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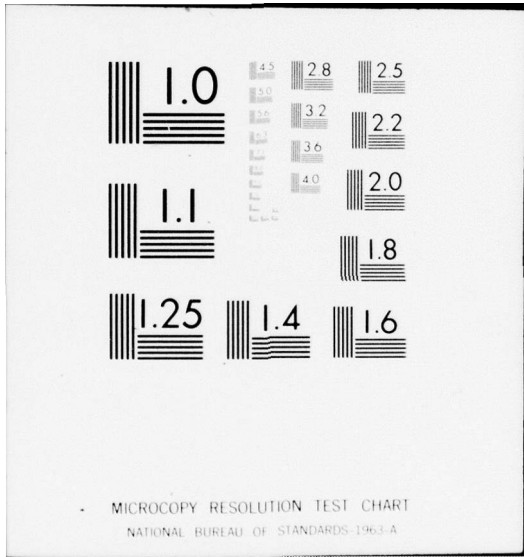
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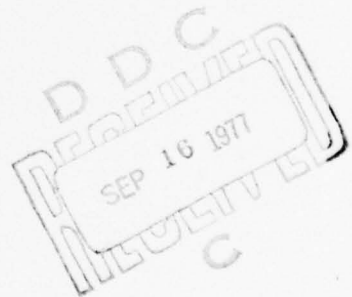
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A REQUIREMENTS STUDY FOR AN AUTOMATED
MAINTENANCE DATA COLLECTION SYSTEM
FOR THE ROKAF F-4 WEAPONS SYSTEM

William J. Callahan, Captain, USAF
D. C. Payne, Squadron Leader, RAAF

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The Republic of Korea Air Force obtains follow-on support for their F-4 fleet from a Special Support Arrangement obtained through the United States Air Force Technical Coordination Group. This SSA is renegotiated each year and the ROKAF requires figures on equipment failures in order to be able to stipulate which items require inclusion in the SSA. This thesis shows the development of a management information system in a computer model to output a number of reports which the TCG believes will be appropriate for use by the ROKAF to enable managerial control of failures. The reports produced are analyzed and shown in detail, together with a discussion of the data requirements and listings of report examples.

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A REQUIREMENTS STUDY FOR AN AUTOMATED MAINTENANCE
DATA COLLECTION SYSTEM FOR THE ROKAF
F-4 WEAPONS SYSTEM

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 Requirements for the
Degree of Master of Science in Logistics Management

By

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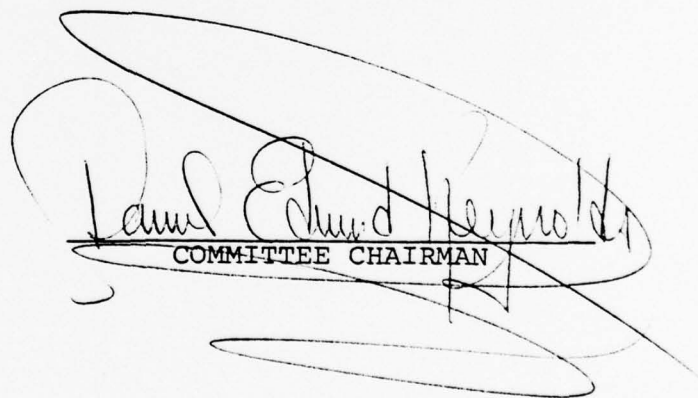
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has been accepted by the undersigned on behalf of the
faculty of the School of Systems and Logistics in partial
fulfillment of the requirements for the degree of

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DATE: 15 June 1977


COMMITTEE CHAIRMAN

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CHAPTER I

INTRODUCTION

Since World War II, the United States has been assisting friendly foreign countries in establishing and maintaining adequate defensive postures, consistent with their economic stability and growth, to maintain internal security and resist external aggression [8:A-1].

In light of this intention, the United States government has developed a program of both military and economic assistance to certain selected foreign countries, known as Security Assistance countries (SA).

As a program, Security Assistance comprises the sale of defense articles and services, the grant of such articles and services without reimbursement in appropriate cases, economic supporting assistance in exceptional cases to offset costs of maintaining armed forces, and grant assistance to public safety forces such as police [8:A-1].

The Department of Defense (DOD) is responsible for the administration of the Foreign Military Sales (FMS) program as part of U.S. Security Assistance. Included as part of the FMS program are the actual sale of defense articles and services, and the extension of guaranteed credit when appropriate (8:A-1). However, the overriding constraint of aid to SA countries is that ". . . it shall support and be in consonance with United States military strategic plans and objectives. . . [8:C-1]."

United States and Korea

The United States military assistance to Korea was originally implemented by the Mutual Assistance Act of October 1949. This Act included the provision that the United States would provide expert advice and technical help in the production of military equipment and in the training of personnel (17:6). In fact, the whole of the Republic of Korea (ROK) foreign policy

. . . is characterized by close ties with the United States and by strong motivation to establish the nation as a recognized power within the community of nations of the free world. The primary objective is the reunification of North and South Korea [17:18].

It was through United States participation in the Korean War (under the aegis of the United National Emergency Force) that military ties between the two countries were cemented; this mutual assistance has been further solidified by the Korea-United States Bilateral Treaty of 1954 and the participation of Republic of Korea troops in the Vietnam conflict. The ROK is presently actively participating in the FMS program as a member SA country.

F-4 Weapons System

Through the SA program the United States Air Force (USAF) has agreed to provide technical support for the integration of the F-4 weapon system throughout the SA countries' armed forces (12:1):

In accordance with Air Staff direction at the 13-14 July 1972 meeting, a plan has been developed to furnish engineering/technical support to foreign users of the F-4 aircraft . . . all countries possessing F-4 aircraft supported by the Air Force . . . will participate fully in sharing the benefits and costs [12:1].

Maintenance Data

As part of the assistance granted to Korea, DOD accepts the responsibility under the FMS agreement to provide the capability to maintain the operational readiness of Republic of Korea Air Force (ROKAF) weapon systems (8:C-3). Therefore, with reference to this readiness it is worth noting that:

One of the first essentials in dealing with the matter of equipment readiness in the Department of Defense is the existence of an effective information system capable of providing accurate data on the condition and degree of readiness of all equipment currently in inventory [6:8].

Not only has the DOD accepted responsibility for the sale of military weapons systems to the Republic of Korea, but also the task of providing programs to insure the maintainability and operational readiness of these weapon systems (8:C-3).

The need for an effective maintenance information system has become critical to the ROKAF because of the method by which the country justifies receipt of necessary military supplies; one year before a requirement for spares exists the ROKAF must provide the DOD with information as to anticipated usage of particular weapon system components.

This enables the DOD to budget for the purchase of these necessary weapon system components. Thus, if the ROKAF cannot provide accurate information as to anticipated usage of particular components, they are not necessarily assured of required support (20).

The collection of maintenance data is important in isolating weapon system components which demonstrate trends of high failure rates; this information is required to justify and develop usage rates for future consumption. "An effective logistic support system cannot function without having accurate data on consumption and usage [2:4]."

The USAF currently stores its maintenance data on computer tapes via a sophisticated computer program. Much of the information provided by this program in the form of output reports is not suitable to the needs of the ROKAF because of a difference in utilization of this data (based on the size differential between USAF and ROKAF). In addition, the USAF will not enter technical data peculiar to a foreign country into the USAF technical data system. Unfortunately this has caused some conflict because:

In accordance with current policies, Air Force Systems Command is totally responsible for a Foreign Military Sales Program until delivery of the last contract article under the case has been accomplished . . . [and] AFSC could be left "holding the ball" for non-standard items/technical data indefinitely, or, at least until the foreign country decides to generate a support case through Air Force Logistics Command or contracts directly with the end item contractor [11:2].

Hence the need for the development of a country-peculiar maintenance data collection system.

Maintainability of F-4 Aircraft

The USAF has developed computer programs to assist in the maintenance of aircraft through the storage, manipulation, and output of F-4 weapon system performance data for utilization in analysis of future spares requirements. This information is extensive: "The USAF currently obtains millions of elements of technical information concerning the operations and maintenance of F-4 aircraft each month [24:1]." Therefore the USAF is able to extract a multitude of information for its own purposes; unfortunately most has little applicability to a SA country with a smaller Air Force operating under a completely different mission environment. Strictly applying these computer programs directly to the ROKAF might result in an information overload, combined with inappropriate reports and failure to output needed reports. However, the system used by USAF has been found appropriate for USAF needs.

Because of the availability of this [maintenance] information, we [the USAF] have been able to correct deficiencies before they occur. We have, therefore, been able to prevent aircraft damage or possible loss and to save a great deal of money and lives of crew members [24:1].

Problem Statement

The ROKAF does not have its own automated Maintenance Data Collection System (MDCS) to furnish accurate and

timely maintenance data. Under present circumstances the ROKAF relies on USAF data manipulation programs to provide required information on high failure rates of F-4 weapon system components, but this system has not proven viable: unfortunately the USAF data system also provides much information that lacks applicability to the ROKAF; in addition, for security reasons, the complete information on all USAF F-4 weapon systems are not made available to the ROKAF (20). This is not to say that, in a general sense, the existing exchange of information is not of use to both parties. Mutual benefits have been realized:

Because of the differences between USAF and United States Security Assistance (SA) countries F-4 operations and environment, there may be some kinds of technical deficiencies which occur in the SA country fleets before they are known to the USAF. At the same time, the countries may be having serious difficulties because of deficiencies already recognized and corrected in the USAF F-4 fleet [24:1].

The problem of nonapplicability or inadequacy of some data could be resolved through the development of a ROKAF-peculiar computer based MDCS which, in combination with a Maintenance Data Retrieval System (MDRS), would be the basis for providing required maintenance data. If such a maintenance data system can be tailored to the ROKAF's needs and resources, providing only pertinent maintenance information, an improvement in the overall performance of the ROKAF F-4 weapon systems performance can be expected (20). In addition, the development of the

MDCS would enable the ROKAF to estimate future maintenance demands and thereby ensure supply of F-4 weapon system components under the provisions of the FMS agreement: "One year in advance each country must know what they will require (based on past consumption) highlighting high failure items [20]."

Background to Problem Statement

Contrary to the belief that Asian countries have a surfeit of labor, this is not the case in the ROKAF. "There is a current shortage of manpower authorizations and the promise of further cutbacks due to budgetary constraints may be necessary [20]." However, to negate the effects of limited manpower authorizations, the ROKAF has purchased modern computer hardware; unfortunately they now lack the necessary software packages to implement computerization of their maintenance data collection efforts. ROKAF currently compiles its reports manually utilizing fifty man months in preparing the following years' budgeted demands; ROKAF management consider a preparation time of fifty man months to be excessive and believe that a mechanical system would prove to be more efficient (20).

The system the ROKAF is presently using is both time consuming and inefficient. Almost 50 man months are invested to produce each [budget] report. Additionally the present system does not have a provision for identifying items which should be candidates for Special Support Agreements [19:3].

Through the use of a unique computer MDCS, information relating to failure items would be quickly compiled into a report designed to assist in the preparation of the following years' budget demands for spare parts. Hence, as the ROKAF have the necessary computer equipment, the main task is to provide maintenance data collection programs that will enable the ROKAF personnel to input data and receive an output that is suitable to their requirements.

Technical Coordination Group (TCG)

The information obtained from USAF maintenance computer programs has been most useful to the USAF and an attempt is being made to permit availability of applicable information to other SA countries operating the F-4 weapon system (24:2); this information coordination effort will be handled by the establishment of a Technical Coordination Group (TCG) which would

. . . provide a single contact point for the collection and analysis of both USAF and SA country technical engineering data and to communicate directly with both USAF agencies and participating SA countries to assist in solving mutual, as well as participating countries' peculiar problems [24:2].

Refer to Figure 1 for a diagrammatic representation of this interface.

The SA countries were contacted and advised of the proposed formation of the TCG and its functions (15); all

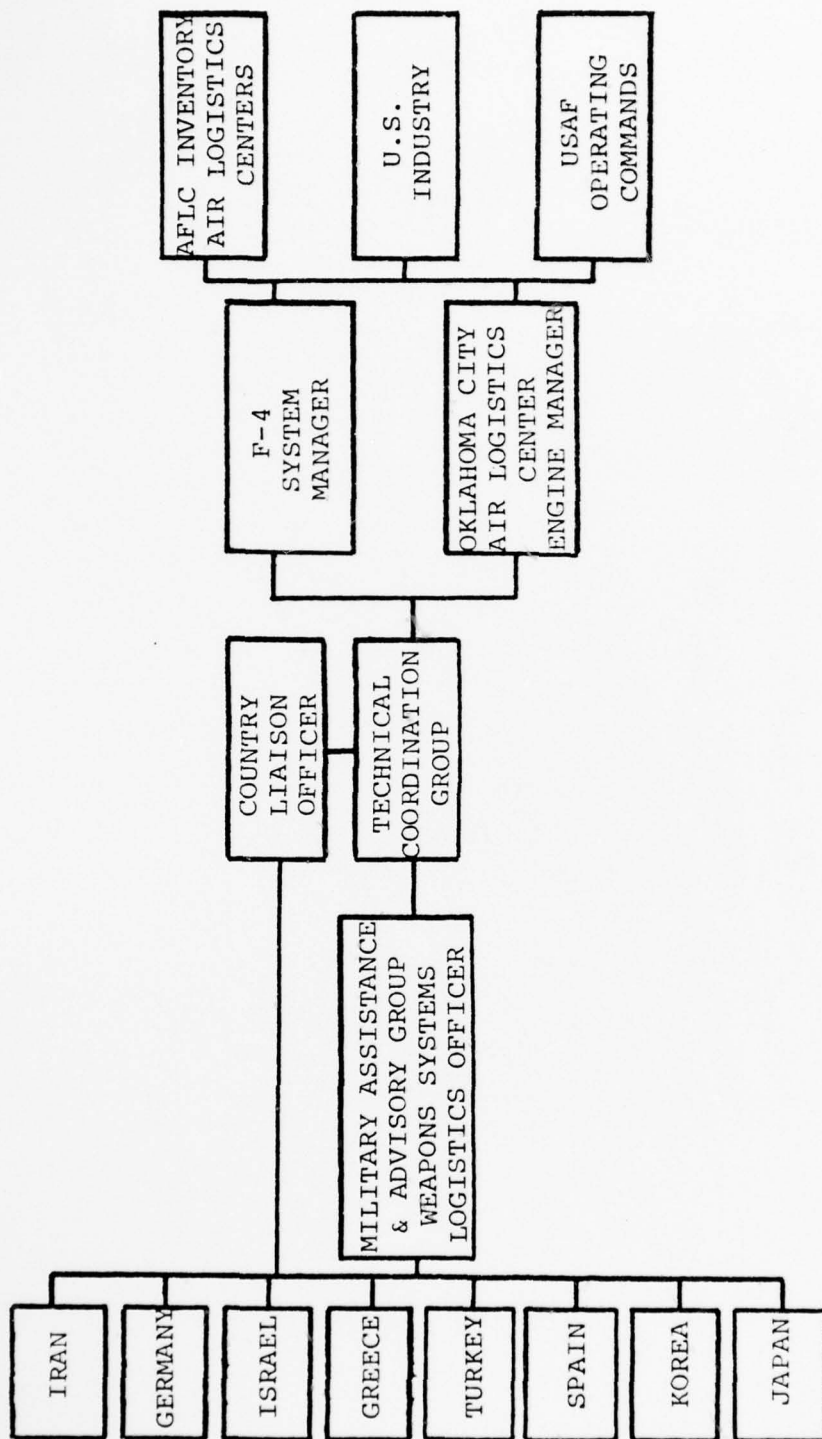


Figure 1. F-4 Technical Coordination Group Lines of Communication

but one country¹ were enthusiastic about the possibilities offered by the TCG (9). However, as previously stated, the foreign maintenance information available could not be entered into the USAF computerized system without causing disruption to USAF data (31). When the TCG representatives made their first implementation visit to the Republic of Korea, they stressed the importance of the development of a country-peculiar MDCS (23:1). As a result of the interest expressed by ROKAF officials, the TCG was assigned the responsibility for adapting the existing USAF MDCS programs for SA countries' use (10). Officials of the TCG conducted a review of existing programs and

. . . decided that a modification of the existing USAF data products would require more effort than developing an entirely new program because of the lack of documentation [18:1].

As a result of these initial conferences and deliberations, the responsibilities of the TCG were to include (1:5):

- a. interfacing USAF and SA country data systems;
- b. entering data into the USAF maintenance computer system or a separate reporting system would be developed tailored to peculiar SA country needs (authors' emphasis); and

¹This one country was unable to budget the money necessary for TCG participation until 1977.

c. reviewing USAF maintenance data records for trends in product performance which may have applicability for SA countries (16:4).

Justification

From the outline above it becomes evident that the TCG will be responsible for the development and implementation of the maintenance data collection system for the ROKAF. Thus the TCG is required to develop a MDCS that is not only suited to the ROKAF needs but that can be later applied to the needs of other SA countries.

The information obtained from the MDCS must assist in the isolation of trouble spots for the future:

In today's environment, a high degree of materiel readiness is of paramount importance in defense planning. Maintenance is a major contributor to this readiness. It is the job of maintenance to sustain equipment in a state of operational readiness consistent with the demands of the operating forces [6:iii].

This becomes of paramount importance for the ROKAF; if they do not forecast future demands in sufficient time for inclusion in the next year's SSA they are not assured of receiving critical supplies.

But why the need for such a reliance on computer systems? The major characteristic that delineates the computer from other managerial aids is the immediate response capability (26). This rapidity of information has

become of paramount importance with the development of military fast strike capabilities:

. . . mobilization time has been reduced from months to days and hours--perhaps in extreme cases to only minutes. Since it would be disastrous to delay mobilization until hostilities begin, it is necessary to be in a continued state of emergency readiness and to be capable to respond rapidly in order to maximize our military advantage [6:2].

The problem of equipment readiness has been further delineated as:

One of the first essentials in dealing with the matter of equipment readiness in the DOD is the existence of an effective information system capable of providing accurate data on the condition and degree of readiness of all equipment currently in the inventory [6:8].

Research Objectives

The objectives of this thesis were to fulfill the following requirements:

1. delineate the maintenance data requirements of the ROKAF F-4 weapon system as they relate to manhours accounting and component identification for inclusion in the special support agreement (SSA);

2. provide maintenance data that will enable ROKAF management to specifically identify these system requirements, based upon information on the following factors:

- a. failure rates,
- b. mission aborts, and
- c. usage of manhours in the maintenance function;

3. provide a MDCS suitable to ROKAF management which would enable production of maintenance data in an informative and meaningful format (i.e., numeric and graphic presentations of components deficiencies with respect to Quality Control inspections); and

4. facilitate manhour accounting and provide data to support redistribution of manpower (19:3).

The above research objectives served as guides in the development of a MDCS aimed at achieving more effective control of the ROKAF maintenance function. In this context, the introduction of a computer-based system into the maintenance management of the F-4 weapon system within the ROKAF would exhibit the following characteristics that delineate it from the manual system:

1. the MDCS is faster than the manual system,
2. it is more accurate, and
3. there is a decreased requirement for labor in preparation of control and maintenance reports.

Preview of Remaining Chapters

The objective of this chapter has been to give some description of the scope of the problem through specification of the background to the situation and some discussion of the perspectives involved. In addition, the research objectives were stated to show the direction of this thesis.

The next chapter will describe the research methodology to be utilized to provide some insight into the four research questions posed, as well as describing the output format. Chapter III will describe the MDCS developed, going into greater detail on each of the elements and sub-routines of the model developed, together with some discussion of the data manipulation.

Chapter IV will describe the results obtained from testing the developed MDCS with simulated data; the final chapter will discuss conclusions about the model usage, outlining the limitations thereto; finally, recommendations will be made with respect to directions for future development of the MDCS.

CHAPTER II

METHODOLOGY

Overview

The purpose of this chapter is to describe the overall system that was developed to enable the construction of an integrated computer-based Maintenance Data Collection System (MDCS). The first section of the chapter will discuss the basic system developed, followed by a discussion of data collection and utilization; the final section will give a clearer definition of each of the outputs--the individual subsystems will be examined and their procedures described in order to specify explicitly the responsibilities of each (3:63-65).

System Manipulation

The purpose of the MDCS is to collate data obtained from all maintenance work centers within the ROKAF that are responsible for support of the F-4 fleet; the data so obtained will be manipulated in order to obtain definitive data on the reliability of each component of the weapons system, isolation of systems requiring inordinate maintenance time, together with manhour accounting functions. The system flowchart shown as Figure 2 is illustrative of

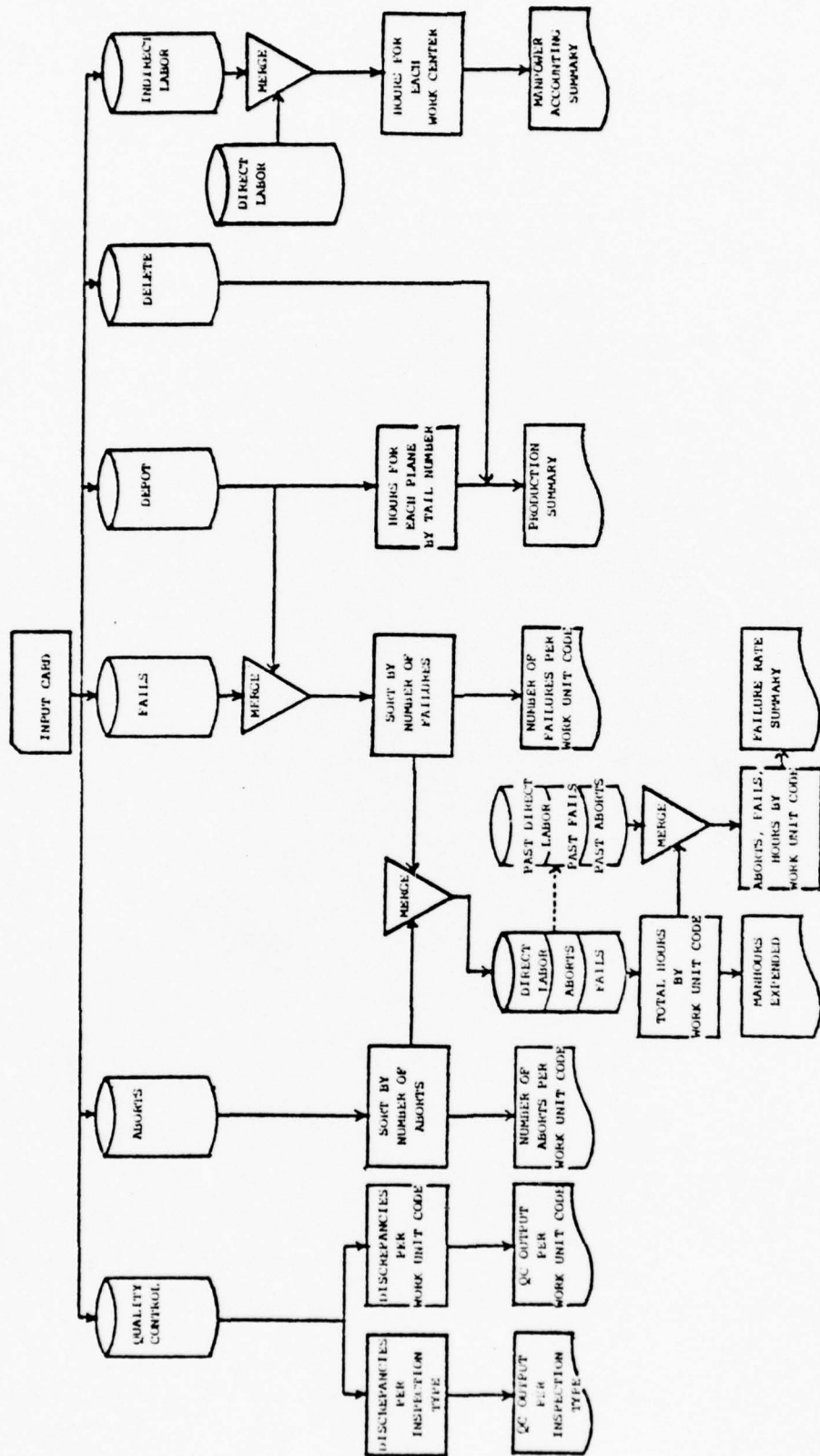


Figure 2. Data System Manipulation Flowchart

the whole process utilized to obtain the requisite output, each of the outputs being labeled as shown; the eight types of reports output have been named and the same terminology will be used with respect to these reports throughout this chapter.

