136           | 0342                | 03                | 00                  | 00                    |
| 73FAS | GYROSCOPE ELECTA  | 028            | 00                  | 00                | 00                  | 00                    |
| 73FA0 | UNIT INERTIAL M   | 051,740        | 0321,000            | 03,424            | 00                  | 00                    |
| 73FAS | NOC               | 05             | 00                  | 00                | 00                  | 00                    |
| 73FBO | RACK ELEC EQUIP   | 0140           | 00                  | 00                | 00                  | 00                    |
| 73FCB | FRONT PANEL       | 02             | 00                  | 00                | 00                  | 00                    |
| 73FCO | CONTROLLER IMS    | 01,362         | 0158                | 03                | 00                  | 00                    |
| 73FC9 | NOC               | 021            | 00                  | 00                | 00                  | 00                    |
| 73FDB | CARD SEQUENCER    | 0121           | 0300                | 02                | 00                  | 00                    |
| 73FDC | CARD SEQUENCER    | 0108           | 038                 | 01                | 00                  | 00                    |
| 73FDD | MODULE 800 MZ     | 0106           | 00                  | 00                | 00                  | 00                    |
| 73FDE | MODULE HEAD REP   | 0049           | 01,011              | 022               | 00                  | 00                    |
| 73FDG | CARD RELAY DRIV   | 0197           | 0198                | 03                | 00                  | 00                    |
| 73FDH | CARD RELAY DRIV   | 0111           | 0228                | 02                | 00                  | 00                    |
| 73FDK | DRIVER AMPLIFIE   | 015            | 00                  | 00                | 00                  | 00                    |
| 73FDL | POWER SUPPLY      | 074            | 00                  | 00                | 00                  | 00                    |
| 73FDN | CARD FOR SUPPLY   | 0143           | 0500                | 00                | 00                  | 00                    |
| 73FDN | CARD FOR SUPPLY   | 032            | 00                  | 00                | 00                  | 00                    |
| 73FDP | CARD FOR SUPPLY   | 0150           | 0132                | 07                | 00                  | 00                    |
| 73FDE | CARD FOR SUPPLY   | 0165           | 0504                | 012               | 00                  | 00                    |
| 73FDR | CARD FOR SUPPLY   | 045            | 0100                | 01                | 00                  | 00                    |
| 73FDS | MODULE SITE       | 028            | 0144                | 01                | 00                  | 00                    |
| 73FDU | MOTHER BOARD HQ   | 028            | 00                  | 00                | 00                  | 00                    |
| 73FDO | ADPTR PART SP LB  | 030,970        | 00                  | 028               | 00                  | 00                    |
| 73FDS | NOC               | 010            | 00                  | 00                | 00                  | 00                    |
| 73FES | HEUNT ADPT/PS     | 078            | 00                  | 00                | 00                  | 00                    |
| 73FFA | BATTERY CHARGER   | 0015           | 00                  | 00                | 00                  | 00                    |
| 73FFB | CHARGER PC 80     | 058            | 00                  | 00                | 00                  | 00                    |
| 73FFC | BATTERY MTER AGSY | 05,205         | 019                 | 000               | 00                  | 00                    |