Data Input

The data used in this system will be the subject of further discussion at a later section of this chapter; suffice it to state at this stage that the input data comes from three basic sources:

- a. Air Force forms 349,
- b. quality control cards, and
- c. production summary delete cards.

As can be seen from Figure 2, these basic inputs are utilized to create six data files:

- a. quality control data,
- b. data on mission aborts,
- c. data on equipment failures,
- d. depot maintenance data,
- e. delete data for file maintenance purposes, and
- f. manpower accounting data (indirect labor).

Quality Control Data

The quality control data is generated from quality control inspections performed on aircraft at various times in the maintenance function (e.g., preflight inspections,

post-maintenance inspections, etc.). The data so generated is used to obtain two outputs:

a. graphical presentations of rates of discrepancies per inspection type, referred to as "QC Output per Inspection Type;" and

b. listings (in tabular form) of discrepancies discovered per work unit code (WUC) referred to as "QC Output per WUC."

These reports enable ROKAF management to observe trends in equipment malfunctions in order to obtain replacement spares prior to the arisal of "not operationally ready supply" (NORS) situations; the second part of the report will also be used to define work unit codes that have caused the greatest number of inspection discrepancies, and hence requiring greater attention during maintenance in order to decrease the number of errors.

Mission Abort Data/Failure Data

The information generated from the mission abort data file is used to compile a monthly listing of those work unit codes which have resulted in the incidence of aborts; these instances are listed in descending order of importance in terms of number of instances; this is the "number of Aborts per WUC" report. Likewise, the information obtained from the failure and depot maintenance data files is used to produce an output by work unit code of those

items which have resulted in equipment failures over the month of the report; this is the "Number of Failures per WUC" report. This data on aborts and failures is further analyzed to produce a report output by WUC accounting for total manhours expended on maintenance. The report shows total hours expended per WUC on maintenance; this is the "Manhours Expended" report--it deals solely with direct labor.

Abort/Failure Manhour Summary Data

The data files for aborts, failures, and depot maintenance are merged to represent a data file for all elements of aborts, failures, and manhours expended on the F-4. This data is used to provide a report for each work unit code, comparing the previous and current months data on mission aborts, equipment failures, and resultant manhour utilization. This report has three elements of information:

- a. data on occurrences and ranking of failures for this and the previous month;
- b. data on occurrences and ranking of aborts for this and the previous month; and
- c. data and ranking of hours expended on failures and aborts for this and the last month.

This report is used to isolate those work unit codes which are causing the greatest burden to the maintenance function

because of mission aborts and equipment failures, which both result in manpower utilization.

Depot Maintenance Data

The primary function of the depot maintenance data is to produce a report which shows the usage of manhours in the maintenance function for each aircraft that is in the depot and which has undergone maintenance in the past three months. The actual manhour usage is compared to that authorized, and a comparison is made of the two figures, differences being highlighted as being under- or over-usage. This is the "Production Summary" report. The delete data file is used for the purpose of file maintenance on the production summary data.

Manhour Utilization

The final subsection of the system is concerned with manpower utilization. The report compares the number of men assigned against the number authorized for each work center and/or depot and then lists all labor under the categories of "direct" labor, "indirect" labor, and "other," a category containing manhours not reported via AF form 349 (e.g., periods of no activity within the work center). Each of these categories is costed out and a percentage of authorized and assigned manpower is tabulated. This is the "Manpower Accounting Summary" report.

Data Collection/Manufacture

Data for utilization in the system was available through two sources: (a) Korean data forwarded through Odgen Air Logistics Center at Hill Air Force Base, and (b) through artificial generation via a data program utilizing the random number facility of the CREATE computer at AFIT SLG.

The establishment of a data base was necessary to permit initial tests of the system to enable determination of the system effectiveness (20), and was further utilized for system debugging during initial development.

Data Generation Model

To enable efficient testing of the MDCS and to eliminate unnecessary data collection by the ROKAF, a data generation model was seen as the most effective method of obtaining data in the quantity and variety necessary to validate the system. The system flowchart of this generation model is shown at Figure 3. The model generates four basic types of data:

- a. quality control data,
- b. "delete" data,
- c. direct labor data (aborts, failures, and depot manhours), and
- d. manhour reporting data (indirect labor).

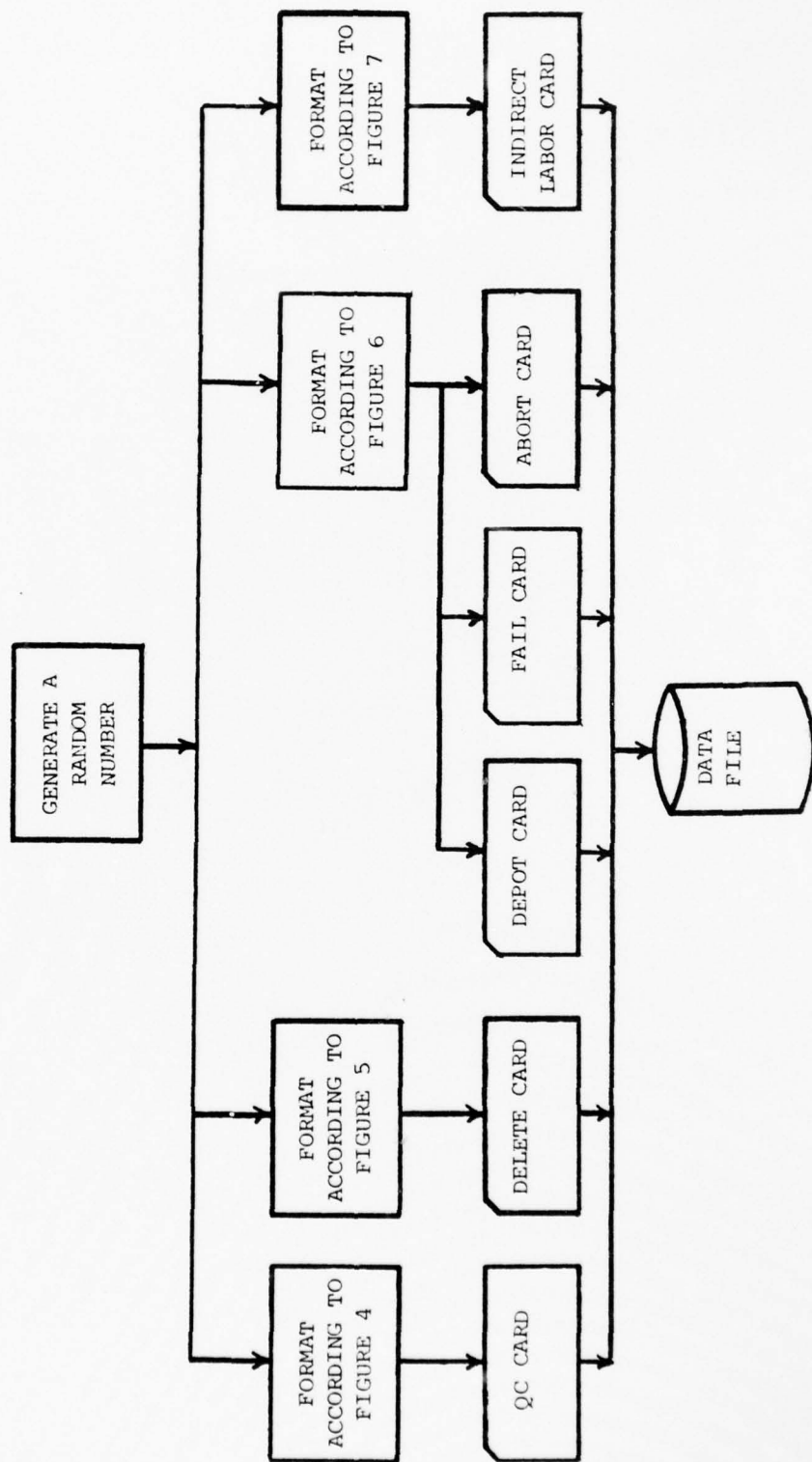


Figure 3. Data Generation System Flowchart

The format utilized for each of these cards is shown at Figures 4, 5, 6, and 7 respectively; for the latter two formats data is provided (in the real world) from AF form 349. An example of AF form 349 is shown as Appendix B. Air Force Manual 66-1 specifies that the 349 is the appropriate document for the collection of maintenance data on major weapons systems, and this form is currently in use by the ROKAF; the information generated is available on these forms.

Data Validation

Actual data from the ROKAF was checked against that generated by artificial means through the CREATE facility to ensure compatibility--further discussion of this subject will be left to Chapter IV as validation of the MDC system. Suffice it to say at this stage that the artificially-created data was used in initial validation of the reports generated by the system based upon congruence between the real and the artificial data.

Data Input

For the purposes of later utilization of the data input capacity, data can be input to computer disc storage in any of the following ways:

- a. directly from computer interaction,
- b. through remote terminals, or
- c. through batch systems.

Card Column	Information	Character Type	Example
1 - 5	Inspection Type	Alphanumeric	5AGE
6	Blank		
7 - 8	Daily Progressive Inspection Number by Inspection Type	Numeric	03
9	Blank		
10 - 14	Julian Date and Year	Numeric	13277
15	Blank		
16 - 22	Mission Design Series	Alphanumeric	BRF004C
23	Blank		
24 - 28	Work Unit Code	Alphanumeric	12345
29	Blank		
30 - 31	Number of Discrepancies on This Inspection	Numeric	12

Figure 4. Quality Control Card Input Format

Card Column	Information	Character Type	Example
1 - 12	Blank		
13 - 20	Airport Serial Number	Alphanumeric	RF004C06
21	Blank		
22 - 27	Delete Instruction	Alpha	Delete (Always)
28	Blank		
29 - 35	Mission Design Series	Alphanumeric	BRF004C

Figure 5. Delete Card Input Format

Card Column	Information	Character Type	Example
1 - 3	Julian Date	Numeric	365
4 - 7	Job Control Number for each Work Center	Numeric	0021
8 - 12	Work Center	Alphanumeric	K3110
13 - 20	Aircraft Serial Number	Alphanumeric	bF004D20
21 - 27	Blank		
28 - 34	Mission Design Series	Alphanumeric	bbF004E
35 - 42	Blank		
43 - 48	Engine Number (when appropriate)	Alphanumeric	ABC123
49 - 52	Blank		
53 - 57	Work Unit Code	Alphanumeric	33333
58	Blank		
59	When Discovered Code:	Alphanumeric	
	(i) Depot Maintenance,		S (always)
	(ii) Abort, or		A or C (always)
	(iii) Failure		Any other alpha
60 - 62	How Malfunctioned Code	Numeric	950
63 - 64	Blank		
65 - 68	Starting Time on Job	Numeric	0820
69 - 71	Shift Indicator	Numeric	196
72 - 75	Finish Time for Job	Numeric	1715
76	Crew Size	Numeric	2

Figure 6. AF Form 349--Direct Labor Reporting Input Format

Card Column	Information	Character Type	Example
1 - 3	Julian Date	Numeric	136
4 - 7	Control Number	Numeric	0000 (always)
8 - 12	Work Center	Alphanumeric	WKCN4
13 - 15	Blank		
16 - 20	Manhour Report Identification	Alpha	INDLB (always)
21 - 52	Blank		
53 - 57	Type of Manhour Report	Alpha	LVEOV
58 - 64	Blank		
65 - 68	Starting Time	Numeric	0800
69 - 71	Indication of Shift	Numeric	123
72 - 75	Finishing Time	Numeric	1700
76	Crew Size	Numeric	6

Figure 7. AF Form 349--Indirect Labor Reporting Input Format

For purposes of validation of the system, data was stored to disc files and directly accessed by the system. Once the system is in use by the ROKAF it is anticipated that punched cards will be the applicable input medium; no conflict is foreseen in the different methods of input utilized.

Permanent Files

To augment the data files created through artificial means, the MDC system also requires the establishment of a number of permanent files for access by the model. The artificial data input to these files has been verified as realistic by the TCG (20). The typical information resident in these permanent files is:

- a. the representative salary for each rank--to be used in the Manpower Accounting Summary for costing of the three categories of labor;
- b. the authorized and assigned manning for each work center--also for manpower accounting computations;
- c. lists of nomenclature for work unit codes--to be used in output formats to enhance readability;
- d. authorized numbers of manhours for overhaul of aircraft types at the depot--for use in the Production Summary report; and
- e. a file of the julian date which corresponds with initialization of end of month reports.

These files were created for purposes of interaction with the system to obtain meaningful output.

Explanation of AF Form 349 Inputs

As an insight into some of the terms used in the next section of this chapter, the following data elements appearing on the AF form 349 are explained:

- a. malfunction codes--used to describe the reason for a malfunction;
- b. work center designators--used to identify that work center which performed the requisite maintenance on the malfunctioned component/assembly;
- c. work unit codes--used to define the maintenance action required to repair/replace the malfunctioned component;
- d. when discovered codes--the method by which the malfunctioning component was isolated (abort, failure, etc.);
- e. mission design series (MDS)--the type of weapons system which was the subject of maintenance; and
- f. identification/serial numbers--unique identifiers for each MDS, in this case also known as tail numbers.

Description of the Output

A review of Figure 2 will show the outputs generated by the MDC system. The outputs will be dealt with as four subsections:

- a. a quality control output:
 - (i) QC output per type of inspection; and
 - (ii) QC output per WUC;
- b. failure/abort output:
 - (i) number of aborts per WUC,
 - (ii) number of failures per WUC,
 - (iii) manhours expended per WUC, and
 - (iv) failure rate summary;
- c. production summary output;
- d. a manpower accounting summary for each base.

Each of these reports will be dealt with in general, and some insight will be given as to the computer routines and algorithms utilized.

Quality Control Output

The aim of the quality control output is to identify significant deviations and trends in the number of discrepancies discovered during quality control inspections. A plot of current inspection results against past inspection results (in accordance with the flowchart at Figure 8 and in the format shown at Figure 9) will show if trends in discrepancies are developing and thereby permit early action to be taken to prevent shortages of spares through subsequent inclusion of additional requirements in the next year's Special Support Agreement. The output has two formats:

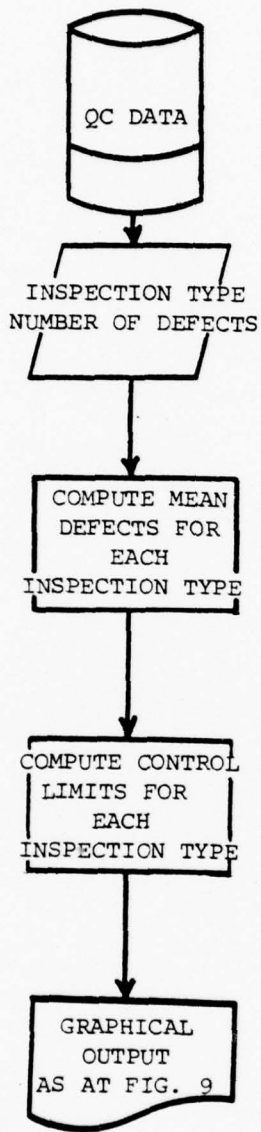


Figure 8. Quality Control Output Flowchart

QUALITY CONTROL OUTPUT
PER TYPE OF INSPECTION

--	--	--	--

TYPE OF INSPECTION

NUMBER OF INSPECTIONS THIS MONTH

TOTAL NUMBER OF DISCREPANCIES

RATE (DISCREPANCIES/INSPECTION)

	J	F	M	A	M	J	J	A	S	O	N	D
UCL	<div style="border: 1px solid black; height: 100%; position: relative;"> - </div>											
\bar{C}												
LCL												

Figure 9. Quality Control Output Per Inspection Format

a. the graph of QC output per type of inspection to identify significant trends in the number of discrepancies discovered on each inspection--this graph is presented in the form of a control chart as Figure 9; and

b. a tabular presentation showing the total number of failures for each work unit code without reference to the type of inspection--this enables management to isolate the types of components that require special attention. The applicable flowchart is Figure 10 and format is shown at Figure 11.

The object of control charts (as illustrated in Figure 9) is to:

. . . determine if variations in a product dimension are random and to detect assignable variations. The control chart is based on a series of samples of subgroups of items drawn randomly from a process over a period of time [4:319].

In this section we are dealing with a "defects per unit time" situation as it refers to the inspection process. Given this premise the control chart should be based on the Poisson distribution; that is, it is believed that there are few discrepancies discovered over a large number of observations. The Poisson probability distribution is a mathematical model with properties suitable for expressing this type of problem: small number of occurrences of a large number of observations (5:171). Applying this function to a control chart results in the use of the formula:

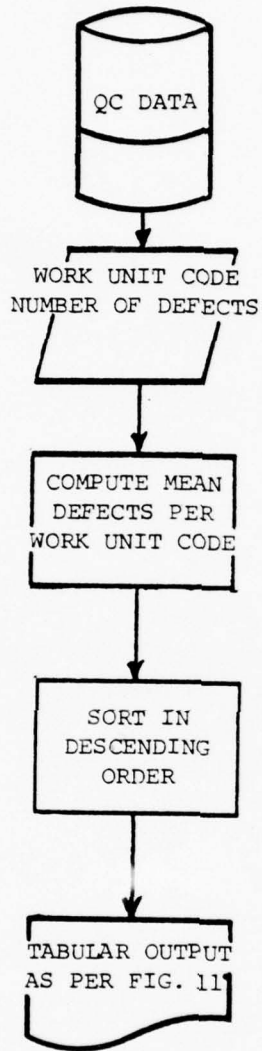


Figure 10. Quality Control Output Per WUC Flowchart

QUALITY CONTROL OUTPUT PER WORK UNIT CODE			
WORK UNIT CODE	NOMENCLATURE	NUMBER OF DISCREPANCIES	PERCENTAGE OF ALL DISCREPANCIES

Figure 11. Quality Control Output Per WUC Format

$$P(c) = \frac{\mu^c e^{-\mu}}{c!}$$

where c = the number of defects per inspection unit, and
 μ = the expected number of defects.

The flowchart for manipulation of the data is found in Figure 8. The control limits of the chart will be the mean of all of the data, plus and minus three times the standard deviation of the number of defects:

$$\mu \pm 3\sigma_c$$

and the estimates of the control limits are:

- a. upper control limit = $\bar{c} + 3\sqrt{\bar{c}}$, and
- b. lower control limit = $\bar{c} - 3\sqrt{\bar{c}}$.

For this formulation

$$\bar{c} = \frac{1}{k} \sum_{j=1}^k c_j \quad (14:207).$$

where k is the number of QC inspections for the last ninety days.

Failure/Abort Output

In order to be able to support the ROKAF it is necessary to develop a system of ranking items by their failure rates. Simple application of USAF failure rates has been found to be ineffective because of the differences

in types of missions flown,² differing climatic conditions, differing mission objectives, etc. Thus, the ROKAF needs to have reliable data concerning their own failure rates.

One objective of this subsystem of the MDCS is to rank items from highest to lowest according to the number of failures experienced within the past month (refer to the flowchart on Figure 12 and the format on Figure 13).

The information on failures is obtained from the failure data, as well as the data from depot overhaul functions. Concomitant to the output of failure rates it is necessary to delimit those items of equipment which have caused missions to be aborted; this information is presented as the Number of Aborts per WUC report. The applicable flowchart is shown as Figure 14 and the output format as Figure 15. The output utilizes information obtained from the abort data file and ranks the WUC by the number of mission aborts per month.

The system merges the data from the data bases (failures, aborts, and depot overhaul information) to produce the Manhours Expended per WUC report; the applicable flowchart is shown as Figure 16 and the output format as Figure 17. This information highlights those work unit codes that have utilized an inordinate number of manhours

²With the F-4, the ROKAF tends to fly a large number of short missions each day, compared to a relatively different type of mission by the USAF. This results in differences in failure items; e.g., higher failure rates of tyres per hour flow for ROKAF aircraft (20).