WEAPON SYSTEM A0070 D00000  
AFM 85-110/88-1 DATA AS OF 73 MAR

DATE PROCESSED  
K051.PN4L

RELATIVE CURRENT COST BREAKDOWN REPORT NO. 2-7213-3  
CURRENT QUARTER COMPUTATION

| WUC   | NOUN              | FIELD<br>MAINT | REP. REPAIR<br>COST | STARTER VALUES<br>PACK SHIP<br>COST | CONCENTRATION<br>COST | BASE MATERIAL<br>COST |
|-------|-------------------|----------------|---------------------|-------------------------------------|-----------------------|-----------------------|
| 73EB4 | PUR SUPPLY 5 VOL  | 922            | \$0                 | \$0                                 | \$0                   | \$0                   |
| 73EB2 | PUR SUPPLY LOW    | 928            | \$0                 | \$0                                 | \$0                   | \$0                   |
| 73EB0 | SIGNAL DATA PRO   | \$27,230       | \$0                 | \$278                               | \$0                   | \$0                   |
| 73EB3 | CHASIS ELECTRONIC | 93             | \$0                 | \$0                                 | \$0                   | \$0                   |
| 73ECU | MT ELECT EQUIPM   | 9263           | \$0                 | \$0                                 | \$0                   | \$0                   |
| 73E00 | CIS SYS HEADSUP   | \$20,229       | \$0                 | \$0                                 | \$0                   | \$0                   |
| 73E44 |                   | \$103,452      | \$10                | \$3,313                             | \$6,856               | \$0                   |
| 73FA0 | BOARD CAPRI       | 9341           | \$284               | \$2                                 | \$0                   | \$0                   |
| 73FAE | MODULE GIMBAL L   | 945            | \$237               | P                                   | \$0                   | \$0                   |
| 73FA5 | MODULE PUR SUP    | 9453           | \$216               | P                                   | \$0                   | \$0                   |
| 73FA0 | MODULE MODE SWI   | \$124          | \$54                | \$1                                 | \$0                   | \$0                   |
| 73FAP | ACCUPTA ELECTRON  | 9              | \$0                 | \$0                                 | \$0                   | \$0                   |
| 73FAC | UNIT INERTIAL M   | \$47,143       | \$143,452           | \$1,380                             | \$0                   | \$0                   |
| 73FAG | NOE               | 237            | \$0                 | \$0                                 | \$0                   | \$0                   |
| 73F80 | RACK ELEC EQUIP   | 940            | \$0                 | \$0                                 | \$0                   | \$0                   |
| 73F8B | FRONT PANEL       | 924            | \$0                 | \$0                                 | \$0                   | \$0                   |
| 73F82 | CONTROLLER IMV    | \$1,622        | \$10                | \$3                                 | \$0                   | \$0                   |
| 73F8A | MODULE SEQUENCE   | 913            | \$0                 | \$0                                 | \$0                   | \$0                   |
| 73F8B | CAPC SEQUENCEP    | 944            | \$15                | \$1                                 | \$0                   | \$0                   |
| 73F8C | CAPC SEQUENCEP    | 945            | \$0                 | \$0                                 | \$0                   | \$0                   |
| 73F8C | MODULE 900 MZ     | 9200           | \$0                 | \$1                                 | \$0                   | \$0                   |
| 73F8E | MODULE HEAD REP   | \$1,271        | \$116               | \$24                                | \$0                   | \$0                   |
| 73F8G | CAPC RELAY DPT    | 942            | \$15                | \$1                                 | \$0                   | \$0                   |
| 73F8H | CAPC RELAY DPT    | 913            | \$14                | \$1                                 | \$0                   | \$0                   |
| 73F8I | MODULE REL DPTC   | 951            | \$0                 | \$0                                 | \$0                   | \$0                   |
| 73F8J | CAPC PUR SUPPLY   | \$171          | \$1,204             | \$16                                | \$0                   | \$0                   |
| 73F8K | CAPC PUR SUPPLY   | 937            | \$300               | \$4                                 | \$0                   | \$0                   |
| 73F8L | CAPC PUR SUPPLY   | 937            | \$130               | \$1                                 | \$0                   | \$0                   |
| 73F8M | CAPC PUR SUPPLY   | 9232           | \$114               | \$21                                | \$0                   | \$0                   |
| 73F8N | CAPC PUR SUPPLY   | 9237           | \$364               | \$4                                 | \$0                   | \$0                   |
| 73F8O | ACUPTA PUR SUP    | \$32,554       | \$72                | \$10                                | \$0                   | \$0                   |
| 73F8P | NOE               | 924            | \$0                 | \$0                                 | \$0                   | \$0                   |
| 73F8Q | MODULE ACUPTA P   | \$132          | \$0                 | \$0                                 | \$0                   | \$0                   |
| 73F8R | WATERPUMP SHIP    | \$1,271        | \$0                 | \$0                                 | \$0                   | \$0                   |
| 73F8S | WATERPUMP SHIP    | 924            | \$0                 | \$0                                 | \$0                   | \$0                   |
| 73F8T | WATERPUMP SHIP    | \$1,271        | \$23                | \$14                                | \$0                   | \$0                   |
| 73F8U | WATERPUMP SHIP    | \$3,071        | \$0                 | \$1                                 | \$0                   | \$0                   |

WEAPON SYSTEM A007D OCAMA  
AFM 65-110/66-1 DATA 'S OF 72 DEC

LOGISTIC REPORT COST BREAKDOWN  
CURRENT QUARTER INFORMATION

| WAC     | NOUN               | FIELD<br>MAINT | SPEC REPAIR<br>COST | QUARTERLY VALUES |         | QUARTERLY<br>COST |   |
|---------|--------------------|----------------|---------------------|------------------|---------|-------------------|---|
|         |                    |                |                     | PAC              | SHIP    |                   |   |
| 73EAS   | NOC                | \$200          | \$0                 | \$0              | \$0     | \$0               | 1 |
| 73EBA   | ASSY DATA INPUT    | \$9            | \$0                 | \$0              | \$0     | \$0               | 1 |
| 73EBB   | ASSY ADDER/MEMO    | \$130          | \$0                 | \$0              | \$0     | \$0               | 1 |
| 73EBC   | ASSY PROCESSOR C   | \$28           | \$0                 | \$0              | \$0     | \$0               | 1 |
| 73EBE   | ASSY DISCRETE I    | \$6            | \$0                 | \$0              | \$0     | \$0               | 1 |
| 73EBH   | ASSY INSTRUCTION   | \$39           | \$0                 | \$0              | \$0     | \$0               | 1 |
| 73EBJ   | ASSY STR CONT R    | \$73           | \$0                 | \$0              | \$0     | \$0               | 1 |
| 73EBK   | ASSY DRIVER TRAN   | \$19           | \$0                 | \$0              | \$0     | \$0               | 1 |
| 73EBL   | ASSY STORE CONT    | \$41           | \$0                 | \$0              | \$0     | \$0               | 1 |
| 73EBM   | ASSY CORE PLANE    | \$45           | \$0                 | \$0              | \$0     | \$0               | 1 |
| 73EBP   | ASSY ANALOG OUT    | \$392          | \$0                 | \$0              | \$0     | \$0               | 1 |
| 73EBQ   | ASSY ANALOG INP    | \$108          | \$0                 | \$0              | \$0     | \$0               | 1 |
| 73EBR   | ASSY RATE-DEFL     | \$22           | \$0                 | \$0              | \$0     | \$0               | 1 |
| 73EBB   | ASSY OVERFLOW R    | \$25           | \$0                 | \$0              | \$0     | \$0               | 1 |
| 73EBT   | ASSY FUNCTION C    | \$37           | \$0                 | \$0              | \$0     | \$0               | 1 |
| 73EBU   | ASSY CLOCK CHEK    | \$113          | \$0                 | \$0              | \$0     | \$0               | 1 |
| 73EBV   | ASSY PARAMETR C    | \$5            | \$0                 | \$0              | \$0     | \$0               | 1 |
| 73EBX   | PUR SUPPLY 5 VOL   | \$6            | \$0                 | \$0              | \$0     | \$0               | 1 |
| 73EBD   | SIGNAL DATA PRO    | \$29,703       | \$0                 | \$0              | \$197   | \$0               | 1 |
| 73EBE   | MAGNETIC ASSY      | \$11           | \$0                 | \$0              | \$0     | \$0               | 1 |
| 73EB3   | CHASSIS ELECTRONIC | \$21           | \$0                 | \$0              | \$0     | \$0               | 1 |
| 73ECA   | ASSY FAN           | \$85           | \$0                 | \$0              | \$0     | \$0               | 1 |
| 73ECO   | MT ELECT EQUIPM    | \$87           | \$0                 | \$0              | \$0     | \$0               | 1 |
| 73E00   | DIB SYS HEADSUP    | \$19,399       | \$0                 | \$0              | \$0     | \$0               | 1 |
| 73EXX   |                    | \$93,674       | \$12                | \$2,773          | \$1,515 | \$0               | 1 |
| 73FA0   | BOARD CAPRI        | \$215          | \$210               | \$0              | \$0     | \$0               | 1 |
| 73FAE   | MODULE GIMBAL L    | \$298          | \$188               | \$0              | \$0     | \$0               | 1 |
| 73FAF   | MODULE PUR SUP     | \$401          | \$53                | \$0              | \$0     | \$0               | 1 |
| 73FAG   | MODULE MODE SWI    | \$124          | \$0                 | \$0              | \$0     | \$0               | 1 |
| X 73FA0 | UNIT INERTIAL M    | \$39,361       | \$30,928            | \$1,770          | \$0     | \$0               | 1 |
| 73FB0   | RACK ELEC EQUIP    | \$458          | \$0                 | \$0              | \$0     | \$0               | 1 |
| 73FC0   | CONTROLLER IMS     | \$548          | \$101               | \$0              | \$0     | \$0               | 1 |
| 73FDA   | MODULE SEQUENCE    | \$14           | \$0                 | \$0              | \$0     | \$0               | 1 |