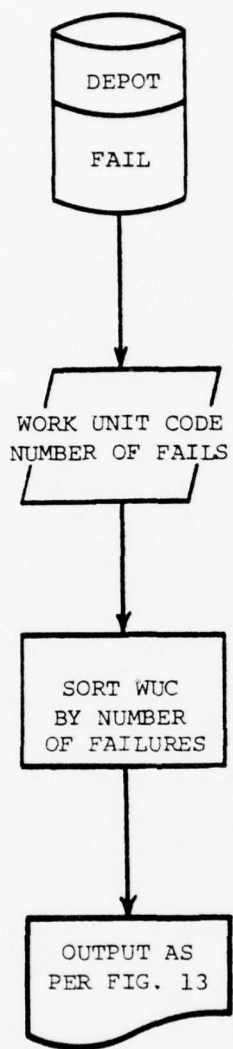


Figure 12. Failures Per WUC Flowchart

NUMBER OF FAILURES			
RANK	WORK UNIT CODE	NOMENCLATURE	NUMBER OF FAILURES

Figure 13. Failures Per WUC Format

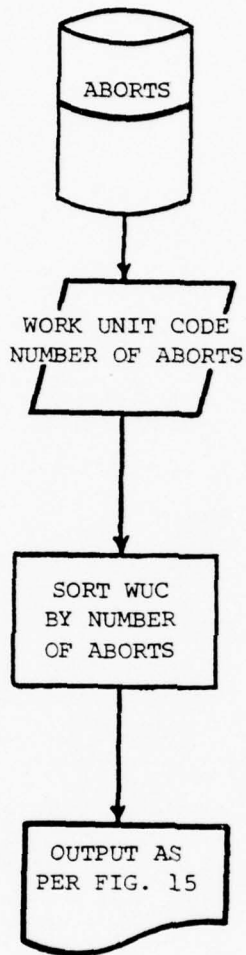


Figure 14. Aborts Per WUC Flowchart

NUMBER OF ABORTS			
RANK	WORK UNIT CODE	NOMENCLATURE	NUMBER OF ABORTS

Figure 15. Aborts Per WUC Format

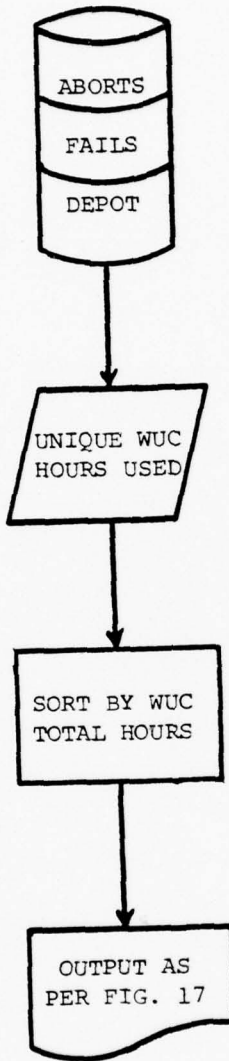


Figure 16. Manhours Expended Per WUC Flowchart

MANHOURS EXPENDED			
RANK	WORK UNIT CODE	NOMENCLATURE	TOTAL MANHOURS

Figure 17. Manhours Expended Per WDC Format

in the maintenance function and hence which may require some managerial attention.

In addition to the above outputs, the system also provides a comparison of all rates (failure, abort, manhours consumed) for the current and the previous month for all work unit codes. This quickly highlights those items that are requiring excess maintenance attention (through manhours expended), those that have caused the greatest disruption to operations (through number of aborts), and those with the highest failure rates (and therefore requiring priority inclusion in the following years SSA). The applicable flowchart is shown as Figure 18 and the output format as Figure 19. The comparison with the previous months data permits ROKAF management to detail those items which show a tendency to increase their relative importance, and hence require greater managerial attention.

Production Summary Output

The production summary is used to identify manhours utilized against those authorized for each weapons system (F-4) undergoing maintenance. From the ROKAF an authorized standard time (for each aircraft type requiring maintenance) has been obtained (from the TCG at Hill AFB) and actual time expended will be compared to highlight those aircraft which have overused manhours, as well as those which still have manhours available for usage. The program flowchart

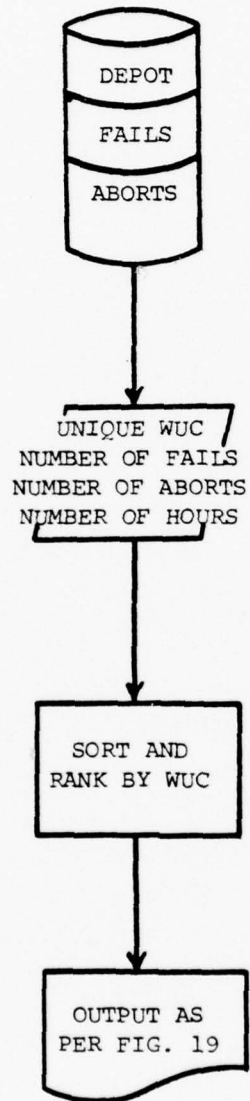


Figure 18. Failure Rate Summary Flowchart

FAILURE RATE SUMMARY													
WORK UNIT CODE	NOMENCLATURE	FAILURES		RANK		ABORTS		RANK		MANHOURS		RANK	
		LAST MONTH	THIS MONTH	LAST MONTH	THIS MONTH	LAST MONTH	THIS MONTH	LAST MONTH	THIS MONTH	LAST MONTH	THIS MONTH	LAST MONTH	THIS MONTH

Figure 19. Failure Rate Summary Format

to be used is outlined in Figure 20. After output of the report the delete file is used to perform file maintenance.

Once the actual manhours utilized for maintenance are obtained for a specific aircraft tail number, these can be compared against the number of hours authorized for that maintenance task and the difference specified. In addition, the percentage of authorized manhours still remaining to be expended will be displayed on the output to enable ROKAF maintenance managers to isolate instances where aircraft are likely to consume excessive maintenance time; this will identify problem areas before they occur, thus enabling correction by schedule adjustments. The Production Summary format is illustrated in Figure 21.

Manpower Accounting Summary

The ROKAF will utilize the MDCS to allocate men to those work centers which have shown a workload indicating a requirement for extra personnel (20). Despite a common misconception, the ROKAF has a shortage of manpower; in the last two years there has been a 25 percent increase in their workload without offsetting increase in authorized manning (20). Hence, for the ROKAF to operate efficiently they must have the capability to effectively reallocate the manpower authorizations that they presently have established.

Figures on manpower usage will be subdivided into "direct," "indirect," and "other" classifications (the

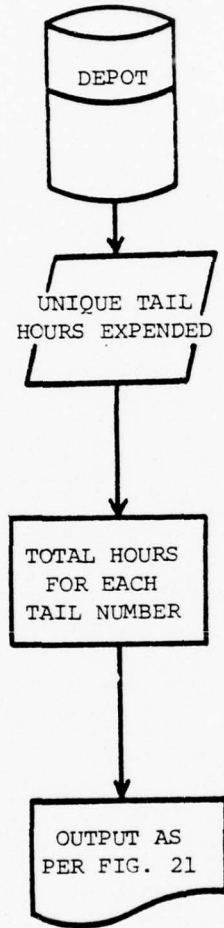


Figure 20. Production Summary Flowchart

PRODUCTION SUMMARY FOR (BASE)					
MDS	SERIAL NO.	M/H USED	M/H AUTH.	M/H LEFT	M/H OVER

Figure 21. Production Summary Output Format

latter to account for times for which no AF form 349 has been submitted); this report facilitates justification for manpower authorization increases, as well as bringing under maintenance managers' scrutiny inordinate times spent on particular maintenance activities (refer to Figure 22 and Figure 23 for the MDCS flowchart and the programmed output, respectively). These figures will be presented for each work center; further, the output will show a comparison of manning authorized against assigned manning for each of the work centers.

Overview

This chapter has given an overview of the elements of the model, together with some discussion of the development of the maintenance data--further development of the data will be discussed in Chapter IV under Validation of the Model. The next chapter will give some insight into the development of the model, together with more detailed analysis of the actual subroutines utilized.

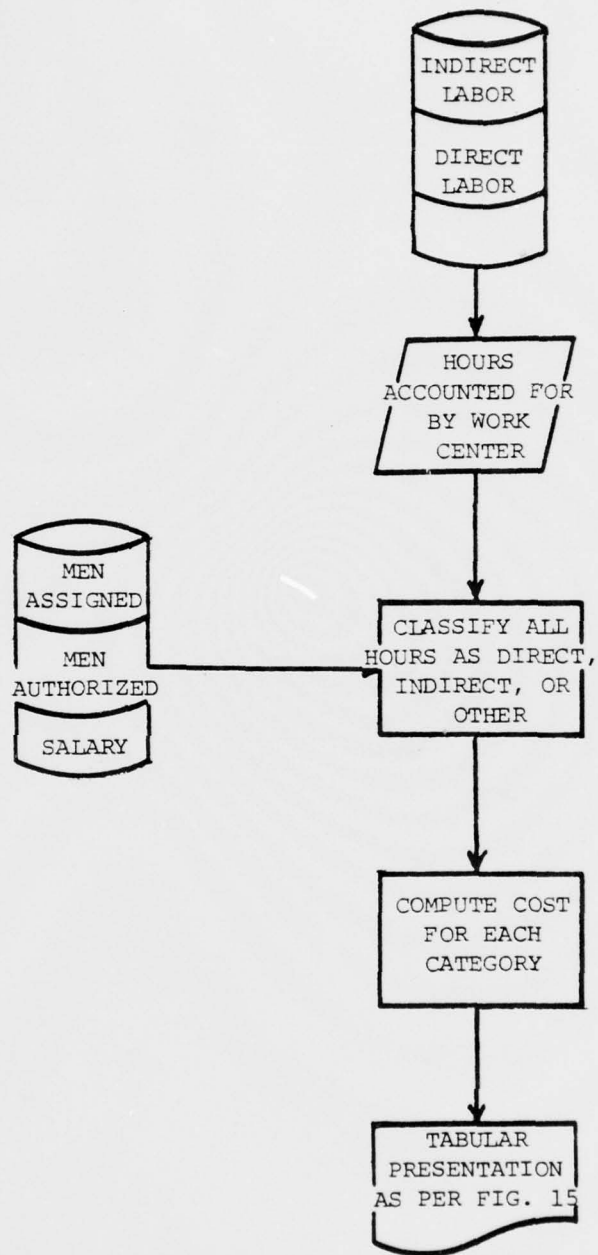


Figure 22. Manpower Accounting Summary Flowchart

MANPOWER ACCOUNTING SUMMARY PER WORK CENTER									
WORK CENTER	DIRECT LABOR		INDIRECT LABOR		OTHER		AUTHORIZED MANNING	ASSIGNED MANNING	PERCENT MANNED
	Manhours	Cost	Manhours	Cost	Manhours	Cost			

Figure 23. Manpower Accounting Summary Format

CHAPTER III

DEVELOPMENT OF THE MODEL

The purpose of this chapter is to give some detailed insight into the actual model developed to fulfill the research objectives outlined in the first chapter. This chapter will be dealt with as two distinct sections: the first will consider the algorithm utilized to develop an extensive data base; the second section will give a detailed account of the model developed to manipulate the data and then provide information on the form of the outputs specified in Chapter II.

Data Generation

At the time that the model was in the developmental stage, no data was available from the ROKAF to enable testing of the model. Further, in the light of the amount of time necessary to collect and input data for a year of maintenance activity, it was decided that the most efficient means of model validation would be to develop an algorithm to generate "artificial" data of sufficient variety to test all aspects of the model in accordance with current Air Force manuals (28; 29). A high level flowchart of the program developed for data generation is shown as Appendix C; the actual program is shown at Appendix D. Each of the

subroutines of the data generation program will now be discussed in some detail to support our later contention that the validated model was realistic in all respects.

Air Force Form 349 Input

For each maintenance activity within each work center, an AF form 349 is submitted to account for manhours expended on some specified maintenance function; these forms are also input to record elements of indirect labor, such as leave, detailed duty, alternative duty, etc. The remaining time not thereby accounted, such as lunch breaks, coffee breaks, etc. is determined from the differences between total time accounted for as "direct" or "indirect" labor, and the total time available for each work center; this element of manhour accounting is classified as "other."

Through the submission of AF form 349, one of four situations is designated:

- a. a mission abort has occurred,
- b. there has been a failure of some sort,
- c. there has been manhour usage at a depot, or
- d. indirect labor usage has been recorded.

Each of these four situations will now be discussed.

Mission Abort. It is of obvious necessity that a MDCS should produce detailed information of the occurrences of mission aborts as this is a most significant form of mission failure. When a mission abort occurs, the

resultant AF form 349 submitted will show a "when discovered code" as an "A" or a "C" in card column 59 of the data input. The model will use this input in the production of the abort report.

Normal Failure. There are a number of occasions when a failure will be detected in aircraft performance which does not result in a mission abort; such a failure is designated through the use of any alphabetic character in card column 59, except for "A", "C", or "S." Nowhere in the model do we require detailed knowledge of the type of failure, merely information to the effect that a failure did occur. Hence, for the purposes of data generation only two alphabetic characters were utilized to designate a failure: "B" or "F." This does not represent a limitation because complete variety in input is represented through mere indication of the existence of a failure. At some later date, through further development of the model, there may be a requirement to expand the capacity of this element of the data generation algorithm. This can be easily effected through minor alteration of the program but no purpose is served thereby at this stage.

Depot Maintenance. Each aircraft is scheduled into the depot for some form of major overhaul at irregular intervals, the exact frequency of this occurrence is unimportant--what is important for the purposes of our

model is a record of the number of manhours actually used in overhaul activities conducted at the depot, and the number of hours authorized for completion of that type of overhaul. Reference to card column 59 will determine whether the AF form 349 was submitted to record depot level maintenance--an "S" indicates this fact. Because the output requirements at Chapter II do not necessitate differentiation between types of overhaul, such a facility has not been incorporated in the data generation program--the algorithm merely generates a number of hours work on a particular aircraft without discriminating between types of overhaul. This is not viewed as a limitation of the program.

Indirect Labor Usage. Each work center manager has a requirement to account for the available work time of his employees--through the input of hours for indirect labor the manager is able to exercise more effective supervision of the activities of the members of the work center. A blank in card column 59 indicates that the input is in the form of an indirect labor usage card; for the purposes of the model there is little need to generate a great variety of types of indirect labor. In the case of this exercise we have generated five different types of indirect labor even though none of the outputs of the model require detailed knowledge to this extent, merely information to

the effect that the card deals with indirect labor is quite sufficient. The types of indirect labor utilized are:

- a. alternative duty : ALTOO
- b. compensatory time : CMPOO
- c. detail duty : DTLOO
- d. leave : LVEOV, and
- e. training : TRNOO

In some later development of the model there may be a need for a more detailed breakdown of the indirect labor--the data generation program can easily be amended to accommodate this new requirement.

Apart from the differentiation required amongst the types of reports as indicated at card column 59, the remaining sections of AF form 349 are of much the same format except for the differences in the indirect labor input. To complete discussion of the AF form 349 input, the remainder of this subsection will differentiate according to whether the input card is for purposes of recording indirect labor or not. To effect this discussion, all elements of the AF form 349 will be defined.

Job Control Number. The job control number is a seven-digit field consisting of two elements: the julian date (three digits) followed by the actual job control number (four digits). For each work center a job control

number counter is initialized for each julian date. The facility to uniquely identify each input card is not a requirement of the model but has been incorporated in the data generation program to add realism. The only difference between direct and indirect labor inputs is that the latter does not require a job control number, but only the inclusion of the julian date (the area designated for issuance of a job control number is left blank).

Work Center. The work center consists of a five-character alphanumeric field in card columns 8 to 12 to uniquely identify that work center which raised the AF form 349, and hence which completed the work shown on that form. For the purposes of data generation we have isolated five work centers from ROKAF data and created one depot--we believe that this will present sufficient variety to validate this aspect of the model. The five work centers and depot are indicated as:

- a. work center K3110,
- b. work center K4140,
- c. work center K3160,
- d. work center K4110,
- e. work center K4230, and
- f. the depot DEPOT

Aircraft Serial Number. In most cases the aircraft serial number will be the tail number of the aircraft upon

which maintenance is being effected. We have allowed for an eight-character alphanumeric field in card columns 13 to 20 to record this tail number. For model validation it has been assumed that there are 20 tail numbers (from 01 to 20) for each of the four aircraft types. In the case of indirect labor, the generation of the label "INDLB" will appear in place of an aircraft serial number.

Aircraft Type. The aircraft type is recorded in card columns 28 to 34 as a seven-character alphanumeric field. The ROKAF has four different aircraft types for which this program generates variety: F-4C, F-4D, F-4E, and RF4-C. This output is in consonance with the ROKAF situation but would necessitate further modification if the model is later expanded to incorporate other aircraft types. For the purposes of this thesis, this limited variety of aircraft type is not viewed as a limitation. In the case of an input of indirect labor information, this field remains blank.

Engine Identification. This six-character alphanumeric field is recorded in card columns 43 to 48; an input will only occur here when the work conducted under the AF form 349 is in respect of an aircraft engine. Nowhere in the model is this information referenced and hence no variety is necessitated: when an engine is worked

upon, the field will show "ABC123;" obviously the field will remain blank for the input of an indirect labor data.

Work Unit Code. The work unit code specifies the type of work that is conducted on the aircraft for this particular AF form 349. Reference to current regulations [i.e., Technical Order (T.O.) IF-4E-06 (27)] will show a multitude of different codes to fill this five-digit field; for the purposes of variety generation it was decided that ten different codes would represent sufficient diversity to validate the model. The algorithm can easily be changed to reflect a greater variety but little purpose would be served thereby. In the case of indirect labor, this field will indicate the type of indirect labor discussed, five different labor inputs are utilized but no later use is made of this fact in the model so further variety is not necessary and the diversity in existence only serves to add realism to the data so generated.

When Discovered Code. This one-character alphanumeric field in card column 59 has already been discussed as the determinant of the type of input generated by the AF form 349.

How Malfunctioned Code. This three-digit field in card columns 60 to 62 is used to indicate the cause of the malfunction (blank in the case of indirect labor input).

There is an allowance here, by T.O. IF-4E-06 (27), for 1000 different malfunction codes but 10 were considered to represent sufficient variety for model validation. Further codes could be developed if the need arose but the utilization of only 10 is not considered to be a limitation of this model.

Commencement Hour. At the time that work starts on the task shown by the AF form 349, such time is recorded to enable management to establish how many manhours were spent on each particular job. This procedure also applies in the case of indirect labor input to account for unproductive manhours. This information is recorded in card columns 65 to 68 as a four-digit field based on a 24-hour clock.

Shift Indication. In the event that a job is commenced on one julian date but the crew so engaged continues on that job past midnight, card columns 69 to 71 record the julian date that the job terminated in order to facilitate later computation of manhours worked. This input becomes particularly relevant for shift work.

Finish Hour. This element is of the same format as the commencement time but recorded at columns 72 to 75; likewise it is utilized to compute manhour accounting.

Crew Size. This one-digit character in column 76 is used to record the number of persons working on the task specified on AF form 349. The algorithm generates from one to seven persons--greater variety can be generated through amendment of the algorithm (and incorporating changes to the model) but it is considered an unlikely event that more than seven persons would be employed upon any one task. This element is not seen as a limitation to the model.

Quality Control Input

After each aircraft has left the work center or depot at the end of maintenance, quality control inspectors conduct a number of tests in the area that has been subjected to repair. There are a number of different quality control inspections that are conducted, but the objective of each is to discover how many discrepancies have not been alleviated by the maintenance function. The number of discrepancies so discovered will be utilized in the production of quality control charts to enable ROKAF management to discover trends in maintenance performances, and thereby to act as a control over the quality of the maintenance function. Each of the elements of the quality control input generation will now be discussed in detail.

Inspection Type. In card column one to five is a five-character alphanumeric field to record the type of

inspection conducted. For the purposes of data generation five different inspection types were utilized to produce sufficient variety to test the model; these inspection types are denoted:

- a. BPE,
- b. BPO,
- c. 5AGE,
- d. QDI, and
- e. QUI.

Once again, modification of the algorithm could result in the generation of increased variety, but such a course of action was considered unnecessary.

Inspection Number. Card columns seven and eight record the serial number of each inspection type for each calendar year. No use is made of the serialization of these inspection numbers within the model; however, the inspections are serialized to lend authenticity to the data so generated.

Julian Date and Year. The julian date and year enables the inspections to be input to the model in day sequence--this will facilitate later inspection of trends. The julian date is a three-digit field commencing in card column 10; the remaining two digits are obtained from the last two digits of the year; they are recorded starting in column 13.

Aircraft Type. This seven-character alphanumeric field is found in card columns 16 to 22. For the purposes of this thesis it has been assumed that there are four different aircraft types available; little alteration is required to increase this variety but to little purpose for the development of the model.

Work Unit Code. As explained in the previous subsection, this code is used to show what work was being performed upon the aircraft. It has been assumed that there are ten different codes.

Number of Discrepancies. This two-digit field indicates the actual number of discrepancies found upon the quality control inspection--the number is generated through a random number generator which produces a Poisson distribution with a lambda value specified by the random number so generated. This process would appear to be a reasonable approximation of the situation encountered in most quality control situations.

Production Summary Delete Card Input

The final product of the data generation algorithm is the production of a delete card. This card is input to the model to perform updating of the Production Summary data file after aircraft have left the depot at the cessation of all maintenance necessary for the particular

overhaul under discussion. Once this card is produced the model will cease to compute a comparison of actual man-hours utilized against the number that is authorized for that aircraft. A more detailed discussion of this card follows.

Aircraft Serial Number. As previously explained, the aircraft serial number is a unique identifier of the plane and would usually be the aircraft tail number.

Deletion Input. If the word "Delete" appears in card columns 22 to 27, this fact is used to identify the production of a deletion card and enables the model to store and utilize this information accordingly.

Aircraft Type. Card columns 29 to 35 show the type of aircraft leaving the depot.

Input Formats

To enable a consolidated inspection of the input format, the details contained in the previous subsections have previously been summarized and appear in Chapter II, Figures 4 to 7. As an example of the product of the data generation algorithm, a typical output is shown as Appendix E.

Data Generation Limitations

For the purposes of data generation the following assumptions were made:

- a. there were five work centers and one depot;
- b. there were four aircraft types, and 20 different aircraft of each type;
- c. no work center or depot worked on more than one aircraft each day;
- d. there were only ten "work unit" codes, five "when discovered" codes, five types of indirect labor, ten "how malfunctioned" codes, and five different types of quality control inspections; and
- e. a maximum of seven people worked on any crew.

None of these assumptions is considered to represent a sizeable constraint on the effectiveness of the data generated although perhaps there is cause for discussion as to whether one plane per shop/depot is realistic. In fact, this problem could have been alleviated but only at some great modification of the algorithm; in the light of time priorities it was decided that better utilization could be made of this scarce resource if allocated towards refinement of the model. However, despite this one limitation, we believe that the data generation represents sufficient variety to validate the model in preparation for the later tests with real data.

Anatomy of the Model

The previous section of this chapter dealt with the development of the data generation algorithm, which in

turn led to a detailed explanation of the format of the input to the model; further discussion of the format is not considered warranted. This section of the chapter will involve a discussion of the model itself, concentrating on how the input is manipulated to achieve the reports shown in Chapter II. Then the discussion will concentrate on the development of the MDCS, through further explanation of the subroutines involved. Figure 24 shows the model with the major elements highlighted. (Listings of all other routines are shown at Appendix N.) For edification, examples of each of the output reports are shown as appendices as follows:

- a. Quality Control Output per Type of Inspection--
Appendix F;
- b. Quality Control Output per Work Unit Code--
Appendix G;
- c. Number of Failures per Work Unit Code--
Appendix H;
- d. Number of Aborts per Work Unit Code--Appendix I;
- e. Manhours Expended per Work Unit Code--
Appendix J;
- f. Failure Rate Summary per Work Unit Code--
Appendix K;
- g. Production Summary--Appendix L; and
- h. Manhour Accounting Summary per Work Center--
Appendix M.

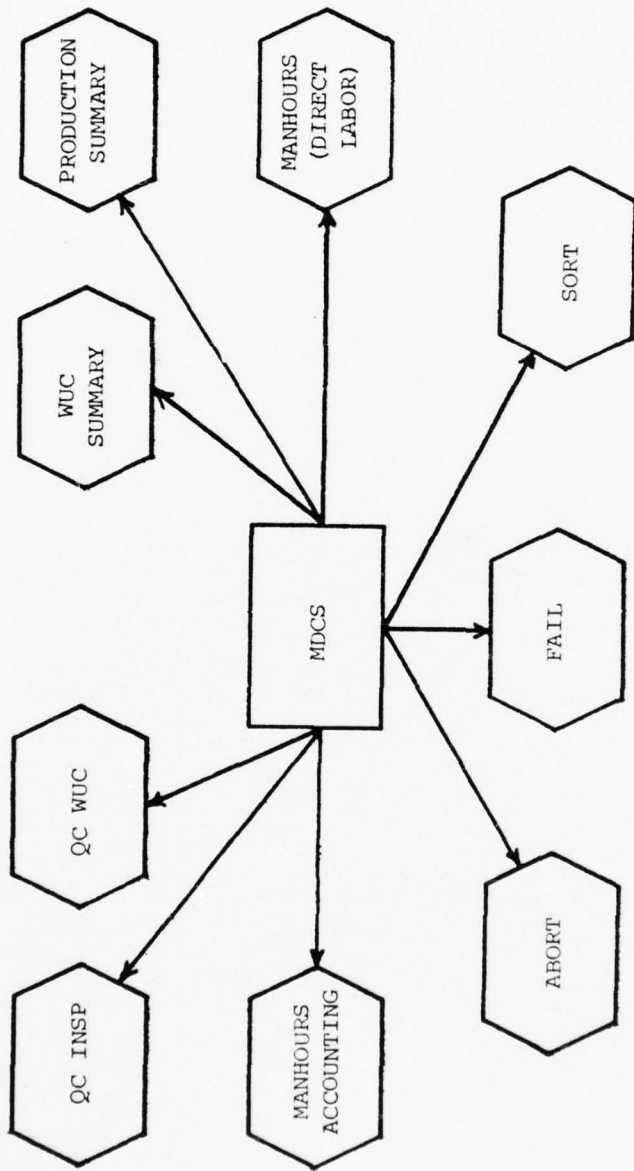


Figure 24. The MDCS Model--Major Routines

Each of the major routines involved in the output of these reports will now be discussed.

Main Program

Any cards may be input at any one time; that is, there is no requirement that the input be presorted to groups of AF forms 349, production delete cards, or quality control inputs. However, the model does require that the input be batched into julian date sequence--this requirement is necessitated by the need to initiate report procedures at the end of each month; this initiation is dependent upon the julian date appearing on the input.

Initial Sort Routine

The first routine observes the julian date to ensure that a monthly report is not required (refer to Figure 25 for the flowchart). The routine then sorts the input into six files:

- a. summary delete cards,
- b. manhour accounting inputs,
- c. depot production control accounting,
- d. mission aborts,
- e. equipment failures, or
- f. quality control cards.

Quality Control by Inspection Type Routine

The quality control inspection routine sorts through the quality control input cards to isolate unique

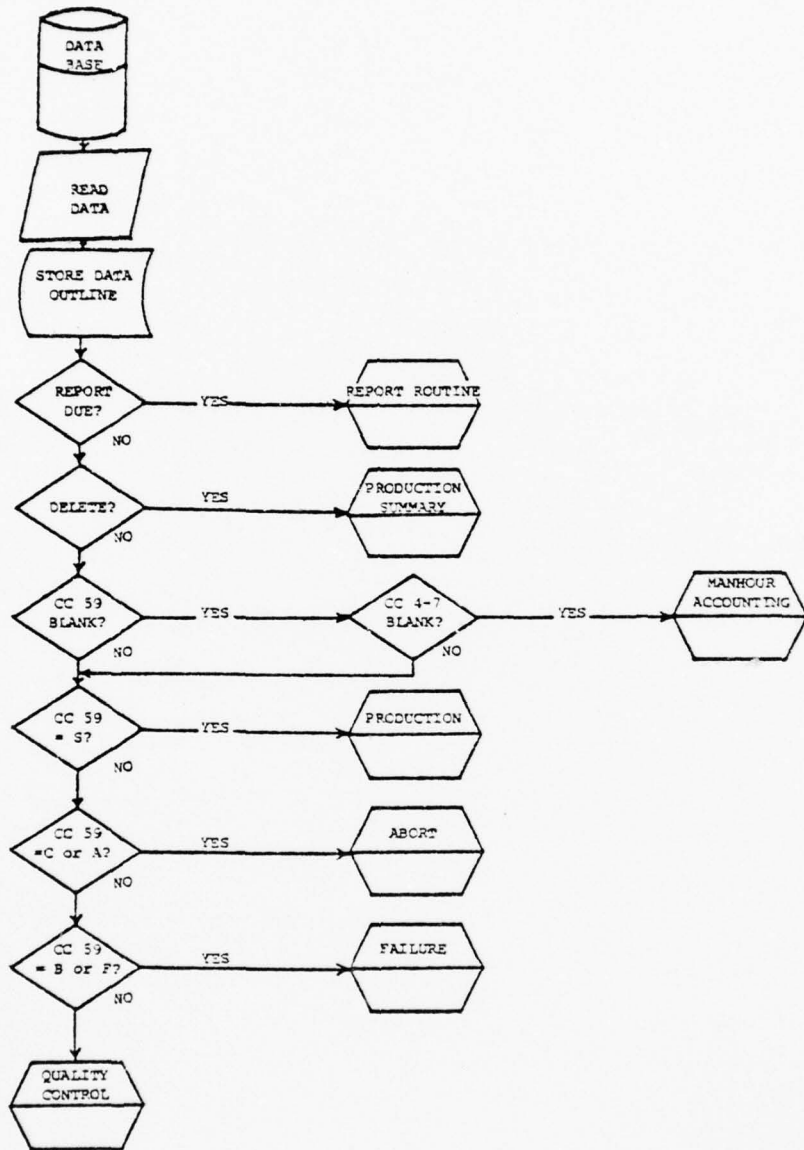


Figure 25. Initial Sort Routine

types of inspection. Then, for each type of inspection (there are five types generated by the data creation algorithm) the model keeps a cumulative total of the number of occurrences of such an inspection, together with a progressive total of the number of discrepancies recorded on each of these quality control inspections. This data is recorded in two counters:

- a. one counter for the current month, and
- b. another counter for the last three months.

The latter counter is used for purposes of comparison and to establish the limits on the graph of Quality Control Output per Inspection Type. This process is then repeated for each type of inspection and the resultant graphs and tables are produced in accordance with the flowchart depicted at Figure 26.

Quality Control by Work Unit Code Routine

This quality control routine then sorts the quality control file according to each work unit code within julian day limits. The objective of this output is to show in tabular form the number of discrepancies isolated for each of the work unit codes. This report is also output monthly, according to the logic flowchart shown at Figure 27.

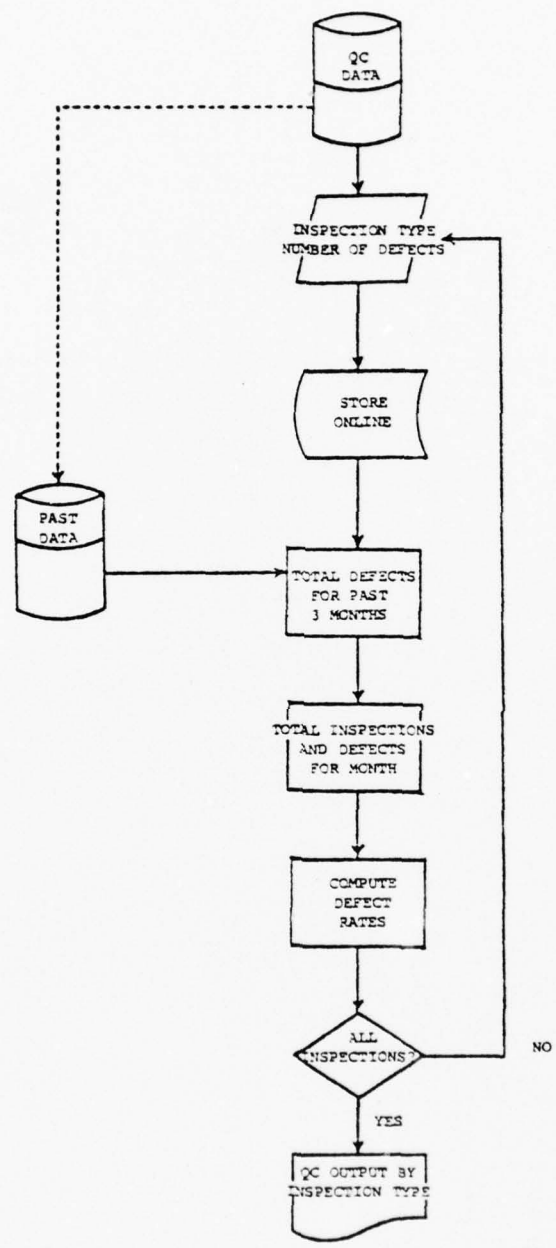


Figure 26. Quality Control by Inspection Type Routine

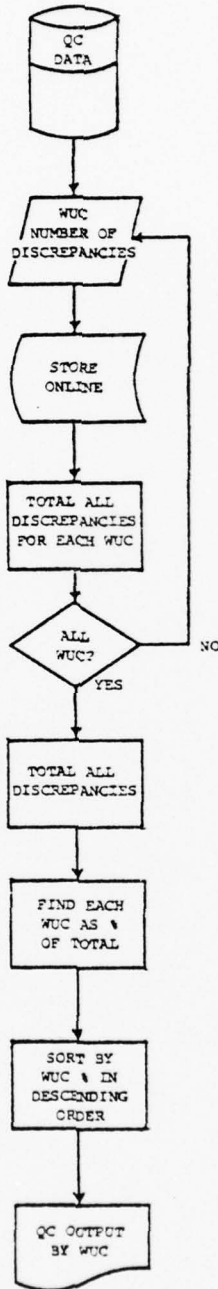


Figure 27. Quality Control Output by WUC Routine

Failure per WUC Routine

The object of this routine is to sort through the data base for all work centers and the depot to isolate information on all failures to enable compilation of a listing of the total number of failures for each work unit code. The total number of failures will determine the ranking assigned to each work unit code (WUC). The output is in descending order of occurrence. The flowchart is shown at Figure 28.

Abort per WUC Routine

This output is in much the same format as that of the equipment failure routine: the abort data base is read and mission aborts are sorted to each work unit code. The routine totals the number of aborts for each work unit code, sorts the WUCs according to total number of aborts for each code, then outputs the codes in descending order; refer to Figure 29 for the relevant flowchart.

Manhours Expended per WUC Routine

The manhours report is a composite listing of all direct manhours expended for each work unit code. This information is obtained from all AF form 349 data files which were raised in respect of failures, mission aborts, or depot level maintenance. The routine sorts the total manhours for each WUC and outputs them in descending order. The applicable flowchart is shown as Figure 30.

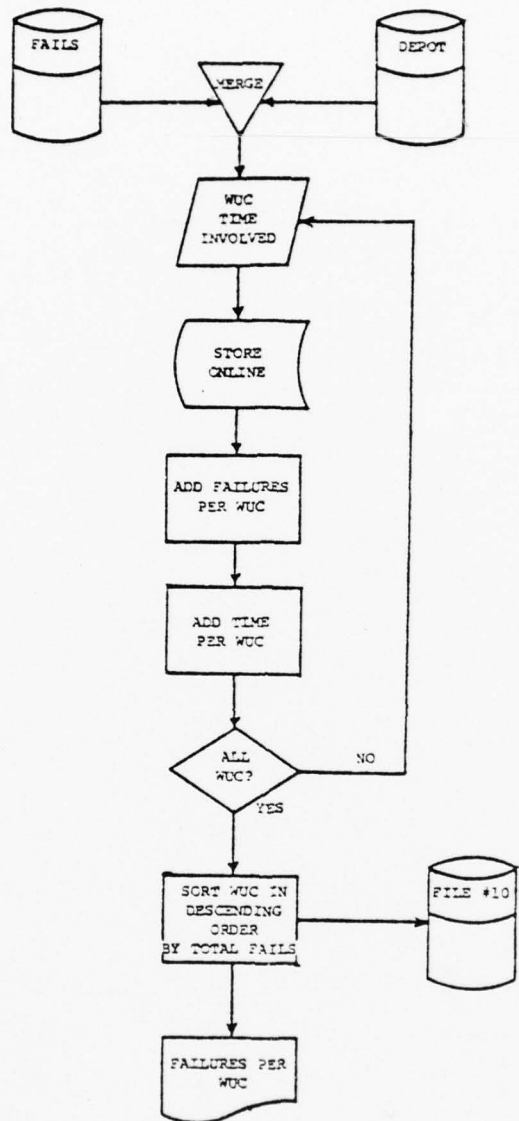


Figure 29. Failure Per WUC Routine

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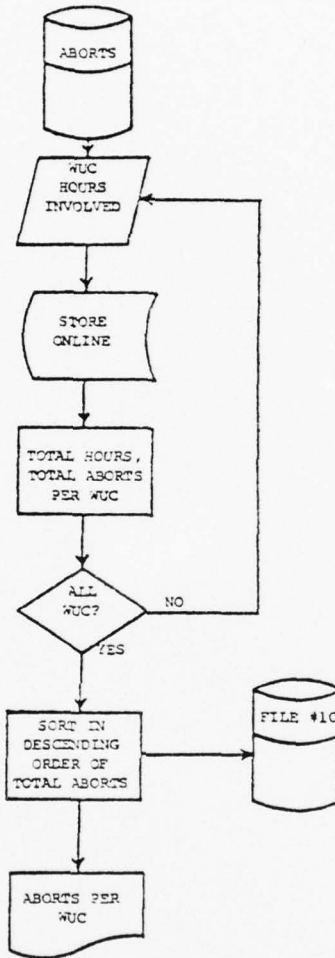


Figure 29. Aborts Per WUC Routine

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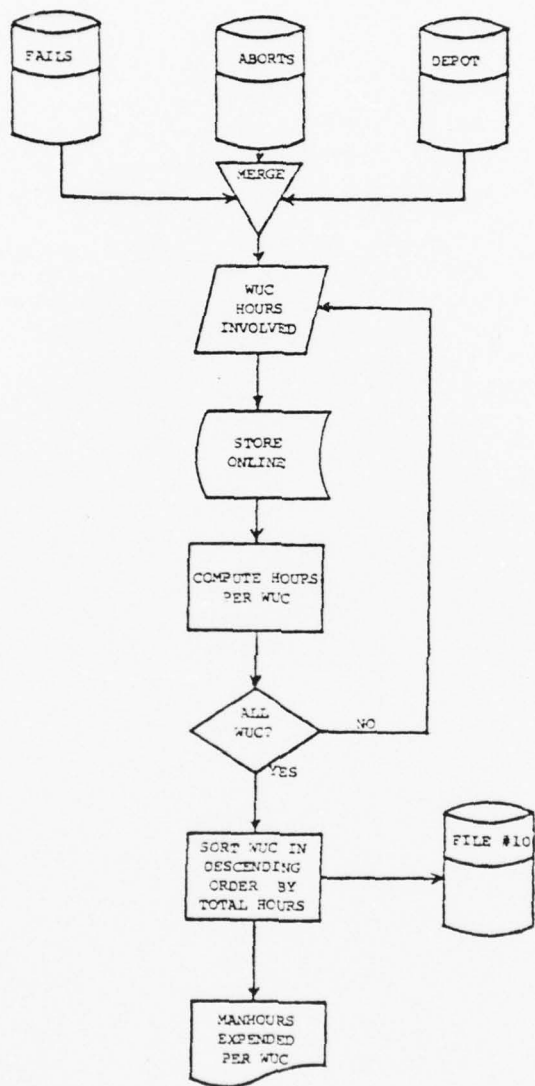


Figure 30. Manhours Expended Per WUC Routine

Failure Rate Summary Routine

The objective of this report is to output the number of failures, mission aborts, and manhours expended on the maintenance function for each work unit code; in effect, this report summarizes the outputs of the previous three reports but also accesses the previous months data for purposes of comparison and outputs the two sets of data for each code. The flowchart of this procedure is shown as Figure 31.

Production Summary Routine

The aim of this routine is to output a quarterly report showing the hours worked on each aircraft in the depot facility. The total hours worked are checked against the total hours authorized and discrepancies are highlighted. The applicable flowchart is shown as Figure 32.

Manpower Accounting Summary Routine

The final output is a summary of the manpower utilization per month for each work center under three headings: "direct labor," "indirect labor," and "other." The routine follows the logic of the flowchart shown at Figure 33 and shows the cost of each of the three manhour elements isolated. The output also shows the number of men assigned to each work center in comparison to the number of men authorized and computes a percent manned.

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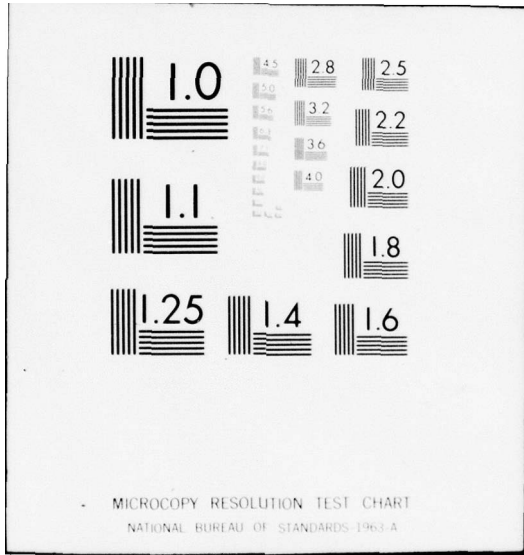
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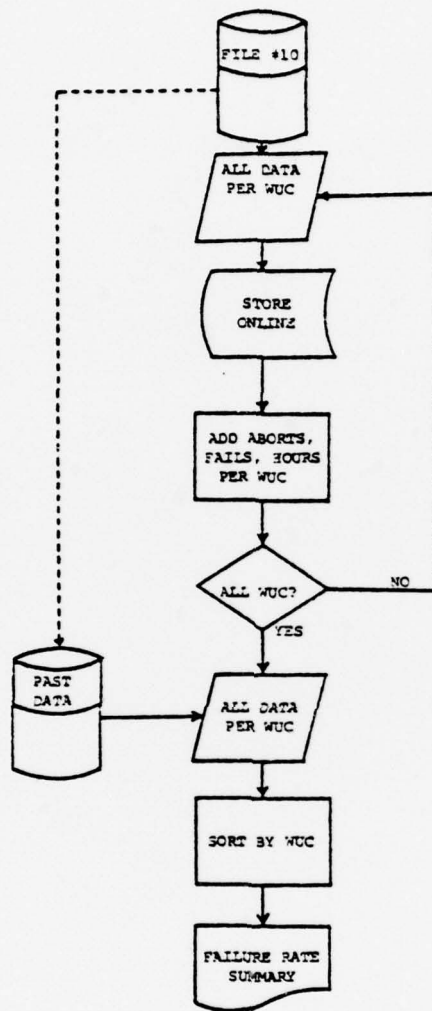


Figure 31. Failure Rate Summary Routine

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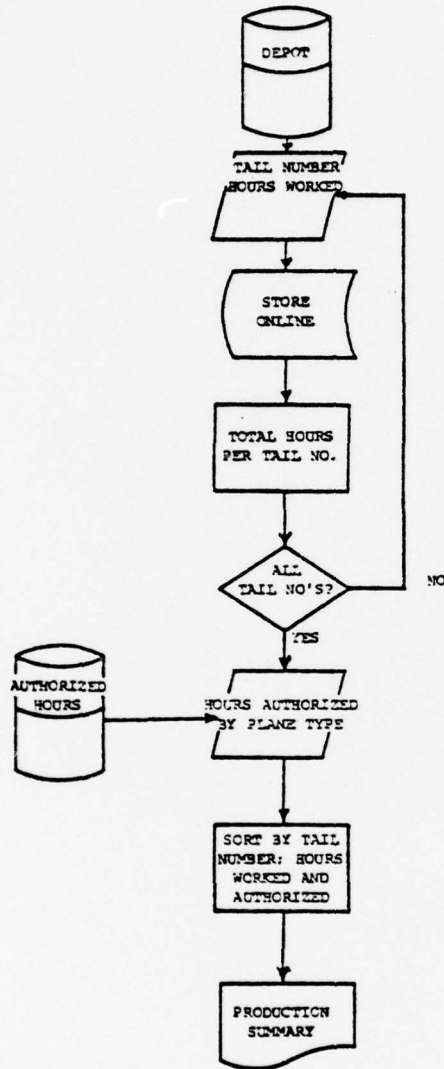


Figure 32. Production Summary Routine

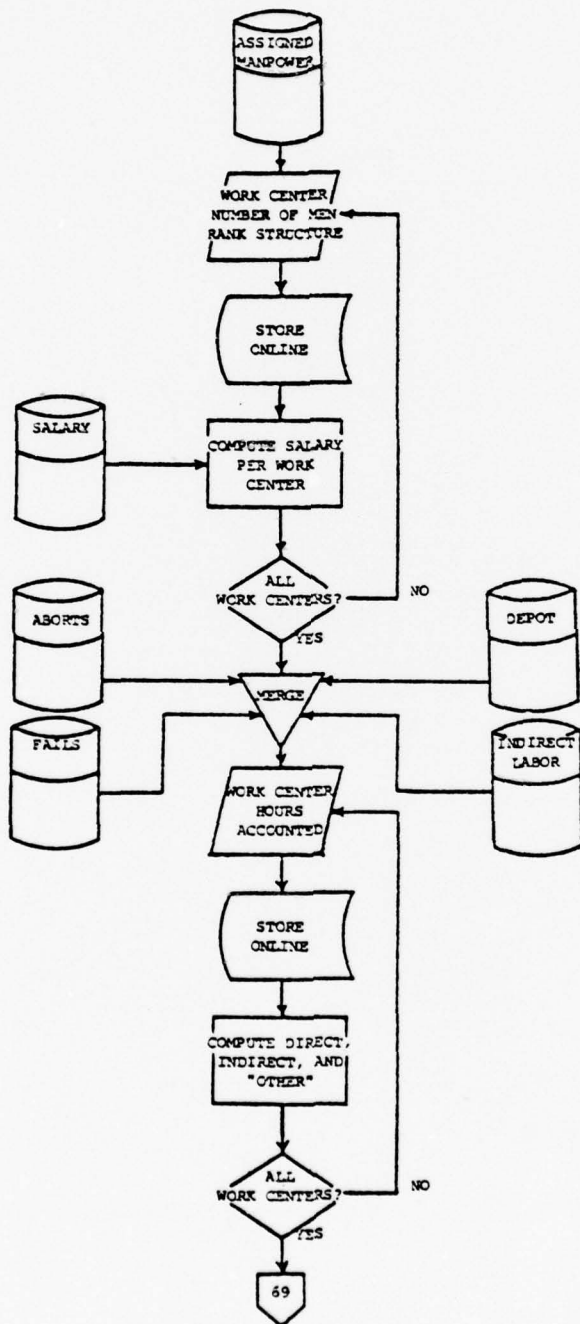


Figure 11. Manpower Accounting Summary Routine

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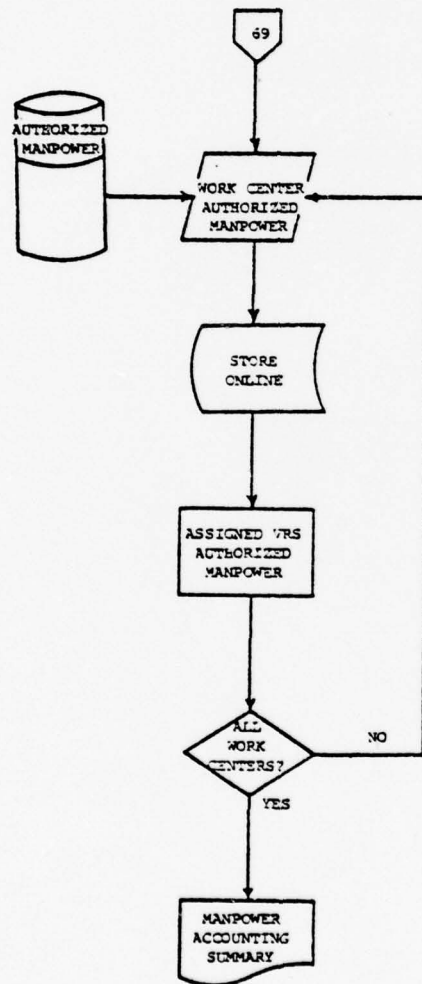


Figure 11--Continued

Summary

This chapter has developed each of the important facets of the model, showing elements of each of the sub-routines utilized to obtain the final outputs. The next chapter will develop the validation of the model, concentrating on use of the "artificially" generated data as a substitute for actual data. The chapter will also discuss the outputs obtained in the light of the original requirements shown at Chapter II.