K051, PM4L  
DATE PROCESSED

LOGISTIC SUPPORT COST BREAKDOWN  
CURRENT QUARTER COMPUTATION

WEAPON SYSTEM A0070 OCAMA  
AFM 05-110/00-1 DATA AS OF 72 SEP

| MAC   | MODL              | FIELD<br>MAINT | QUARTERLY VALUES    |                   |                      | BASE MATERIAL<br>COST |
|-------|-------------------|----------------|---------------------|-------------------|----------------------|-----------------------|
|       |                   |                | SPEC REPAIR<br>COST | PACK/SHIP<br>COST | CONCERNATION<br>COST |                       |
| 73EC0 | MT ELECT EQUIPM   | 9158           | 90                  | 90                | 90                   | 90                    |
| 73EC9 | NOC               | 920            | 90                  | 90                | 90                   | 90                    |
| 73E00 | D18 SYS HEADSUP   | 910,003        | 90                  | 90                | 90                   | 90                    |
| 73E1X |                   | 930,913        | 98                  | 93,482            | 91,510               | 90                    |
| 73FAD | BOARD CAPRI       | 987            | 970                 | 91                | 90                   | 90                    |
| 73FAE | MODULE C10MAL L   | 9146           | 958                 | 90                | 90                   | 90                    |
| 73FAF | MODULE PUR SUP    | 952            | 90                  | 90                | 90                   | 90                    |
| 73FAG | MODULE MODE SHI   | 963            | 9112                | 91                | 90                   | 90                    |
| 73FAD | UNIT INERTIAL M   | 941,243        | 9104,392            | 92,249            | 90                   | 90                    |
| 73FBO | RACK ELEC EQUIP   | 9562           | 90                  | 90                | 90                   | 90                    |
| 73FC0 | CONTROLLER INS    | 9760           | 9505                | 90                | 90                   | 90                    |
| 73FC9 | NOC               | 924            | 90                  | 90                | 90                   | 90                    |
| 73FDB | CARD SEQUENCER    | 943            | 90                  | 90                | 90                   | 90                    |
| 73FDC | CARD SEQUENCER    | 920            | 90                  | 90                | 90                   | 90                    |
| 73FDB | MODULE HEAD REP   | 92,368         | 9890                | 935               | 90                   | 90                    |
| 73FDB | CARD RELAY D11V   | 937            | 90                  | 90                | 90                   | 90                    |
| 73FDB | MODULE REL-P1TC   | 93             | 90                  | 90                | 90                   | 90                    |
| 73FDB | CARD PUR SUPPLY   | 9178           | 9525                | 98                | 90                   | 90                    |
| 73FDB | CARD PUR SUPPLY   | 918            | 9158                | 92                | 90                   | 90                    |
| 73FDB | CARD PUR SUPPLY   | 9188           | 9320                | 912               | 90                   | 90                    |
| 73FDB | CARD PUR SUPPLY   | 984            | 9313                | 910               | 90                   | 90                    |
| 73FDB | CARD PUR SUPPLY   | 924            | 9102                | 91                | 90                   | 90                    |
| 73FDB | MODULE SITE       | 96             | 974                 | 91                | 90                   | 90                    |
| 73FDB | ADPTR PUR SP LS   | 930,648        | 93,337              | 928               | 90                   | 90                    |
| 73FDB | NOC               | 9282           | 90                  | 90                | 90                   | 90                    |
| 73FDB | MODULE ADPTR/PS   | 9122           | 90                  | 90                | 90                   | 90                    |
| 73FDB | BATTERY CHARGER   | 91,717         | 90                  | 90                | 90                   | 90                    |
| 73FDB | CHARGER PC 80     | 949            | 90                  | 90                | 90                   | 90                    |
| 73FDB | BATTERY MTER ASBY | 93,015         | 922                 | 934               | 91,112               | 90                    |
| 73FDB | BATTERY PACK IN   | 94,585         | 90                  | 90                | 90                   | 90                    |
| 73FDB | INTR REMOTE COM   | 9791           | 90                  | 90                | 90                   | 90                    |
| 73FDB | INERTIAL MEASUR   | 933,120        | 90                  | 90                | 90                   | 90                    |
| 73FDB |                   | 9120,279       | 9111,508            | 92,493            | 91,112               | 90                    |