CHAPTER IV

VALIDATION OF THE MODEL

This chapter will deal with the validation of the model as two distinct sections:

- a. validation of the use of generated data; and
- b. validation and examination of the system outputs.

The third section of the chapter will analyze the times involved to produce the requisite outputs to test the research objectives posited in Chapter I.

Data Validation

AF Form 349

Reference to Appendix B shows a copy of AF form 349 which is used by the ROKAF to account for manhours expended on maintenance functions. The data recorded on this form has been generated by the data program in the format shown at Figures 6 and 7; each element of this input will now be examined.

Julian Date. The program generated one year of data so the capability to utilize 366 days of outputs has been tested. The model uses the julian date to initiate reports due monthly and quarterly; this aspect will be fully tested later in this chapter.

Job Control Number. The data generated includes the capability to increment a progressive job control number, starting at unity for each work center for each julian date. The ROKAF generates actual AF form 349s in this fashion for purposes of manpower and accounting controls. The model does not require that unique job control numbers be input as they are not used in any of the output reports; however, we believed that the model should have the facility to acknowledge the existence of the job control numbers for running checks on what may appear to be abnormal inputs-- in this way the information stored on tape can be checked with the actual data.

Work Center. From data obtained from the ROKAF (22) we have selected five representative work centers for which data has been generated. We had no real data on a depot but created the manning for a depot to enable full testing of the model. This manning was based on Flight Line Support Branch manning figures (22). The model has the capability of outputting the requisite reports for as many work centers as exist in the ROKAF; however, to generate data for a large number of work centers was not considered worthwhile in the light of thesis time constraints. We believe that the selection of five work centers and one depot represents sufficient variety to test the capabilities of the model.

Aircraft Serial Number. The data generation program utilizes an eight-character combination of alphas and numerics to represent the tail number of each of the aircraft. In practice, the use of three numerals is sufficient to uniquely identify each of the F-4s used by the ROKAF, but the program generates a more complicated input to test the capability of the model to manipulate such an input format. The aircraft serial number is required to account for manhours expended on the maintenance function during overhaul at the depot--this is output as the Production Summary Report for each tail number.

Aircraft Type. The ROKAF currently uses four types of F-4--the program generates these four types with equal probability. As was explained earlier, twenty different tail numbers may be generated for each aircraft type for a total of 80 different aircraft tail numbers. In actuality, the ROKAF does not have exactly 20 of each aircraft type but the data generated represents a realistic approximation that satisfies the requirements for model validation. The model can recognize seven characters (both alphas and numerics) as representing the aircraft type; the data generation program fully tests this capability.

Engine Identification. The data generated for an engine number is fixed as "ABC123." Nowhere does the model use the engine number in the reports output so the facility

to generate variety was not incorporated as such a facility would have led to needless difficulties in effecting such an inclusion. The engine number has been allocated a field in the input format to add authenticity to the input, as well as to enable expansion of the model at some later date to incorporate reporting on engine maintenance. For the reports currently produced by the model, the engine identification is not required.

Work Unit Code. There are only ten work unit codes generated but they represent sufficient variety to test the capability of the model to manipulate this input. In fact, there are a great diversity of work unit codes (27) but to incorporate more than ten adds unneeded complexity. The nomenclature of the work unit codes is stored as a permanent file and accessed as needed for output reports to add clarity to those reports.

When Discovered Code. The data generated consists of the alphas "A," "B," "C," "F," and "S," or a blank. The "when discovered code" can take on any alpha, dependent upon the circumstances of the occurrence of a malfunction; whereas the real world will generate greater variety than the data program; this is not seen as a limitation to the realism of the artificial data. The model merely recognizes the input as a mission abort ("A" or "C"), an equipment failure ("B" or "F"), depot maintenance ("S"), or manhour

accounting (blank). At some later development of the model there may be a requirement for definition of more input types and this need can be met through the "when discovered code."

How Malfunctioned Code. This element is represented through the generation of ten different codes; in practice, there are up to one thousand different codes but we believe that ten represents sufficient complexity to validate the model. Besides, the reports output by the model do not require details of the malfunction code--the facility to generate the code has been incorporated to lend authenticity and to ensure that the input data utilized by the model has the facility for later utilization of this input should such a need arise.

Start Hour. The starting time is generated from a random number according to a specific distribution as shown in Appendix O. The times and probabilities chosen are entirely arbitrary and based solely on the authors' own experience. However, this distribution of starting times is not seen as a limitation because the data is used merely to test the model. It would have been possible to write a program to generate data for each person employed in each work center (and thereby eliminate possible start/finish time inconsistencies) but such a schedule would have resulted in an added authenticity which was not required

at the time cost that would have been necessary. The data generated is sufficient to test the capabilities of the model to manipulate hours worked on particular maintenance functions, as shown by the output reports.

Shift Indicator. The julian date is printed as an indicator that a work crew has been employed for a period of time that includes midnight--this input is necessary for manpower accounting purposes to enable correct recording of hours worked. This is an exact duplication of reality.

Finish Hour. The remarks made under the start hour are equally applicable here: the times were generated according to an arbitrary distribution shown at Appendix O. To lend authenticity to the data so generated, minutes for both start and finish time have also been included in the form of a uniform distribution. The model incorporates this data for manipulation of manhour data and the facility to use minutes in that data has been verified.

Crew Size. The crew size is also used for purposes of manhour accounting. The data generated will produce a crew size of from one to seven in accordance with an arbitrary distribution contained within the data generation program. The AF form 349 only permits recording of one digit of information on crew size which effectively places a maximum limitation of nine persons per task. The model

reflects this limitation. This is in consonance with reality in which a crew size usually does not exceed five; certainly in reviewing sample data from the ROKAF this was the situation. However, future modification of the model would permit the use of larger crew sizes up to a maximum of nine persons.

A sample of 200 AF form 349s has been received from the ROKAF to aid in data validation. These forms have been examined by the authors and no discrepancies were found between the type of data generated artificially and that actual data, with an exception in that the actual data incorporated greater variety than the artificial data. This limitation has been discussed above; suffice it to add that the real data verifies the generated data. The real data has not been run against the program because it is incomplete: these forms are from a variety of work centers and for various times and do not show sufficient time consistency for system validation. Therefore, it was decided to utilize the artificial data as a surrogate for the real ROKAF data.

Quality Control Inputs

The format of the quality control inputs has previously been shown as Figure 4; to recapitulate: the quality control input is used to record the number of discrepancies found on inspections of aircraft. Very little

actual data has been received from the ROKAF which would enable complete validation of the data artificially generated; however, the information used is according to ROKAF examples--the actual input format was devised by the authors to enable output of the Quality Control Outputs by Type of Inspection and Work Unit Code. Each element of the input will now be examined for validation purposes.

Type of Inspection. The data generation program produces five different types of quality control inspection. A greater number would be a closer approximation to reality but is considered unwarranted. The five types of inspections used are sufficient to test the capacity of the model to handle variety, without causing added complexity. The model will manipulate as much variety as exists in the real world so the use of only five types in the generation is not viewed as a limitation.

Inspection Number. The data generated also includes the capacity for sequential numbering of each inspection type for each julian date. This capability is not utilized by the model but may be necessary for later development of the model to output a proliferation of other reports. This characteristic is not required but adds authenticity.

Julian Date and Year. This element is used for initiation of the Quality Control Reports, as well as

enabling storage of data in data files for production of the Quality Control Output per Type of Inspection. No validation is required for this input, except to ensure that days were generated sequentially.

Aircraft Type. The four aircraft types are generated according to a uniform distribution; this data element is not required in the current output reports but may be a requisite under later modifications (e.g., output of discrepancies on QC inspections per aircraft type). Currently this field serves to lend authenticity to the data input.

Work Unit Code. Ten different work unit codes are generated according to a uniform distribution. Whilst it is recognized that this does not convey the whole gamut of codes available in the working environment, we believe that it does represent sufficient diversity for model verification.

Number of Discrepancies. The data generated will show the number of discrepancies as a two-digit field based on the output of a Poisson distribution with a lambda value specified by uniform distribution. There is no requirement to have realistic data in this field because the model merely uses this element to graph the discrepancies per inspection type, and to accumulate discrepancies per work

unit code--all that is required is that the numbers generated are sufficient to test the model. In this respect, this element is validated.

Few ROKAF quality control reports are available at this time to enable comprehensive verification of the quality control input. However, the data input should contain (as a minimum) the elements outlined above, each of which has been individually discussed and verified; the quality control input is therefore realistic.

Summary Delete Cards

The summary delete cards are generated according to the format shown in Figure 5. No Air Force manual describes the form of this card but a requirement exists under the model for information of the departure of aircraft from the depot level maintenance facility to enable output of the Production Summary Report. The delete card facilitates file maintenance functions, thereby eliminating the need for manual (intermittent) file closures. All that is required is that when the depot completes overhauling an aircraft, a delete card should be produced to record this event. No further validation appears necessary.

Summary

From the detailed discussion above the data input has been shown to be realistic, subject to the constraint

of limited variety in some instances. The next section will examine each of the reports output by the model.

Output Validation

This section will deal with each of the reports, examining them in detail and explaining how the information thereupon recorded is to be interpreted.

Quality Control Output per Type of Inspection

Reference to Appendix F will show a sample of the type of output generated by the model under this report. The objective of the output is to illustrate graphically the movement in the average number of discrepancies found for each type of inspection.

The output lists the type of inspection by name and month, followed by the total number of inspections of this type conducted at all of the work centers. The model then computes a discrepancy rate (mean average number of discrepancies per inspection type) based on the total number of discrepancies found on all inspections of that type for that month.

The graphical display is in the normal control chart format with an average (\bar{c}) computed from the past three months data for that inspection type. The output is in the form of one years data commencing at January for each year. This output is in the format required by

Figure 9 and hence meets the needs of the ROKAF. Limitations of this output are:

a. the vertical axis presents data to the nearest graphed point; i.e., it does not graph the exact position of the data, but only its general location with respect to the upper- and lower-control limits and \bar{c} . To obtain the exact rate requires examination of the tabular output above each chart; and

b. the normal chart prints a maximum of twelve months information--as of the commencement of each calendar year information from the previous year is not shown and hence it is not until December that a complete twelve months data is printed.

With these minor limitations in mind the output will enable ROKAF management to take early remedial action should there be an inordinate increase in the number of discrepancies discovered on QC inspections.

Quality Control Output per Work Unit Code

An example of the type of output given under this report is shown at Appendix G. The objective of this report is to list in tabular form the discrepancies found on quality control inspections for each work unit code.

The report shows all work unit codes for which QC reports have been input for the month--the model accesses

work unit code file for nomenclatures to increase the meaningfulness of the output. The work unit codes are sorted by the number of discrepancies found for that work unit code over all quality control inspections. The output also shows that percentage of total discrepancies which are attributable to that particular work unit code.

The output is in the format defined at Figure 11 and is therefore of the type required by ROKAF management. Therefore, the output is validated and no limitations are seen in the use of this report as it has the capability to sort and list all work unit codes used by the ROKAF. Therefore this report will be suitable for use in highlighting those work unit codes which are causing an inordinate strain on the maintenance function. This highlighting can then lead to increased managerial attention to that work unit code to discover the reasons for the increased burden of maintenance.

Number of Failures per
Work Unit Code

An example of this report is shown as Appendix H. The objective here is to correct all of the data on direct labor accounting (except for mission aborts) to show the total number of failures that occur, listed by work unit code. The report ranks the work unit codes by the number of failures associated with each. Alongside each code is

printed the applicable nomenclature to increase readability. Finally, the total number of failures is shown.

The report is in the form shown as necessary by Figure 13 and hence is of the format required by ROKAF management. The report will output work unit codes for which failures occurred during the month and there is no limit on the number of such codes that can be output. There are no limitations on the use of this output which will be used to isolate those work unit codes which define the greatest number of equipment failures.

Number of Aborts per
Work Unit Code

Reference to Appendix I will show an example of this report. The report shows all work unit codes for which mission aborts have been reported over the previous month. The work unit codes are ranked according to the frequency of occurrence of aborts; the WUC nomenclature is also included to enhance presentation, and then the actual number of aborts is recorded.

This report is in the format specified by Figure 15 and is hence in consonance with the requirements of the ROKAF. The objective is to delineate those work unit codes which define equipments causing mission aborts, and hence constrain equipment readiness. No limitations are envisaged on this output as it includes the ability to

output (and rank) as many work unit codes as are in use by the ROKAF.

Manhours Expended per
Work Unit Base

Appendix J shows an example of the type of output given by this report. In effect, this report is issued in conjunction with the last two previously described-- the model computes the hours expended on the maintenance function for each work unit code. This information is collated from the AF form 349s input as failures, aborts, and depot maintenance. The model sorts the work unit codes in descending order in accordance with the magnitude of the hours expended on maintenance functions associated with that work unit code. The report also prints the work unit code nomenclature to enhance readability.

The requisite format for this report is shown as Figure 17. The actual output is in accordance with this figure and hence the output fulfills the requirements of the ROKAF. The report will be used to isolate those equipment items that are causing the greatest burden to the total maintenance function. In this way management is able to concentrate its attention on those components which indicate excessive time for failure corrections; there is no limitation to the use of this report for the above-mentioned management function.

Failure Rate Summary

An example of this report is shown as Appendix K. The report is a compilation of the previous three reports, together with comparative data from the previous month. The report shows each work unit code listed in numerical order (for convenience), together with the applicable nomenclature. The report shows the number of failures (and ranking) for each WUC for the current and the past month; the same information is recorded for aborts. Likewise, the report shows the total number of direct labor manhours (and rankings) used over the month compared to those of the previous month.

Reference to Figure 19 will show the required format of this report; the actual format is in compliance with the dictates of this figure and hence will meet the requirements of the ROKAF. Besides acting as a compilation of the previous three reports, the fact that comparative statistics are available means that the report can be used to indicate movements in relative importance of particular work unit codes. There are no limitations to the use of this report (within the requirements stated).

Production Summary Report

Appendix L contains an example of this report. The objective of the report is to output the number of hours of maintenance utilized by each aircraft during the

performance of depot-level maintenance. Once an aircraft has left the depot a final manhour utilization entry is recorded; otherwise, each aircraft in the depot is shown together with the number of hours already consumed and a comparison against the number of hours authorized for that maintenance function. The report also shows whether there are authorized manhours still available, or whether the authorized limit has already been exceeded. This report is output quarterly.

From Figure 21 a copy of the required output format is available. A comparison with the output obtained will show that the actual output will satisfy the requirements of the ROKAF--the necessary information has been presented as required. This report will be used to determine which aircraft have exceeded their authorized manhour usage, those likely to exceed their authorized usage, leaving those which do not require managerial attention. This information can then be used for depot scheduling or to aid in managerial investigations of maintenance delays.

As the model currently operates, a standard number of hours for each aircraft type overhaul has been listed on a permanent file which is accessed each time the report is generated. A possible complication exists which has not been addressed by the model. The input method utilized from AF form 349 does not allow for the reporting of the type of overhaul that is being conducted. If there is a

variety of types of overhaul that are conducted on each aircraft type (a not unrealistic assumption) then this factor would need to be reported on the AF form 349 and the model would require some modification in the light of this circumstance. No other limitations exist.

Manpower Accounting Summary
per Work Center

An example of the output generated as this report is shown as Appendix M. The objective of the report is to divide labor into three elements and provide a costing for each of these components for each work center. From the assigned manning permanent file for each work center the model accesses the total assigned manhours available for each work center each month. The model works on the basis that each man works 176 hours per month (22). The model totals direct labor and indirect labor, the difference between this sum and total hours available is referred to as "other." The costs are found through computing the total salary for each work center through interaction with the salary permanent file. Each component of labor is then allocated a cost in relation to the total cost in a direct relationship between that component and the total labor availability. The model also shows the authorized and assigned manning, and the percentage manning for each work center.

The format of the output required is shown as Figure 23; the actual output report includes all those elements required by the ROKAF in respect to manhour accounting. The report will be used to highlight those work centers which have an inordinate amount of nondirect labor in an endeavor to raise the element of direct labor which would result in an increase in productivity; the report will also show which work centers most need increased manpower assignments.

The major limitation to the model is that it does not have the capability of computing manhour costs when the assigned manning varies over the period of the month of the report. The same limitation is evident for the authorized manning but this varies so rarely that this does not act as a constraining factor. The model can be modified to require reporting of assigned manning whenever such a change occurs, and hence computing costs on a daily basis. This facility has not been incorporated in the model because of limited time availability.

Another minor limitation exists--the AF form 349 does not record the grade and seniority of the person/ persons assigned the task covered by the AF form 349; hence, there is no means to defining the exact cost of each task. The method by which the model handles this constraint is to compute costings on the basis of averaged salaries for each work center. The resultant costings are therefore not

exact, but represent sufficiently accurate approximations to enable this report to be used as intended. To record the exact cost would necessitate the inclusion of grade/seniority data on the AF Form 349 and the resultant increase in decimal accuracy is not considered to be worth the extra data required for implementation.

Validation of the System

Information has been obtained from the ROKAF on the manning of all work centers used for F-4 maintenance (22). From this data five representative work centers were selected with manning as indicated:

- a. K3110 (Repair Reclamation Shop) - 24 men;
- b. K3130 (Electrical Shop) - 21 men;
- c. K3160 (Fuel System Shop) - 10 men;
- d. K4110 (Flight Line Support Shop) - 43 men; and
- e. K4230 (Electrical Navigation Shop) - 10 men.

(The details of authorized and assigned manpower for each of these shops is shown at Appendix P.) In the case of a depot no figures were presented--it was decided to assume that a depot would require approximately the same number of men as a flight line branch (for which figures are available). A representative figure was 71 men.

From the data supplied there are 1053 men assigned to the whole maintenance function; as the above work centers and depot total 179 men, we have made the not unrealistic

assumption that they would be responsible for 17 percent of all work generated each day. Now, we know that the maintenance system generates 600 cards per day (22); therefore, our work centers would be expected to generate approximately 17 percent of these cards, or 100 cards per day.

From the ROKAF data, salaries were available for each rank and increment thereto. This data was stored in permanent files for access in generation of the Manpower Accounting Summary. The assigned and authorized manning for each of the work centers was also stored in permanent files for interaction in the output of the Manpower Report.

The actual number of hours worked by each man is obviously subject to some variation each month but the information provided by the ROKAF indicates an average of 176 hours per man per month. This figure is based on a 44 hour week with 4 complete weeks per month, the remaining time being taken up in holidays. In fact, we question the exactness of this figure of 176 but take it at face value under the circumstances. Once the MDCS is put into practice by the ROKAF some deeper examination of the hours available each month may be warranted.

The ROKAF data indicated that there were approximately 138 QC inspections per month, or approximately 5 per day. The data generation program was therefore altered to ensure that approximately 96 percent of all items output were in the AF form 349 format, with the remainder being

in the quality control inspection format. This whole system of 105 cards per day was run for two years to obtain data for system validation.

System Production

With the algorithm producing approximately 105 cards per day for two complete years, the model was utilized to produce the required reports and the times taken for each segment were totalled. Because of the fact that data was generated through the computer, no definitive times were available for data input through the card punch medium. However, as some sample AF form 349s were available, the authors were able to punch up 50 cards in less than an average of 30 seconds each (an average of 24 seconds per card for 50 cards). It was therefore reasoned that a trained card punch operator would experience little difficulty in achieving a comparable rate of one card per 30 seconds over an extended period. (We believe this to be a much slower time that would actually be achieved but wish to consider a "worst case" situation.)