| NAIC  | NAUN              | FIELD<br>NAME | SPEC REPAIR<br>COST | QTY | UNIT PRICE | TOTAL PRICE | QTY | UNIT PRICE | TOTAL PRICE |
|-------|-------------------|---------------|---------------------|-----|------------|-------------|-----|------------|-------------|
| 73EAS | ASSY VIDEO        | 88            | \$0                 | 1   | \$0        | \$0         | 1   | \$0        | \$0         |
| 73EAS | ASSY BITE         | 845           | \$0                 | 1   | \$0        | \$0         | 1   | \$0        | \$0         |
| 73EAT | PWR SUPPLY LOW V  | 811           | \$0                 | 1   | \$0        | \$0         | 1   | \$0        | \$0         |
| 73EAV | PRINT CIR BRD IM  | 82R           | \$0                 | 1   | \$0        | \$0         | 1   | \$0        | \$0         |
| 73EAV | CIR BRD ER AMP    | 8183          | \$0                 | 1   | \$0        | \$0         | 1   | \$0        | \$0         |
| 73EAV | CIR BRD OUTPT R   | 807           | \$0                 | 1   | \$0        | \$0         | 1   | \$0        | \$0         |
| 73EAS | ASSY RECTIFIER B  | 818E          | \$0                 | 1   | \$0        | \$0         | 1   | \$0        | \$0         |
| 73EAO | DIS UNIT HEADCU   | 826,221       | \$0                 | 1   | \$0        | \$0         | 1   | \$0        | \$0         |
| 73EAS | NOC               | 8213          | \$0                 | 1   | \$0        | \$0         | 1   | \$0        | \$0         |
| 73EAS | ASSY DATA INPUT   | 822           | \$0                 | 1   | \$0        | \$0         | 1   | \$0        | \$0         |
| 73EAS | ASSY ADAPTER MEMO | 896           | \$0                 | 1   | \$0        | \$0         | 1   | \$0        | \$0         |
| 73EHC | ASSY PROCESSOR C  | 834           | \$0                 | 1   | \$0        | \$0         | 1   | \$0        | \$0         |
| 73EHC | ASSY DISCRETE I   | 813           | \$0                 | 1   | \$0        | \$0         | 1   | \$0        | \$0         |
| 73EHC | ASSY INSTRUCTION  | 816           | \$0                 | 1   | \$0        | \$0         | 1   | \$0        | \$0         |
| 73EHC | ASSY STR CONT R   | 840           | \$0                 | 1   | \$0        | \$0         | 1   | \$0        | \$0         |
| 73EHC | ASSY DRIVE TRAN   | 844           | \$0                 | 1   | \$0        | \$0         | 1   | \$0        | \$0         |
| 73EHC | ASSY STORE CONT   | 859           | \$0                 | 1   | \$0        | \$0         | 1   | \$0        | \$0         |
| 73EHC | ASSY CORE PLANE   | 876           | \$0                 | 1   | \$0        | \$0         | 1   | \$0        | \$0         |
| 73EHC | ASSY ANALOG OUT   | 830           | \$0                 | 1   | \$0        | \$0         | 1   | \$0        | \$0         |
| 73EHC | ASSY ANALOG IMP   | 840           | \$0                 | 1   | \$0        | \$0         | 1   | \$0        | \$0         |
| 73EHC | ASSY RATE DEF     | 849           | \$0                 | 1   | \$0        | \$0         | 1   | \$0        | \$0         |
| 73EHC | ASSY ORIFLOW R    | 821           | \$0                 | 1   | \$0        | \$0         | 1   | \$0        | \$0         |
| 73EHC | ASSY CLOCK CHECK  | 866           | \$0                 | 1   | \$0        | \$0         | 1   | \$0        | \$0         |
| 73EHC | ASSY PARALLEL C   | 874           | \$0                 | 1   | \$0        | \$0         | 1   | \$0        | \$0         |
| 73EHC | PWR SUPPLY 5 VOL  | 820           | \$0                 | 1   | \$0        | \$0         | 1   | \$0        | \$0         |
| 73EHC | PWR SUPPLY LOW    | 854           | \$0                 | 1   | \$0        | \$0         | 1   | \$0        | \$0         |
| 73EHC | SIGNAL DATA PWD   | 819,761       | \$0                 | 1   | \$0        | \$0         | 1   | \$0        | \$0         |
| 73EHC | NOC               | 816           | \$0                 | 1   | \$0        | \$0         | 1   | \$0        | \$0         |
| 73EHC | ASSY FAN          | 871           | \$0                 | 1   | \$0        | \$0         | 1   | \$0        | \$0         |
| 73EHC | MT ELECT GROUND   | 8412          | \$0                 | 1   | \$0        | \$0         | 1   | \$0        | \$0         |
| 73EHC | DIS UNIT HEADCU   | 84,533        | \$0                 | 1   | \$0        | \$0         | 1   | \$0        | \$0         |
| 73EHC |                   | 858,027       | \$10                | 1   | \$10       | \$10        | 1   | \$10       | \$10        |
| 73EHC | GROUND CAPRI      | 8296          | \$0                 | 1   | \$0        | \$0         | 1   | \$0        | \$0         |
| 73EHC | MODULE GIMBAL L   | 8145          | \$0                 | 1   | \$0        | \$0         | 1   | \$0        | \$0         |
| 73EHC | MODULE MODE SWI   | 896           | \$224               | 1   | \$224      | \$224       | 1   | \$224      | \$224       |
| 73EHC | UNIT INERTIAL M   | 834,127       | \$156,426           | 1   | \$156,426  | \$156,426   | 1   | \$156,426  | \$156,426   |

Weapon System      A007D      OCAMA      Logistic Support Cost Breakdown  
 AFM 65-110/66-1      Data as of 79 Mar      Current Quarter Computation      K051.PN4L

| QUARTERLY VALUES |                  |             |                  |                |                   |
|------------------|------------------|-------------|------------------|----------------|-------------------|
| WUC              | NOUN             | FIELD MAINT | SPEC REPAIR COST | PACK/SHIP COST | CONDEMNATION COST |
| 73FAO            | Unit Inertial M. | 71,969      | 157,325          | \$2,992        | 0                 |
|                  |                  |             |                  |                | 0                 |

SELECTED BIBLIOGRAPHY

#### A. REFERENCES CITED

1. Allison, Lieutenant Colonel Jeffrey B., USAF. "Documentation of the USAF Implementation of Reliability-Centered Maintenance." Unpublished research report No. 810603, AFLMC, Gunter AFS AL, July 1981.
2. Asselin, Joseph R., Program Analysis Officer, Production Division, AGMC, Newark AFS OH. Telephone interview. 24 May 1982.
3. Badalamente, Major Richard V., USAF, and Major Thomas D. Clark, Jr., USAF. "Spinning Our (Information) Wheels: A Look at the Maintenance Data Collection System." Unpublished technical report No. LSTR 1-78, AFIT/LS, Wright-Patterson AFB OH, February 1978.
4. Barlow, Richard E., and Raphael Campo. "Total Time on Test Processes and Applications to Failure Data Analysis," in Richard Barlow, Jerry Fussell and Nozer Singpurwalla, eds., Reliability and Fault Tree Analysis. Philadelphia PA: SIAM, 1975, pp. 451-481.
5. ———, and Larry Hunter. "Optimum Preventive Maintenance Policies," Operations Research, 1960, pp. 90-100.
6. ———, and F. Proschan. Mathematical Theory of Reliability. New York: Wiley and Sons, 1965.
7. Berg, Menachem. "A Proof of Optimality for Age Replacement Policies," Journal of Applied Probability, 1976, pp. 751-759.
8. ———, and B. Epstein. "A Modified Block Replacement Policy," Naval Research Logistics Quarterly, March 1976, pp. 15-24.
9. Bergman, Bo. "Some Graphical Methods for Maintenance Planning," Proceedings of the Annual Reliability and Maintainability Symposium, 1977, pp. 467-471.
10. Covency, William. Program Manager, Singer Company, Kearfott Division, Little Falls NJ. Telephone interview. 16 July 1982.