On the basis of card punch operations as outlined above, the time required to punch up 105 cards per day for one year is 320 hours, or 26 hours and 30 minutes per month. The actual computer manipulation for one years data was 18 minutes, plus 20 minutes for output printing (on a GE 115 PRT 100 printer). This means total system time is:

- a. computer time per months: 3.2 minutes;
- b. card punch time for month: 26 hours and 30 minutes; and therefore
- c. total MDCS time: 26 hours and 33 minutes.

Data provided on the current system has been provided from the TCG at Hill AFB (21) and is shown as Figure 34.

<u>Report</u>	<u>Direct Manpower</u>	<u>Indirect Manpower</u>	<u>Total (Monthly)</u>
a. Production Summary	140	285	425
b. Quality Control Outputs	140	265	405
c. Manpower Accounting	160	360	520
d. AF Form 349 Reports	375	589	964
			<u>2314</u>

Figure 34. Manual Output Times in Hours

Now, the data manipulated each month represents 17 percent of the total time for each of the following reports:

- a. Production Summary-- 17% of 425 hours = 72.25
- b. Manpower Accounting-- 17% of 520 hours = 88.40
- c. AF Form 349 Reports-- 17% of 964 hours = 163.88

This totals to approximately 325 hours for manual output. In addition to this time, the model also utilizes all QC input each month and outputs all applicable reports. This would take 405 hours manually. Hence, the total manual

time required to duplicate the MDCS output would be
(405 + 325 =) 730 hours.

The time computed for the MDCS was 26.5 hours which is less than 4 percent of the time required for the equivalent manual system of 730 hours. Based on the criterion for significance established in Chapter I, this figure is considered to show that the MDCS is significantly faster than the manual system, and examination of all reports output over the two-year period show that the model is operating as expected.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

This thesis has examined the development and validation of an automated Maintenance Data Collection System for utilization by the Republic of Korea Air Force. The resultant system will serve two specific purposes:

1. This system will give a strong basis to the ROKAF management functions of the F-4 weapon system as they relate to maintenance and manhour accounting.
2. The MDCS will enable the ROKAF to make specific estimates of the needed logistical spare parts support required on an annual basis.

The final model developed is listed as Appendix Q.

Applicability

The previous chapter validated the model's use in the output of the following reports:

- a. Quality Control report per Type of Inspection;
- b. Quality Control report per Work Unit Code;
- c. Number of Failures report per Work Unit Code;
- d. Number of Aborts report per Work Unit Code;
- e. Manhours Expended report per Work Unit Code;

- f. Failure Rate Summary per Work Unit Code;
- g. Production Summary Report; and
- h. Manpower Accounting Summary report per Work Center.

Each of these reports is equally applicable for use by other countries which receive security support for the F-4 weapon system through the Technical Coordinating Group. The only requirement is that countries will need to collect and input their maintenance data in the same formats as presented in Chapter II of this thesis. Further, this will require the use of AF form 349 and appropriate AF Technical Orders and Manuals relating to maintenance functions. Additionally, Quality Control data will need to be recorded.

The model points out the fact that there does not appear to be a need to confine the use of this MDCS to F-4 weapon systems management, as the routines and algorithms are equally applicable to other weapon systems. As in all actual real world applications of any system, there will be a need to alter certain permanent files (e.g., salary, authorized and assigned manpower, etc.) to reflect local conditions, but this task simply requires the employment of a systems programmer to make the necessary system changes.

Limitations

Although the limitations to this model have been highlighted as they occurred in the validation outlined in Chapter III, one is particularly troublesome: changes in manning authorizations or assignments that occur during the month are not reflected in computations of manpower costs until the permanent manpower file has been updated. The limitation to the effective use of this system can be eliminated by use of a daily manning input and resultant computations, rather than the monthly computations which now exist; unfortunately, because of the pressure of limited time, the authors were not able to develop this capability themselves.

Further Development

As with all computer models developed, this MDCS leaves the possibility for further development limited only by the systems designer's imagination. However, there are some suggested areas for development.

1. Develop a daily manning input and a computation routine to enable a more refined manning cost figure to be produced.
2. Develop a routine to sort quality control data not only by type of inspection but also by Mission Design Series (MDS) of each specific weapon system.

3. Develop the capability to break down the depot maintenance activities by types of overhaul performed and the manhours devoted to each type of overhaul by weapon system.

From the data available to this model there is a plethora of other reports that could have been produced-- it is in this field that we need to exercise restraint. The idea behind a report is to attenuate the variety of the real world situation to a meaningful scope that is comprehensible to the manager. To add to the proliferation of demands for an increased number of reports is often to increase the variety of the existent data, rather than to decrease that variety.

The reports generated currently by this MDCS meet the requirements of the ROKAF for advanced knowledge of possible equipment malfunctions to enable these components to be included in the following years Special Support Arrangement. Further, it creates a unique weapon system management system to reduce maintenance problems and inefficient manpower utilization. This thesis and development of the resultant MDCS have been confined to the satisfaction of this requirement. Once new requirements are definitized, and we express no doubt that such a requirement will be perceived, then the model will require further development. We leave it to the capable hands of future system analysts to fulfill these perceptions.

APPENDICES

APPENDIX A
GLOSSARY OF DEFINITIONS

Definitions

The following glossary of definitions will be used throughout the thesis and is presented here for the convenience of the reader.

Access--"the ability to retrieve data from a computerized storage media [7:2]."

Characteristic--"a specific capability or feature possessed by a retrieval system [7:2]."

Computer program--"A series of instructions or statements in a form acceptable to a computer [and] prepared in order to achieve a certain result [30:C-9]."

CREATE--the computer facility utilized at AFIT SLG.

Data base--"the collection of data stored within the computer system [7:2]."

Edit--"the capability to diagnose syntax errors in the retrieval system input parameters [7:2]."

File--"A collection of related records treated as a unit [30:F-2]."

Input--"data to be processed [30:I-4]."

Maintenance Data Collection System (MDCS)--a combination of computer programs aimed at manipulation of input maintenance data to enable an expansion of the data base to provide that information required by the MDRS.

Maintenance Data Retrieval System (MDRS)--a combination of computer programs to provide access to specific information in the data base, and then to output that information in a meaningful format.

On-line inquiry--"an immediate (normally a matter of seconds) response given to a question asked over a remote keyboard terminal, which is hooked up on-line to the central processor [7:8]."

Processing logic--"those predetermined series of steps in which data are internally manipulated within the computer system [7:2]."

Random sample--"a sample in which each element of the population has an equal and independent chance of being included [13:337]."

Record--"a collection of related items of data, treated as a unit [30:R-2]."

Retrieval system--computer programs or routines which have the capability to extract specified data from

computer storage, reformat or manipulate this data and
output the data in the format specified by the requestor
(25:1).

Sample--"any subset of elements from the universe
or one of its populations [13:327]."

Syntax--rules for using a retrieval system (26:1-2).

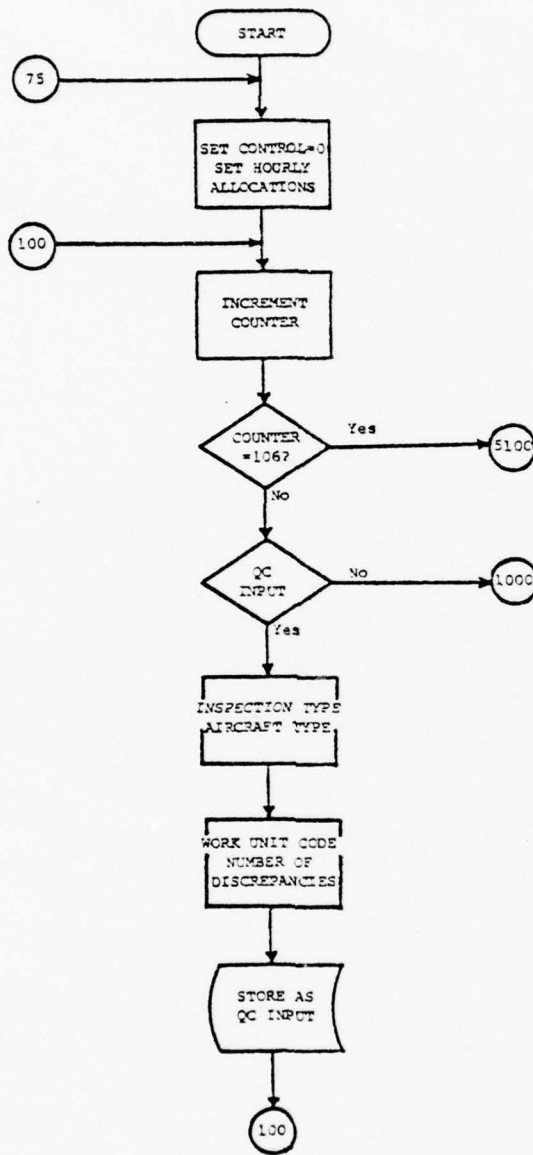
APPENDIX B
SAMPLE COPY AF FORM 349

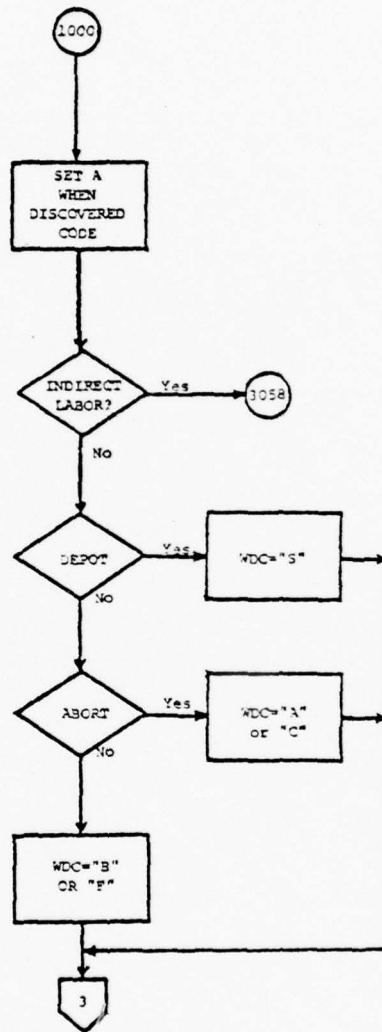
MAINTENANCE DATA COLLECTION RECORD													OMB NO. 21-40227	
1. JOB CONTROL NO.	2. WORK CENTER	3. I.D. NO./SERIAL NO.	4. MDS	5. EQ/GL	6. TIME	7. PRI	8. SORTIE NO.	9. LOCATION						
10. ENG. TIME	11. ENGINE I.D.	12. INST ENG TIME	13. INST. ENG. I.D.	14.	15.	16.	17. TIME SPC REQ		18. JOB STD.					
19. FSC	20. PART NUMBER			21. SER. NO./OPER. TIME		22. TAG NO.	23. INST. ITEM P. RT NO.		24. SERIAL NUMBER		25. OPER. TIME			
A TYPE MAIN1	B COMP POS	C WORK UNIT CODE	D ACTION TAKEN	E WHEN DISC	F HOW MAL	G UNITS	H START HOUR	I STOP HOUR	J CREW SIZE	K CAT LAB	L CMD ACT ID	M SCH CODE	N EMPLOYEE NUMBER	
1														
2														
3														
4														
5														
26. DISCREPANCY														
27. CORRECTIVE ACTION														
												28. RECORDS ACTION		

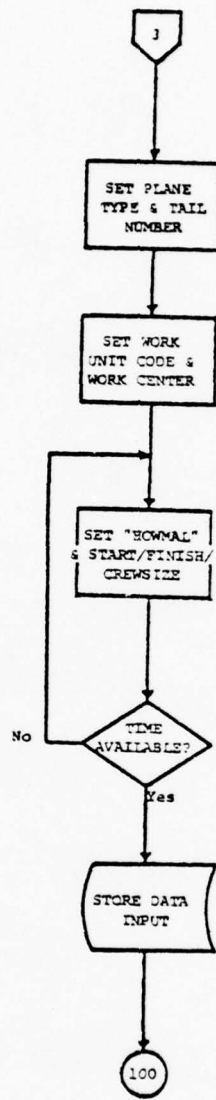
AFTO FORM 349 TEST
DEC 74
AFLC-WPAFB-JAN 75 400

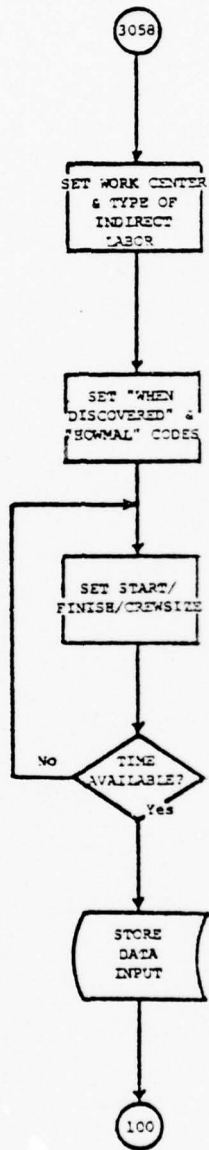
APPENDIX C

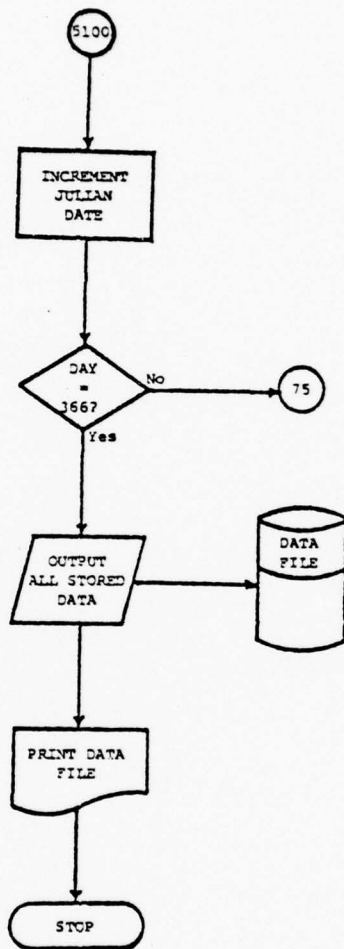
HIGH LEVEL FLOWCHART OF DATA GENERATION PROGRAM











APPENDIX D
PROGRAM LISTING OF DATA GENERATION ALGORITHM

DATA GENERATION PROGRAMME (MDCS)

```

1970*SRUN **CHITROGRAPHIUT55.P
1991 CALL CALLS('RMD CIPARTLES')
1992C
1994C
1994C *****
1994C * THIS PROGRAMME GENERATES DATA FOR USE IN THE COMPUTER
1994C * MDCS DEVELOPED FOR THE ROKAF BY PAYNE & CALLAHAN AS
1994C * PART OF THE REQUIREMENTS OF THE MASTER OF SCIENCE IN
1994C * LOGISTICS. THE PROGRAMME GENERATES DATA IN THREE
1994C * BASIC FORMATS:
1994C * 1. A QUALITY CONTROL INPUT,
1994C * 2. A 349 INPUT FOR MAINTENANCE - MANUOUR
1994C * ACCOUNTING, AND
1994C * 3. A SUMMARY WHITE INPUT.
1994C *****
1994C CALL CREATE(10,9999,0,1,STAT)
1994C CHAPACTER TYPES=5,ACRAFT=7,HKUCOD=5,NONTRONL=4,
1994C PLANE=6,IND=7,PLANT=6,ENGNO=6,MMDISC=1,NORMML=3,
1994C MGEN=5,PLANE6,PLANT1=6,PLANE2=6,PLANE3=6,
1994C PLANE4=6,PLANE5=6,PLANE6=6,IND=2,TAIL1=2,TAIL3=2,
1994C TAIL4=2,TAIL5=2,TAIL6=2,K3110=5,K3130=5,
1994C K3160=5,K4110=5,K4230=5,DEL=6,TAIL2=2
1994C INTEGER OYR/77
1994C .001 = 0.01
1994C K01=00
1994C I=0
1994C GO TO 1000
2110 74 OYR = 77
2120 75 K01 = 00
2130 OYR=0
2140 OYR=0
2150 OYR=0
2160 OYR=0
2170 OYR=0
2180 ACEN0 = 00
2190 K0001 = 0
2200 K0001 = 0000
2210 K0001 = 0000
2220 K0001 = 0000
2230 K0002 = 0000
2240 K0003 = 0000
2250 K0004 = 0000
2260 K0005 = 0000
2270 I0051=4274
2280 I0052=3696
2290 I0053=1760

```

```

2500      IUP54=7560
2510      IUP55=1760
2520      IUP50=12196
2530      100      KMI=KMI*1
2540      IF(KMI.EQ.100) GO TO 5100
2550      X=PNDC(1.0)
2560      IF(X.GT..04) GO TO 1000
2570      X=PNDC(1.0)
2580      IF(X.LT..2) GO TO 222
2590      IF(X.GT..2.AND.X.LE..4) GO TO 333
2600      IF(X.GT..4.AND.X.LE..6) GO TO 444
2610      IF(X.GT..6.AND.X.LE..8) GO TO 555
2620      IF(X.GT..8) GO TO 566
2630      222      TYP105 = " 0P1"
2640      0P100 = OPEN(1)
2650      IUP50 = 0P100
2660      GO TO 666
2670      333      TYP105 = " 0P0"
2680      0P000 = OPEN(1)
2690      IUP50 = 0P000
2700      GO TO 666
2710      444      TYP105 = " 0U1"
2720      0U100 = OPEN(1)
2730      IUP50 = 0U100
2740      GO TO 666
2750      555      TYP105 = " 0U1"
2760      0U100 = OPEN(1)
2770      IUP50 = 0U100
2780      GO TO 666
2790      565      TYP105 = " 53GF"
2800      AG100 = OPEN(1)
2810      IUP50 = AG100
2820      666      X=PNDC(1.0)
2830      IF(X.LT..25) ACRAFT = " F004C"
2840      IF(X.GT..25.AND.X.LE..5) ACRAFT = " F004D"
2850      IF(X.GT..5.AND.X.LE..75) ACRAFT = " F004E"
2860      IF(X.GT..75) ACRAFT = " REB01C"
2870      875      X=PNDC(1.0)
2880      IF(X.LT..1) WKUC00 = "11111"
2890      IF(X.GT..1.AND.X.LE..2) WKUC00 = "12345"
2900      IF(X.GT..2.AND.X.LE..3) WKUC00 = "22222"
2910      IF(X.GT..3.AND.X.LE..4) WKUC00 = "33333"
2920      IF(X.GT..4.AND.X.LE..5) WKUC00 = "44444"
2930      IF(X.GT..5.AND.X.LE..6) WKUC00 = "55555"
2940      IF(X.GT..6.AND.X.LE..7) WKUC00 = "66666"
2950      IF(X.GT..7.AND.X.LE..8) WKUC00 = "77777"
2960      IF(X.GT..8.AND.X.LE..9) WKUC00 = "88888"

```

```

2770 IF(X,C1..9) WKUCOD = "99999"
2780 X=RDHC(1.0)
2790 IF(X,C1..2) AI = 3.
2800 IF(X,C1..2..AND..X..F..4) AI = 3.
2810 IF(X,C1..4..AND..X..F..6) AI = 4.
2820 IF(X,C1..6..AND..X..F..8) AI = 5.
2830 IF(X,C1..8) AI = 6.
2840 X=DESSORCAL(1.)
2850 WDISC = X
2860 JUL = JUL + 1000
2870 WRITE(10,945)TDYNS,INSMO,JUL,NYH,ACRAFT,WKUCOD,WDISC
2880 XPLNS = " "
2890 ACALT = " "
2900 WKUCOD = " "
2910 945 FORMAT(A9,1X,12,1X,11,12,1X,14,15,1X,12)
2920 GO TO 1000
2930 X=RDHC(1.0)
2940 IF(X,C1..2) GO TO 3051
2950 IF(X,C1..2..AND..X..F..45) GO TO 1003
2960 IF(X,C1..45..AND..X..F..55) WDISC = "A"
2970 IF(X,C1..55..AND..X..F..6) WDISC = "B"
2980 IF(X,C1..6..AND..X..F..65) WDISC = "C"
2990 IF(X,C1..65) WDISC = "F"
3000 GO TO 1050
3010 1003 KIDPT=KDEPT + 1
3020 KOTRDI=KDEPT
3030 KRCEN = "DEPT"
3040 WDISC = "5"
3050 IF(KRT,0..1) GO TO 2024
3060 IF(JUL..F..001) GO TO 1000
3070 IF(KRT..F..1) DIF="DEFF"
3080 WRITE(10,1051)PLAN6,TAIL6,DEL,PLAN6
3090 1051 FORMAT(X,6,A9,1X,16,1X,16)
3100 KOUNT=8
3110 KOUNT=KOUNT+1
3120 X=RDHC(1.0)
3130 IF(X,C1..25) PLAN = "1004"
3140 IF(X,C1..25..AND..X..F..2) PLAN = "1004A"
3150 IF(X,C1..5..AND..X..F..75) PLAN = "1004B"
3160 IF(X,C1..75) PLAN = "RE004C"
3170 X=RDHC(1.0)
3180 IF(X,C1..05) TH = "01"
3190 IF(X,C1..05..AND..X..F..10) TH = "02"
3200 IF(X,C1..10..AND..X..F..15) TH = "03"
3210 IF(X,C1..15..AND..X..F..20) TH = "04"
3220 IF(X,C1..20..AND..X..F..25) TH = "05"
3230

```

```

3410 IF(X.C1..25.AND.X.IF..40) TH = "06"
3420 IF(X.C1..30.AND.X.IF..35) TH = "07"
3430 IF(X.C1..35.AND.X.IF..40) TH = "08"
3440 IF(X.C1..40.AND.X.IF..45) TH = "09"
3450 IF(X.C1..45.AND.X.IF..50) TH = "10"
3460 IF(X.C1..50.AND.X.IF..55) TH = "11"
3470 IF(X.C1..55.AND.X.IF..60) TH = "12"
3480 IF(X.C1..60.AND.X.IF..65) TH = "13"
3490 IF(X.C1..65.AND.X.IF..70) TH = "14"
3500 IF(X.C1..70.AND.X.IF..75) TH = "15"
3510 IF(X.C1..75.AND.X.IF..80) TH = "16"
3520 IF(X.C1..80.AND.X.IF..85) TH = "17"
3530 IF(X.C1..85.AND.X.IF..90) TH = "18"
3540 IF(X.C1..90.AND.X.IF..95) TH = "19"
3550 IF(X.C1..95) TH = "20"
3560 IF(KOUBT.F0.1) GO TO 2015
3570 IF(KOUBT.F0.2) GO TO 2016
3580 IF(KOUBT.F0.3) GO TO 2017
3590 IF(KOUBT.F0.4) GO TO 2018
3600 IF(KOUBT.F0.5) GO TO 2020
3610 IF(KOUBT.F0.6) GO TO 2022
3620 2015 PLANE3=PLAN
3630 TAIL1=IH
3640 GO TO 1091
3650 2016 PLANE2=PLAN
3660 TAIL2=IH
3670 IF(TAIL2.NE.TAIL1) GO TO 1091
3680 IF(PLANE1.NE.PLANE2) GO TO 1091
3690 GO TO 1091
3700 2017 PLANE3=PLAN
3710 TAIL3=IH
3720 IF(TAIL3.NE.TAIL2.OR.TAIL3.NE.TAIL1) GO TO 1091
3730 IF(PLANE3.NE.PLANE2.OR.PLANE3.NE.PLANE1) GO TO 1091
3740 GO TO 1091
3750 2018 PLANE4=PLAN
3760 TAIL4=IH
3770 IF(TAIL4.EQ.TAIL3.OR.TAIL4.EQ.TAIL2) GO TO 2019
3780 IF(TAIL4.EQ.TAIL1) GO TO 2019
3790 GO TO 1091
3800 2019 IF(PLANE4.EQ.PLANE3.OR.PLANE4.EQ.PLANE2) GO TO 1091
3810 IF(PLANE4.EQ.PLANE1) GO TO 1091
3820 PLANE5=PLAN
3830 TAIL5=IH
3840 IF(TAIL5.EQ.TAIL4.OR.TAIL5.EQ.TAIL3) GO TO 2021
3850 IF(TAIL5.EQ.TAIL2.OR.TAIL5.EQ.TAIL1) GO TO 2021
3860 GO TO 1091

```

```

4710 2021 IF(PLANE5,FO,PLANE3,OR,PLANE5,FO,PLANE3) GO TO 1091
4710 IF(PLANE5,FO,PLANE2,OR,PLANE5,FO,PLANE1) GO TO 1091
4720 GO TO 1091
4760 2022 PLANE6=PIAN
4770 TAIL6=TH
4770 IF(TAIL6,FO,TAIL5,OR,TAIL6,FO,TAIL4) GO TO 2023
4780 IF(TAIL6,FO,TAIL5,OR,TAIL6,FO,TAIL2) GO TO 2023
4790 IF(TAIL6,FO,TAIL1) GO TO 2025
4810 GO TO 2024
4820 2023 IF(PLANE6,FO,PLANE5,OR,PLANE6,FO,PLANE4) GO TO 1091
4830 IF(PLANE6,FO,PLANE3,OR,PLANE6,FO,PLANE2) GO TO 1091
4840 IF(PLANE5,FO,PLANE1) GO TO 1091
4850 2024 IF(JUL,FO,001,AND,KHI,FO,00) GO TO 74
4860 X=000(-1,0)
4870 IF(X,LI,2,1) WKUC00 = "111111"
4880 IF(X,LI,1,AND,X,LI,2) WKUC00 = "12345"
4890 IF(X,LI,2,AND,X,LI,3) WKUC00 = "22222"
4900 IF(X,LI,3,AND,X,LI,4) WKUC00 = "33333"
4910 IF(X,LI,4,AND,X,LI,5) GO TO 2030
4920 IF(X,LI,5,AND,X,LI,6) WKUC00 = "55555"
4930 IF(X,LI,6,AND,X,LI,7) WKUC00 = "66666"
4940 IF(X,LI,7,AND,X,LI,8) WKUC00 = "77777"
4950 IF(X,LI,8,AND,X,LI,9) WKUC00 = "88888"
4960 IF(X,LI,9) WKUC00 = "99999"
4970 ENGO0 = "
4980 GO TO 2020
4990 2030 WKUC00 = "44144"
5000 ENGO0 = "ABC123"
5010 2050 IF(CHRDISC,NE,"5") GO TO 2051
5020 PLANE=PLANE6
5030 ENO=TAIL6
5040 GO TO 2054
5050 2051 X=000(-1,0)
5060 IF(X,LI,2) GO TO 2052
5070 IF(X,LI,2,AND,X,LI,40) GO TO 2053
5080 IF(X,LI,40,AND,X,LI,52) GO TO 2054
5090 IF(X,LI,52,AND,X,LI,90) GO TO 2055
5100 IF(X,LI,90) GO TO 2056
5110 2052 KCPEN="K3110"
5120 KOUTP01=KOUTP1 + 1
5130 KOUTP01=KOUTP1
5140 PLANE=PIANE1
5150 ENO=TAIL1
5160 GO TO 2054
5170 2053 KCPEN="K3110"
5180 KOUTP01=KOUTP1 + 1
5190 KOUTP01=KOUTP1

```

```

4020 PLANE=PLANE2
4030 END=TAIL
4040 GO TO 2054
4050 2054 KOFFEN="K160"
4060 KONTR4="KONTR4 * I
4070 KONTR01="DNTR4
4080 END=TAIL
4090 GO TO 2054
1070 2055 KOFFEN="K110"
1080 KONTR4="KONTR4 * I
1090 KONTR01 = KONTR4
1100 PLANE=PLANE4
1110 END=TAIL
1120 GO TO 2054
5030 2056 KOFFEN="K4230"
5040 KONTR5="KONTR5 * I
5050 KONTR01="KONTR5
5060 PLANE=PLANE5
5070 END=TAIL
5080 X=RD0(-1.0)
5090 IF(X,1,1) NORMAL = "100"
5100 IF(X,0,1,1,ADD,X,1,F,2) NORMAL = "200"
5110 IF(X,0,1,2,ADD,X,1,F,3) NORMAL = "300"
5120 IF(X,0,1,3,ADD,X,1,F,4) NORMAL = "400"
5130 IF(X,0,1,4,ADD,X,1,F,5) NORMAL = "500"
5140 IF(X,0,1,5,ADD,X,1,F,6) NORMAL = "600"
5150 IF(X,0,1,6,ADD,X,1,F,7) NORMAL = "700"
5160 IF(X,0,1,7,ADD,X,1,F,8) NORMAL = "800"
5170 IF(X,0,1,8,ADD,X,1,F,9) NORMAL = "900"
5180 IF(X,0,1,9) NORMAL = "950"
5190 2077 ST=RD0(-1.0)
5200 IF(S1,1,F,02) KSTART=04
5210 IF(S1,ST,02,ADD,ST,1,F,05) KSTART=05
5220 IF(S1,ST,05,ADD,ST,1,F,10) KSTART=06
5230 IF(S1,ST,10,ADD,ST,1,F,20) KSTART=07
5240 IF(S1,ST,20,ADD,ST,1,F,60) KSTART=09
5250 IF(S1,ST,60,ADD,ST,1,F,70) KSTART=09
5260 IF(S1,ST,70,ADD,ST,1,F,75) KSTART=10
5270 IF(S1,ST,75,ADD,ST,1,F,80) KSTART=11
5280 IF(S1,ST,80,ADD,ST,1,F,85) KSTART=12
5290 IF(S1,ST,85,ADD,ST,1,F,89) KSTART=13
5300 IF(S1,ST,89,ADD,ST,1,F,92) KSTART=14
5310 IF(S1,ST,92,ADD,ST,1,F,95) KSTART=15
5320 IF(S1,ST,95,ADD,ST,1,F,98) KSTART=17
5330 2094 FT=RD0(-1.0)
5340 IF(F,1,F,01) KFIN = 01

```

```

5450 IF(CTI.GT..01.AND.FI.IF..83) KFIN = 02
5450 IF(CTI.GT..03.AND.FI.IF..86) KFIN = 03
5460 IF(CTI.GT..06.AND.FI.IF..88) KFIN = 04
5460 IF(CTI.GT..08.AND.FI.IF..11) KFIN = 11
5470 IF(CTI.GT..11.AND.FI.IF..15) KFIN = 12
5470 IF(CTI.GT..15.AND.FI.IF..20) KFIN = 13
5490 IF(CTI.GT..20.AND.FI.IF..25) KFIN = 14
5490 IF(CTI.GT..25.AND.FI.IF..30) KFIN = 15
5490 IF(CTI.GT..30.AND.FI.IF..50) KFIN = 16
5490 IF(CTI.GT..50.AND.FI.IF..70) KFIN = 17
5490 IF(CTI.GT..70.AND.FI.IF..80) KFIN = 18
5490 IF(CTI.GT..80.AND.FI.IF..85) KFIN = 19
5490 IF(CTI.GT..85.AND.FI.IF..90) KFIN = 20
5490 IF(CTI.GT..90.AND.FI.IF..94) KFIN = 21
5490 IF(CTI.GT..94.AND.FI.IF..96) KFIN = 22
5490 IF(CTI.GT..96.AND.FI.IF..98) KFIN = 21
5490 IF(CTI.GT..98) KFIN = 00
6400 3014 ICUM=KSTART-KFIN
6400 IF(CICUP.I0.0) GO TO 2094
6400 IF(CICUP.I1.12) GO TO 2077
6400 IF(CICUP.I1.12) GO TO 2077
6400 IF(CICUP.I1.0) GO TO 3016
6400 IF(CICUP.I1.0) GO TO 3015
6400 3015 ISHIFT=000
6410 GO TO 3017
6420 3016 RUM=(KI10+24) - KSTART
6430 IF(CNUM.GT.12) GO TO 2094
6440 ISHIFT=001
6450 KFIN=KI10 + 24
6460 3017 X=DMU(-1.0)
6470 IF(X.IF..40) KREVSZ = 1
6480 IF(X.GT..40.AND.X.IF..70) KREVSZ = 2
6490 IF(X.GT..70.AND.X.IF..85) KREVSZ = 3
6500 IF(X.GT..85.AND.X.IF..95) KREVSZ = 4
6510 IF(X.GT..95.AND.X.IF..98) KREVSZ = 5
6520 IF(X.GT..98.AND.X.IF..99) KREVSZ = 6
6530 IF(X.GT..99) KREVSZ = 7
6670 3025 KUMK=KFIN - KSTART
6680 KTHURK=KUMK + KREVSZ
6690 IF(KKCN.NE."K3110") GO TO 3027
6700 IUPSI=IUPSI-KTHURK
6710 IF(IUPSI.LE.0) GO TO 3026
6720 GO TO 3039
6730 3026 KUMI=KUMI-1
6740 IUPSI=IUPSI+KTHURK
6750 GO TO 100
6760 3027 IF(KKCN.NE."K3130") GO TO 3029

```

6770 IURS2=IURS2-KTURK
6780 IF(IURS2,LE,3) GO TO 3020
6790 GO TO 3032
6800 3020 KONTR2=KONTR2-1
6810 IURS2=IURS2-KTURK
6820 GO TO 100
6830 3029 IF(CKCFL,NE,"K3160") GO TO 3031
6840 IURS3=IURS3-KTURK
6850 IF(IURS3,LE,0) GO TO 3030
6860 GO TO 3039
6870 3030 KONTR3=KONTR3-1
6880 IURS3=IURS3-KTURK
6890 GO TO 100
6900 3031 IF(CKCFL,NE,"K4110") GO TO 3033
6910 IURS4=IURS4-KTURK
6920 IF(IURS4,LE,0) GO TO 3032
6930 GO TO 3039
6940 3032 KONTR4=KONTR4-1
6950 IURS4=IURS4-KTURK
6960 GO TO 100
6970 3033 IF(CKCFL,NE,"K4230") GO TO 3037
6980 IURS5=IURS5-KTURK
6990 IF(IURS5,LE,0) GO TO 3034
7000 GO TO 3039
7010 3034 KONTR5=KONTR5-1
7020 IURS5=IURS5-KTURK
7030 GO TO 100
7040 3037 IURS6=IURS6-KTURK
7050 IF(IURS6,LE,0) GO TO 3038
7060 GO TO 3039
7070 3038 KONTR6=KONTR6-1
7080 IURS6=IURS6-KTURK
7090 GO TO 100
7100 3039 IF(CI00,EQ,"L") GO TO 3040
7110 PLAIN = PLAIN
7120 GO TO 3041
7130 3040 PLAIN = "
7140 3041 IF(CK10,LT,20) GO TO 5000
7150 KFI0 = KFI0 - 24
7160 GO TO 5000
7170 5051 K=K000-1.01
7180
7190 IF(X,LE,13) KFCUM = "K3110"
7200 IF(X,GT,13,AND,X,LE,26) KFCEN = "K3130"
7210 IF(X,GT,26,AND,X,LE,33) KFCEN = "K3160"
7220 IF(X,GT,33,AND,X,LE,52) KFCEN = "K4110"
7230 IF(X,GT,52,AND,X,LE,59) KFCEN = "K4230"
7240 IF(X,GT,59) KFCIY = "HEPOT"

```

7400 3058 X=RND(-1.0)
7410 IF(X.LF..2) WKUCGD = "AL100"
7420 IF(X.G1..2.AND.X.LF..4) WKUCGD = "C4P00"
7430 IF(X.G1..4.AND.X.LF..6) WKUCGD = "D1L00"
7440 IF(X.G1..6.AND.X.LF..8) WKUCGD = "I.V10V"
7450 IF(X.G1..8) WKUCGD = "I.P000"
7460 3064 NCHIRI = " "
7470 4500 DECODE(QUINPOL,4500)KONTRCI
7480 4500 FORMAT(14)
7490 PLANE = " IND"
7500 IND = "I1"
7510 IJGDD = " "
7520 IJGJSC = " "
7530 IJGJAI = " "
7540 KSTART=0
7550 I51=0
7560 I52=0
7570 KFI=0
7580 KFI=0
7590 KFI=0
7600 5000 X=RND(-1.0)
7610 IF(X.LF..17) I51=0
7620 IF(X.G1..17.AND.X.LF..34) I51=1
7630 IF(X.G1..34.AND.X.LF..50) I51=2
7640 IF(X.G1..50.AND.X.LF..67) I51=3
7650 IF(X.G1..67.AND.X.LF..84) I51=4
7660 IF(X.G1..84) I51=5
7670 X=RND(-1.0)
7680 IF(X.LF..1) I52=0
7690 IF(X.G1..1.AND.X.LF..2) I52=1
7700 IF(X.G1..2.AND.X.LF..3) I52=2
7710 IF(X.G1..3.AND.X.LF..4) I52=3
7720 IF(X.G1..4.AND.X.LF..5) I52=4
7730 IF(X.G1..5.AND.X.LF..6) I52=5
7740 IF(X.G1..6.AND.X.LF..7) I52=6
7750 IF(X.G1..7.AND.X.LF..8) I52=7
7760 IF(X.G1..8.AND.X.LF..9) I52=8
7770 X=RND(-1.0)
7780 IF(X.LF..17) KFI=0
7790 IF(X.G1..17.AND.X.LF..34) KFI=1
7800 IF(X.G1..34.AND.X.LF..50) KFI=2
7810 IF(X.G1..50.AND.X.LF..67) KFI=3
7820 IF(X.G1..67.AND.X.LF..84) KFI=4
7830 IF(X.G1..84) KFI=5
7840 X=RND(-1.0)

```

```

7920 IF(X,LI,..1) KF2=0
7930 IF(X,G1,..1,AND,X,LF,..2) KF2=1
7940 IF(X,G1,..2,AND,X,LF,..3) KF2=2
7950 IF(X,G1,..3,AND,X,LF,..4) KF2=3
7960 IF(X,G1,..4,AND,X,LF,..5) KF2=4
7970 IF(X,G1,..5,AND,X,LF,..6) KF2=5
7980 IF(X,G1,..6,AND,X,LF,..7) KF2=6
7990 IF(X,G1,..7,AND,X,LF,..8) KF2=7
8000 IF(X,G1,..8,AND,X,LF,..9) KF2=8
8010 IF(X,G1,..9) KF2=9
8020 JUL = JUL + 1000
8030 KONTROL = KONTROL + 10000
8040 KSTART = KSTART + 100
8050 ISI = ISI + 10
8060 ISHIFT = ISHIFT + 1000
8070 KEIN = KEIN + 100
8080 KEI = KEI + 10
8090 WRITE(10,5000)JUL,KONTROL,WKGEN,PLANE,IMO,PLAIN,ENCGO,
8100 WKUCO,MMDISC,HOMMAL,KSTART,ISI,IS2,ISHIFT,KEIN,
8110 KF1,KF2,APERS7
8120 PLANE = " "
8130 IMO = " "
8140 PLAIN = " "
8150 ENCGO = " "
8160 WKUCO = " "
8170 MMDISC = " "
8180 HOMMAL = " "
8190 5000 FORMAT(13,14,A5,A6,A2,FX,A6,FX,A6,4X,A5,1X,A1,A3,2X,
8200 12,11,11,13,12,11,11,11)
8210 JUL = JUL + 1000
8220 KONTROL = KONTROL + 10000
8230 KSTART = KSTART + 100
8240 ISI = ISI + 10
8250 ISHIFT = ISHIFT + 1000
8260 KEIN = KEIN + 100
8270 KEI = KEI + 10
8280 GO TO 100
8290 5100 JUL = JUL + 1
8300 IF(JUL,FO,097) GO TO 5150
8310 GO TO 75
8320 5150 PC=4100 10
8330 STOP
8340 END

```

APPENDIX E
EXAMPLE OF DATA GENERATION ALGORITHM OUTPUT

0350004DEPOTRF004C12 RF004C
 0350001K3110 F004D06 F004D
 0350002K4230 F004D13 F004D
 RF004C12 DELETE RF004C
 0360001DEPOT F004D06 F004D
 0360001K4230 F004D04 F004D
 0360000DEPOT INDLR
 0360001K3110RF004C17 RF004C
 0360001K3130RF004C11 RF004C
 QUI I 03677 F004D 12345 7
 0360000DEPOT INDLR
 0360002K3110RF004C17 RF004C
 0360002K3130RF004C11 RF004C
 QUI I 03677 F004C 33333 7
 0360002DEPOT F004D06 F004D
 RF004C11 DELETE RF004C
 QUI I 06277 F004E 99999 6
 SAGE I 06277 F004E 88888 1
 F004D12 DELETE F004D
 0630001K3160 INDLR
 0630001DEPOT F004D14 F004D
 0630002DEPOT F004D14 F004D
 0630001K3130 F004D12 F004D
 0630003DEPOT F004D14 F004D
 0630004DEPOT F004D14 F004D
 0630000DEPOT INDLR
 0630001K4230RF004C13 RF004C
 SAGE I 06377 F004D 33333 10
 0630001K4110RF004C07 RF004C
 BPO I 06377 F004E 77777 2
 F004D14 DELETE F004D
 0640001DEPOT F004C03 F004C
 0640002DEPOT F004C03 F004C
 0640003DEPOT F004C03 F004C
 0640001K3160 F004C05 F004C
 0640000K4110 INDLR
 0640000K4230 INDLR
 0640001K4110RF004C20 RF004C
 0640000K4110 INDLR
 SAGE I 06477 RF004C 22222 2
 0640001K3110 F004C05 F004C
 BPO I 06477 F004C 55555 2
 F004C03 DELETE F004C
 0650001K3160 F004C09 F004C
 0650000DEPOT INDLR
 0650001DEPOT F004D02 F004D
 BPE I 06577 RF004C 66666 3
 0650002K3160 F004D09 F004D
 0650000K3130 INDLR
 SAGE I 06577 F004D 11111 9
 0650000DEPOT INDLR
 0650001K4230 F004D06 F004D
 0650001K3130RF004C04 RF004C
 0650002K4230 F004D06 F004D

66666 S700 134100017491
 99999 F100 091900018254
 33333 F100 141500016583
 99999 S950 082200016122
 55555 B100 120400015053
 DTLOO 084800017221
 66666 F200 072400012403
 44444 F700 170900020092
 ALTOO 083000017203
 77777 F900 175100020071
 22222 F950 070500017401
 11111 S100 085000017451
 66666 F200 080200019564
 88888 S900 104000016513
 11111 S950 081200019344
 55555 A800 150700016354
 44444 S400 101100016326
 66666 S800 082700017227
 LVEOV 085800017482
 12345 C200 061800017302
 99999 F300 061400017577
 77777 S600 131600020304
 11111 S200 085900017161
 77777 S600 073600017486
 99999 F100 092100013451
 TRNOO 084100017503
 DTLOO 083300017521
 66666 C600 062700016003
 DTLOO 083300017121
 33333 F200 144700017527
 11111 F300 085500015413
 CHPOO 084600017233
 44444 S600 084300014152
 22222 F800 141000020492
 DTLOO 080400017205
 CHPOO 080000017442
 66666 F600 085900015121
 22222 A100 084000016242
 33333 F800 091800014301

ABC123

ABC123

ABC123

0650002K4230	F004D06	F004D
	F004C07 DELETE	F004C
	SAGE 1 09377 F004C 55555	4
	F004D15 DELETE	F004D
0940001K3160	F004E19	F004E
0940001K4110	F004D15	F004D
0940000K3130	INDLR	
0940001K4230	F004C05	F004C
0940002K4110	F004D15	F004D
	QDI 1 09477 F004C 99999	1
0940001DEPOT	F004C08	F004C
0940002DEPOT	F004C08	F004C
0940003DEPOT	F004C08	F004C
	SAGE 1 09477 F004E 33333	5
0940004DEPOT	F004C08	F004C
	F004C08 DELETE	F004C
0950001DEPOT	F004D10	F004D
	QDI 1 09577 F004C 55555	1
0950000K3130	INDLR	
	QDI 2 09577 F004E 55555	6
	BPO 1 09577 RF004C 77777	3
	BPE 1 09577 F004D 12345	2
0950000K3110	INDLR	
0950001K3130	F004D17	F004D
0950001K3160	F004D02	F004D
0950002DEPOT	F004D10	F004D
0950001K4110	F004D16	F004D
	QDI 1 09677 F004E 99999	2
	BPE 1 09677 F004C 88888	4
0960001K4110	F004D16	F004D
	QDI 1 09677 F004E 55555	5
0960002K4110	F004D16	F004D
0960001K3130	F004D17	F004D
0960000K4230	INDLR	
	SAGE 1 09677 F004C 77777	1
0960000DEPOT	INDLR	
0960000K3110	INDLR	
0960001DEPOT	F004D10	F004D
	F004C05 DELETE	F004C
	BPE 1 12377 RF004C 55555	7
	QDI 1 12377 F004D 44444	5
	QDI 1 12477 F004C 33333	10
1240001DEPOT	F004E04	F004E
	SAGE 1 12477 F004D 77777	4
	BPO 1 12477 RF004C 66666	6
1240001K3110RF004C13		RF004C
1240000DEPOT	INDLR	
1240002DEPOT	F004E04	F004E
1240001K3160	F004E10	F004E
	BPO 2 12477 F004D 77777	1
1240002K3160	F004E10	F004E
1240003K3160	F004E10	F004E
	F004E04 DELETE	F004E
1250001K3110	F004C11	F004C