11. Crowe, Captain Lowell R., USAF, and Captain Levi D. Lowman, USAF. "An Analysis of the Exponential Function as the Underlying Distribution for Describing Failures in Initial Measurement Units." Unpublished master's thesis. LSSR 22-77A, AFIT/LS, Wright-Patterson AFB OH, June 1977. AD A044189.
12. Fox, B. "Age Replacement with Discounting," Operations Research, 1966, pp. 533-537.
13. Freund, John E. Mathematical Statistics. Englewood Cliffs NJ: Prentice-Hall, Inc., 1971.
14. Frick, Lynn A., Captain, USAF, and Captain R. E. Sasser, Jr., USAF. "Improving the Preventive Maintenance Checks and Services Program for the M60A1 Main Battle Tank." Unpublished master's thesis. LSSR 15-79B, AFIT/LS, Wright-Patterson AFB OH, September 1979. AD A075589.
15. Glasser, Gerald J. "The Age Replacement Problem," Technometrics, February 1967, pp. 83-91.
16. Griffin, Captain John T., Jr., USAF. Lead Reliability Engineer, Reliability Engineering and Operations Division, AGMC, Newark AFS OH. Telephone interview. 14 May 1982.
17. Hall, H. D. "Computer Monitored Inspection Programs (CMIP)," Proceedings of the 14th Annual International Logistics Symposium, 1980, pp. 29-38.
18. Ingram, C. R., and R. L. Scheaffer. "On Consistent Estimation of Age Replacement Intervals," Technometrics, May 1976, pp. 213-219.
19. Janisieski, John A. Deputy Chief, Maintenance Policy Division, HQ USAF/LEYM. Letter, subject: Reliability Centered Maintenance, to HQ AFLC/LOL/LOE, 29 May 1981.
20. Leaf, Lieutenant General Howard W. Inspector General, HQ USAF/IG. Letter, subject: Summary of Class A Aircraft Final Progress Report, to HQ USAF/CS, 10 April 1981.
21. Lewis, Jim, C-141 Systems Management Office. Address to the Joseph P. Cribbins Product Support Symposium, St. Louis MO, 5 November 1980.

22. Nowlan, Stanley F., and Howard F. Heap. Reliability-Centered Maintenance. El Paso TX: Dolby Access Press, 1978.
23. Pierskalla, William P., and John A. Voelker. "A Survey of Maintenance Models: The Control and Surveillance of Deteriorating Systems," Naval Research Logistics Quarterly, March 1975, pp. 353-388.
24. Ross, Sheldon M. Applied Probability Models with Optimization Applications, San Francisco: Holden-Day, Inc., 1970.
25. Scheaffer, Richard L. "Optimum Age Replacement Policies with an Increasing Cost Factor," Technometrics, February 1971, pp. 139-144.
26. Singpurwalla, Nozer D., and Major Carlos M. Talbott, Jr., USAF. "Optimum Maintenance Policies," Unpublished research report, unnumbered, AFLMC, Gunter AFS AL, 1981.
27. Smith, Michael C. "An Analysis of Opportunistic Maintenance Policy for the F100PW100 Aircraft Engine." Unpublished research report No. AFOSR-80-0102, Air Force Office of Scientific Research, Alexandria VA, 1980. AD A097548.
28. Talbott, Captain Carlos M., Jr., USAF, Scientific Analyst. Address to the Military Operations Research Society, 42nd Symposium, U.S. Naval War College, Newport RI, 7 December 1978.
29. Taylor, Howard M. "Optimal Replacement Under Additive Damage and Other Failure Models," Naval Research Logistics Quarterly, March 1975, pp. 1-18.
30. U.S. Air Force Logistics Command. Scheduled Maintenance Requirements Analysis. AFLCP 66-35. Wright-Patterson AFB OH, 2 September 1977.
31. U.S. Department of the Air Force. Equipment Maintenance Policies, Objectives and Responsibilities. AFR 66-14. Washington: Government Printing Office, 1978.
32. \_\_\_\_\_. Product Improvement Policy (PIP) for Operational Equipment. AFR 66-30. Washington: Government Printing Office, 1982.

33. U.S. Department of the Army. DARCOM Guide to Logistic Support Analysis. DARCOM-P 750-16. Washington: Government Printing Office, 1980.
34. U.S. Department of Defense. Maintenance Program Planning. MIL-M-5096D. Washington: Government Printing Office, 1967.
35. \_\_\_\_\_. Reliability Prediction. MIL-STD-756A. Washington: Government Printing Office, 1963.
36. \_\_\_\_\_. Requirements for Reliability Program. MIL-STD-785B. Washington: Government Printing Office, 1980.

#### B. RELATED SOURCES

- A'Hearn, Major Francis W., USAF. "The MSG-2 Commercial Airline Concept: A Department of Defense Program for Reliability-Centered Maintenance." Unpublished research report No. PMC 77-2, Defense Systems Management College, Fort Belvoir VA, February 1978. AD A050531.
- Barlow, Richard E., "Analysis of Retrospective Failure Data Using Computer Graphics." Proceedings of the Annual Reliability and Maintainability Symposium, 1978, pp. 113-116.
- \_\_\_\_\_. "Geometry of the Total Time on Test Transform," Naval Research Logistics Quarterly, September 1979, pp. 393-402.
- Budne, Thomas A. "Basic Philosophies in Reliability," Industrial Quality Control, September 1961, pp. 87-93.
- Denardo, Eriv V., and Bennett L. Fox. "Nonoptimality of Planned Replacement in Intervals of Decreasing Failure Rate," Operations Research, 1967, pp. 358-359.
- Rambo, Major Stephen W., USAF. "Impact of Reliability Centered Maintenance on Scheduled Aircraft Maintenance Man-Hours in Three C-130 USAF Reserve Units." Unpublished research report No. 1920-79, Air Command and Staff College, Maxwell AFB AL, April 1979. AD B039473.
- Resnikoff, H. L. Mathematical Aspects of Reliability--Centered Maintenance. Los Altos CA: Dolby Access Press, 1979.

Singpurwalla, Nozer D., and Captain Carlos M. Talbott, Jr., USAF. "An Assessment of the Benefits Due to Reliability Centered Maintenance on the C-141," Air Force Journal of Logistics, Winter 1980, pp. 11-15.

Story, Major Donald H., USAF. "F100 Engine Reliability Centered Maintenance (RCM)--Success or Failure." Unpublished research report No. 2305-81, Air Command and Staff College, Maxwell AFB AL, May 1981. AD B057596L.

U.S. Department of the Air Force. "Review of Selected Aircraft Maintenance Programs." Summary report of audit. SRA 67248, Air Force Audit Agency, Norton AFB CA, October 1978. AD B030559.

BIOGRAPHICAL SKETCHES OF THE AUTHORS

Captain Douglas C. Beckwith graduated from high school in Pembroke, New York, in 1967. He attended Oklahoma State University from which he received a Bachelor of Science degree in Hotel Administration in May 1973. Commissioned an officer in 1973, he received nine months of formal training at Fort Rucker, Alabama, for subsequent duty as a Flight Examiner Pilot at Minot Air Force Base, North Dakota. He was then transferred to Eglin Air Force Base, Florida, where he performed duties as the Wing H-1F Standardization Pilot and Wing Executive Officer. He then became a Maintenance Supervisor and was assigned to the Air Force Systems Command.

Captain Anthony R. Roclevitch was born 1 January 1953 in Bourne, Massachusetts. He graduated from high school in Wiesbaden, Germany, in 1971. He attended Troy State University where he earned a Bachelor of Science degree in History and received an officer commission through the AFROTC Program in June 1975. He cross-trained from the Administration career field in 1980 and was assigned as OIC of the Aircraft Branch, 1 TFW, Langley Air Force Base, Virginia, from 1980 to 1981. He graduated from the Squadron Officer School with Class 3-79.

MEI  
-83