33333	F800	0918000014301
66666	A200	0803000016452
88888	F200	125800017081
DTL00	084000017551	
66666	F200	074500016222
11111	F700	085000018481
88888	S100	084300017055
77777	S200	080500017371
22222	S950	071200017021
77777	S400	083000017222
11111	S600	134100017472
AL700		081300017203
DTL00		083800017313
12345	C400	084600019082
12345	F400	130300018052
77777	S400	080800017444
22222	F900	150200019522
44444	F600	141800019215
12345	F900	140700021011
22222	F100	082700016137
TRN00		085500017102
CHP00		085800017263
DTL00		080000017112
77777	S950	100000018511
77777	S900	160400020063
99999	A600	124200018244
TRN00		083700017126
66666	S600	095300012223
12345	B600	083200016581
22222	F800	080803017492
66666	F600	095600017382
12345	C600	111700018181

ABC123

APPENDIX F

QUALITY CONTROL OUTPUT PER TYPE OF INSPECTION: OUTPUT

QUALITY CONTROL OUTPUT
FOR EACH TYPE OF INSPECTION

TYPE OF INSPECTION: ORI
 NUMBER OF INSPECTIONS THIS MONTH: MAR 1
 TOTAL NUMBER OF DISCREPANCIES: 6
 RATE (DISCREPANCIES / INSPECTIONS): 6.00

UPPER CONTROL LIMIT	J	F	M	A	M	J	J	A	S	O	N	D
10	-	-	-	-	-	-	-	-	-	-	-	-
COMPUTED	-	-	-	-	-	-	-	-	-	-	-	-
LOWER CONTROL LIMIT	-2	-	-	-	-	-	-	-	-	-	-	-

APPENDIX G

QUALITY CONTROL OUTPUT PER WORK UNIT CODE: OUTPUT

QUALITY CONTROL OUTPUT
FOR ALL TYPES OF INSPECTIONS FOR MAR

UNIT CODE	NOMENCLATURE	NUMBER OF DISCREPANCIES	PERCENTAGE OF ALL DISCREPANCIES
3333	RADIO	10	0.206
1111	RADAR	9	0.257
9999	FLEX-TUBE	6	0.171
6666	IND-GEAR	3	0.086
2222	MLC-SWITCH	2	0.057
5555	NLO-ASS	2	0.057
7777	GRYO-COMP	2	0.057
0000	FJCT-SEAT	1	0.029

APPENDIX H

NUMBER OF FAILURES PER WORK UNIT CODE: OUTPUT

NUMBER OF FAILURES FOR MAW

RAID	WORK UNIT CODE	DESCRIPTION	NUMBER OF FAILURES
1	11111	RADAR	3
2	66666	IND-O-FAR	3
3	33333	RADIO	2
4	44444	ENC-MNFOLD	2
5	77777	GYRO-COMP	2
6	99999	FLEX-TURE	2
7	22222	DEC-SWITCH	1
8	88888	EJCT-SEAT	1

APPENDIX I

NUMBER OF ABORTS PER WORK UNIT CODE: OUTPUT

NUMBER OF ABORTS FOR MAR

BANK	WORK UNIT CODE	NOMENCLATURE	NUMBER OF ABORTS
1	12345	LD-EOF-FLP	1
2	22222	HLG-SWITCH	1
3	55555	HLG-ASS	1
4	66666	LND-GEAR	1

APPENDIX J

MANHOURS EXPENDED PER WORK UNIT CODE: OUTPUT

MAN-HOURS EXPENDED FOR MAR

MANH	WORK UNIT CODE	NOMENCLATURE	TOTAL MAN-HOURS
1	66666	LND-GEAR	144.88
2	77777	GRYO-COMP	90.13
3	99999	FLEX-TURE	86.42
4	11111	RADAR	74.05
5	44444	ENO-MNFOLD	49.17
6	22222	RIC-SWITCH	28.77
7	33333	RADIO	26.78
8	12345	LD-EGF-FLP	22.40
9	88888	EJCT-SFAT	18.55
10	55555	NLD-ASS	5.87

APPENDIX K

FAILURE RATE SUMMARY PER WORK UNIT CODE: OUTPUT

FAILURE RATE SUMMARY FOR BAR

GROUP	UNIT CODE	DESCRIPTION	FAILURES		RANK		ABORTS		RANK		MAN-HOURS		RANK		
			THIS MONTH	LAST MONTH	THIS MONTH	LAST MONTH	THIS MONTH	LAST MONTH	THIS MONTH	LAST MONTH	THIS MONTH	LAST MONTH	THIS MONTH	LAST MONTH	
	11111	PAUSE	3	7	1	0	0	0	0	0	0	8.92	74.05	7	4
	12345	LD-FSE-FLP	2	5	0	0	1	0	0	0	1	54.73	22.48	5	6
	22222	MIC-SWITCH	3	2	7	0	1	0	0	0	2	60.28	28.77	3	6
	33333	RADIO	1	0	3	0	0	0	0	0	0	8.15	26.78	8	7
	44444	ENG-HELD	1	0	2	0	0	0	0	0	0	6.00	49.17	9	5
	55555	HE-ASS	6	1	0	0	1	0	0	3	94.78	5.87	2	10	
	66666	END-STAR	3	3	3	0	1	0	0	4	25.60	144.00	6	1	
	77777	GRYD-COMP	2	6	2	0	0	0	0	0	59.35	98.13	4	2	
	88888	JECT-SEAT	1	10	0	0	0	0	0	0	5.40	18.55	10	9	
	99999	LINK-TUFT	2	4	0	0	0	0	0	0	99.40	86.42	1	3	

APPENDIX L
PRODUCTION SUMMARY: OUTPUT

PRODUCTION SUMMARY FOR BASE FOR MAR

MDS	SERIAL NO.	M/H USED	M/H AUTH	M/H LEFT	M/H OVER
F004C	F004C03	98.42	300	281.58	0.00
F004D	F004D06	24.58	400	375.42	0.00
F004E	F004E13	39.03	500	468.97	0.00
R004C	R004C13	53.27	600	546.73	0.00

APPENDIX M

MANPOWER ACCOUNTING SUMMARY PER WORK CENTER: OUTPUT

MANPOWER ACCOUNTING SUMMARY PER WORKCENTER FOR MAR

WORKCENTER	DIRTCT LABOR HOURS	DIRTCT LABOR COST	INDIRTCT LABOR HOURS	INDIRTCT LABOR COST	OTHER LABOR HOURS	OTHER LABOR COST	AUTHORIZED MANNING	ASSIGNED MANNING	PERCENT MANNED
DEPOT	274.02	229850	62.90	86760	12159.00	49984	77	71	0.922
K111	21.50	744171	0.00	738360	4202.42	794751	22	24	1.091
K313	15.47	314163	46.33	204574	3634.20	14700	25	21	0.840
K316	05.60	447124	0.00	730360	1674.40	525019	10	10	1.000
K411	110.67	321674	36.10	120113	7421.23	53164	53	43	0.811
K421	03.02	017103	9.32	209084	1716.87	144013	9	10	1.111

APPENDIX N
LISTING OF MDCS SUBROUTINES

GETJUL	For retrieval of julian date limits
DELETE	For storage of delete data
QCRPT	For storage of QC data
FAIL	For storage of failure data
MHRA	For storage of AF form 349 data
PROD	For storage of production summary data
ABRT	For storage of abort data
LIMIT	For checks on report dates
GRAPH	For output of QC graphs
LIMITX	For checks on report dates
TYPECHK	Holds data on aircraft types
ROADNC	For quarterly reports
LIMITZ	For output of monthly reports
MNTHLY	For printing monthly reports
EOF	Positions files
PUTJUL	Updates julian dates
PREP	Establishes new julian date limits
QTCHK	Checks for quarterly report applicability
MAINT	Maintains QC file data
PARE	Monitors the reports
FAILR	Prints Monthly Failure Report
ABORTR	Prints Monthly Abort Report
MANHR	Prints the Monthly Manhour Report
FAM	Controls the previous three subroutines

LASTHIS	Updates the Summary File
FRS	Liaison for the Summary File
FSUM	Prints the Summary Report
UNIQUE	Compares summary data
PRODELT	Maintains the Production File
PSFB	Prints the Production Summary
LIMITP	Controls Six Month Maintenance Routine
FMAINT	File Maintenance
MDSPWC	Prints Cost Report
SORT1	Sorts Work Unit Code
SORT1A	Monitors the sort routine
SORT1B	Rebuilds output file

APPENDIX O
TIME DISTRIBUTIONS

<u>Start</u>	<u>Probability</u>	<u>Finish</u>	<u>Probability</u>
0400	.02	0000	.02
0500	.03	0100	.01
0600	.05	0200	.02
0700	.10	0300	.03
0800	.40	0400	.02
0900	.10	1100	.03
1000	.05	1200	.04
1100	.05	1300	.05
1200	.05	1400	.05
1300	.04	1500	.05
1400	.03	1600	.20
1500	.03	1700	.20
1600	.03	1800	.10
1700	.02	1900	.05
		2000	.05
		2100	.04
		2200	.02
		2300	.02

APPENDIX P
MANPOWER ASSIGNMENTS PER WORK CENTER

<u>K3110 Repair Reclament Shop</u>	<u>Authorized</u>	<u>Assigned</u>
Major	01	00
Lieutenant	01	01
Master Sergeant	01	01
Technical Sergeant	03	05
Sergeant	05	04
Airman	11	13

<u>K3130 Electrical Shop</u>	<u>Authorized</u>	<u>Assigned</u>
Lieutenant	01	00
Warrant Officer	01	01
Master Sergeant	02	02
Technical Sergeant	03	03
Sergeant	04	03
Airman	13	11
Civilian	01	01

<u>K3160 Fuel System Shop</u>	<u>Authorized</u>	<u>Assigned</u>
Master Sergeant	01	01
Technical Sergeant	01	01
Sergeant	02	03
Airman	06	05

<u>K4110 Flight Line Support Shop</u>	<u>Authorized</u>	<u>Assigned</u>
Captain	01	00
Lieutenant	01	01
Warrant Officer	01	04
Master Sergeant	05	07
Technical Sergeant	08	07
Sergeant	10	04
Airman	27	20

<u>K4230 Electronic Navigation Shop</u>	<u>Authorized</u>	<u>Assigned</u>
Warrant Officer	01	00
Master Sergeant	01	02
Technical Sergeant	01	01
Sergeant	02	00
Airman	03	06
Civilian	01	01

<u>Depot Depot Maintenance Facility</u>	<u>Authorized</u>	<u>Assigned</u>
Major	01	01
Captain	02	01
Lieutenant	04	03
Warrant Officer	04	05
Master Sergeant	06	06
Technical Sergeant	10	10
Sergeant	15	15
Airman	35	30

APPENDIX Q
LISTING OF MDCS PROGRAM


```

00300C
00305C
00310C
00315C
00320C
00325C
00330C
00335C
00340C
00345C
00350C
00355C
00360C
00365C
00370C
00375C
00380C
00385C
00390C
00395C
00400C
00405C
00410C
00415C
00420C
00425C
00430C
00435C
00440C
00445C
00450C
00455C
00460C
00465C
00470C
00475C
00480C
00485C
00490C
00495C
00500C
00505C
00510C
00515C
00520C
00525C
00530C
00535C
00540C
00545C
00550C
00555C
00560C
00565C
00570C
00575C
00580C
00585C
00590C
00595C

```

END --- POSITIONS FILES AT THE END OF FILE MARK - 1
OUTJUL --- REPLACES AND UPDATES THE JULIAN DAY WITH THE
NEW DAY LIMIT
PREF --- ROUNDS AN INPUTTED JULIAN DAY UPWARD TO
ESTABLISH A NEW JULIAN DAY LIMIT
UTCHK --- DETERMINES IF A QUARTERLY REPORT IS TO BE
PRINTED
MAINT --- PERFORMS MAINTENANCE ON THE OC DATA FILE
PARM --- MONITORS AND SPANS HOSTS OF THE REPORTS
FAILP --- PRINTS THE MONTHLY FAILURE REPORT AND
UPDATES THE SUMMARY FILE
ABORTR --- PRINTS THE MONTHLY ABORT REPORT AND UPDATES
THE SUMMARY FILE
MANHR --- PRINT THE MONTHLY MAN-HOUR REPORT AND UPDATES
THE SUMMARY FILE
IAN --- CONTROLS SUBROUTINES (FAILR & ABORTR & MANHR)
LASTHS --- UPDATES SUMMARY FILE BY REPLACING ALL OF THE
PREVIOUS MONTH'S VALUES WITH THE CURRENT AND
ZEROS OUT THE CURRENT VALUES
FRS --- LATSUN FROM (FAILR & ABORTR & MANHR) TO THE
SUMMARY FILE
LSTFILE --- WILL LIST THE CONTENTS OF ANY FILE IN
THIS SYSTEM AT ANY POINT YOU DESIRE
FSUM --- PRINTS THE SUMMARY REPORT FOR FAILURES, ABORTS
AND MANHOURS WITH THE CURRENT AND PREVIOUS
RANK
UNTOH --- PARS AND SIMLES THE SUMMARY FILE TO INDIVIDUAL
WORK UNIT CODES AND TALLIES THE CURRENT AND
PREVIOUS RANKS AND VALUES FOR THE SUMMARY FILE
PROBET --- PERFORMS MAINTENANCE ON PRODUCTION FILE BY
PRINTING WITH THE DELETE FILE
PSPD --- PRINTS THE PRODUCTION SUMMARY FOR THE BASE
LIMIT --- CONTROLS THE SIX MONTH MAINTENANCE ROUTINE - FMAI
CHAIT --- PERFORMS THE SIX MONTH MAINTENANCE ON THE FAILURE
FILE AND THE ABORT FILE
MUSPWC --- CALCULATES AND PRINTS THE COST REPORT FOR THE WORK
CENTERS
SOMT --- ACCEPTS THE INPUT PARAMETERS FOR SORT PROCESSING

SORTIA --- MONITORS AND CONTROLS THE MAIN SORT ROUTINE

SORTIO --- MAIN SORT AND REQUILDS OUTPUT FILE

00600C
00601C
00602C
00603C
00604C
00605C
00606C
00607C
00608C
00609C
00610C
00611C
00612C
00613C
00614C
00615C
00616C
00617C
00618C
00619C
00620C
00621C
00622C
00623C
00624C
00625C
00626C
00627C
00628C
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00660C
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00675C
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00680C
00681C
00682C
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00685C
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00688C
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00698C
00699C
00700C
00701C
00702C
00703C
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00705C
00706C
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00800C
00801C
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00862C
00863C
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00874C
00875C
00876C
00877C
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00880C
00881C
00882C
00883C
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00888C
00889C
00890C
00891C
00892C
00893C
00894C
00895C
00896C
00897C
00898C
00899C
00900C

CALL ATTACH(25,"77A77/CREATE2",3,0,1,STAT,)
CALL HSTAT(1,STAT,115)
CALL ATTACH(20,"77A77/OC1",3,0,1,STAT,)
CALL HSTAT(1,STAT,116)
CALL ATTACH(22,"77A77/AHOR1",3,0,1,STAT,)
CALL HSTAT(1,STAT,117)
CALL ATTACH(23,"77A77/FALL",3,0,1,STAT,)
CALL HSTAT(1,STAT,118)
CALL ATTACH(24,"77A77/MURACT",3,0,1,STAT,)
CALL HSTAT(1,STAT,119)
CALL ATTACH(29,"77A77/PROH1",3,0,1,STAT,)
CALL HSTAT(1,STAT,120)
CALL ATTACH(27,"77A77/FILE7",3,0,1,STAT,)
CALL HSTAT(1,STAT,121)
CALL ATTACH(18,"77A77/TYPEFILE",3,0,1,STAT,)
CALL HSTAT(1,STAT,122)
CALL ATTACH(11,"77A77/MONEY",3,0,1,STAT,)
CALL HSTAT(1,STAT,123)
CALL ATTACH(12,"77A77/MANPOWER",3,0,1,STAT,)
CALL HSTAT(1,STAT,124)
CALL ATTACH(13,"77A77/MUSHMURS",3,0,1,STAT,)
CALL HSTAT(1,STAT,125)
CALL ATTACH(14,"77A77/SCRATCH",3,0,1,STAT,)
CALL HSTAT(1,STAT,126)
CALL ATTACH(15,"77A77/TEMP15",3,0,1,STAT,)
CALL HSTAT(1,STAT,127)
CALL ATTACH(16,"77A77/SUMMARY",3,0,1,STAT,)
CALL HSTAT(1,STAT,128)
CALL ATTACH(17,"77A77/TEMP17",3,0,1,STAT,)
CALL HSTAT(1,STAT,129)
CALL ATTACH(19,"77A77/TEMP19",3,0,1,STAT,)
CALL HSTAT(1,STAT,130)
CALL ATTACH(19,"77A77/WORKCODE",3,0,1,STAT,)
CALL HSTAT(1,STAT,131)
CALL ATTACH(21,"77A77/DELETE",3,0,1,STAT,)
CALL HSTAT(1,STAT,132)
CALL ATTACH(20,"77A77/JULIAN",3,0,1,STAT,)
CALL HSTAT(1,STAT,133)
CALL ATTACH(89,"77A77/TYPERAND",3,1,1,STAT,)
CALL HSTAT(1,STAT,134)
CALL PAST(109,00)

FILENAMES AND CODES

TYPEFILE 10
MONEY 11
MANPOWER 12
MUSHMURS 13
SCRATCH 14
TEMP15 15
SUMMARY 16
TEMP17 17

```

00480C TEMPER
00481C MURKURE
00482C OC
00483C
00484C BELTI
00485C AUDT
00486C FAIL
00487C MURACT
00488C CPFAIT
00489C FILI27
00490C JULIAN
00491C P000

```

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```

VARIABLES USED AND MEANINGS
-----
CARD INPUT RECORDS
I RECORD COUNTER
JUL JULIAN DAY
REC IMAGE OF CARD
JUL3 UPPER LIMIT FOR INPUT JULIAN DATES
JUL4 LOWER LIMIT FOR INPUT JULIAN DATES
MNT5 CARRIES THE NAME OF THE CURRENT MONTH
-----

```

```

SUBROUTINES CALLED FROM - MAINLINE
-----

```

```

01040C IDENT
01041C DELETE (USING REC)
01042C OCRT (USING REC)
01043C FAIL (USING REC)
01044C MURA (USING REC)
01045C P000 (USING REC)
01046C ADRT (USING REC)
01047C EOF
-----

```

```

01100C
01101C
01102C
01103C
01104C
01105C
01106C
01107C
01108C
01109C
01110C
01111C
01112C
01113C
01114C
01115C
01116C
01117C
01118C
01119C
01120C

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01121C *****
01122C *****
01123C *****
01124C *****
01125C *****
01126C *****
01127C *****
01128C *****
01129C *****
01130C *****
01131C *****
01132C *****
01133C *****
01134C *****
01135C *****
01136C *****
01137C *****
01138C *****
01139C *****
01140C *****
01141C *****
01142C *****
01143C *****
01144C *****
01145C *****
01146C *****
01147C *****
01148C *****
01149C *****
01150C *****
01151C *****
01152C *****
01153C *****
01154C *****
01155C *****
01156C *****
01157C *****
01158C *****
01159C *****
01160C *****
01161C *****
01162C *****
01163C *****
01164C *****
01165C *****
01166C *****
01167C *****
01168C *****
01169C *****
01170C *****
01171C *****
01172C *****
01173C *****
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01175C *****
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01178C *****
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01180C *****
01181C *****
01182C *****
01183C *****
01184C *****
01185C *****
01186C *****
01187C *****
01188C *****
01189C *****
01190C *****
01191C *****
01192C *****
01193C *****
01194C *****
01195C *****
01196C *****
01197C *****
01198C *****
01199C *****
01200C *****

```

```

01200C *
01205C * 6. STOP (COMMENT)-- PRINTS ERROR MESSAGES *
01210C *
01215C * 7. ENCODE -- VARIABLE WRITE
01220C * (INT0,7001)FOH
01225C * 7001 FORMAT(CUSING THE SIZE OF INTO)
01230C *
01235C *
01240C *
01245C *
-----
01250C *
01255C * COMMON INT,NJUL,KJUL,I7M,JUL,JUL3,JUL4,MN15
01260 * REMIND 25
01265 * CHARACTER CARD*09,MN15*3
01270 * BU 1 1 = 1,99999
01275 * READ(25,7001,FND=2)CARD
01280 * WRITE(27,7001)CARD
01285 * FILECODES 27 --- A608T
01290C *
01295C * 1 CONTINUE
01300 * STOP -NO THAN 99999 RECORDS-
01305 * 2 REMIND 27
01310 * 1 = 1 - 1
01315 * REMIND 25
01320 * CALL DETACH(25,,)
01325 *
01330C *
01335 * CALL GETJUL
01340 * CALL JOINT
01345 * CHARACTER REC*(00)
01350 * CALL FOI
01355 * I7M = 0
01360C *
01365C * 17M - REMEMBERS WHETHER TO PUT A DATA *
01370C * BACK INTO THE STORAGE(INPUT)FILE *
01375C *
01380 * 3 READ(27,7002,END=L)REC
01385C *
01390C *
01395 * IF(REC(22).FO."0".AND.REC(21).FO."F".AND.REC(24).
01400 * REC(1).AND.REC(25).FO."F".AND.REC(26).FO.
01405 * IF(REC(59).FO."")GO TO 4
01410 * GO TO 5
01415 * 4 IF(REC(4).EO." ".AND.REC(5).FO." ".AND.
01420 * REC(6).FO." ".AND.REC(7).FO." ".OR.
01425 * REC(4).FO."0".AND.REC(5).FO."0".AND.
01430 * REC(6).FO."0".AND.REC(7).FO."0".GO TO 11
01435 * 5 IF(REC(9).FO."5")GO TO 12
01440 * 6 IF(REC(9).FO."A")GO TO 13
01445 * 7 IF(REC(9).FO."C")GO TO 13
01450 * IF(REC(9).FO."A".AND.REC(59).NE."C".AND.
01455 * REC(59).NE."S".AND.REC(59).NE."R" GO TO 10
01460 * GO TO 9
01465C *
01470 * 8 CALL DELETE(REC)
01475 * GO TO 3
01480 * 9 CALL UNGET(REC)
01485 * GO TO 3
01490 * 10 CALL FAIL(REC)
01495 * GO TO 3

```

01500 11 CALL PURA(REC)
01505 GO TO X
01510 12 CALL PROD(REC)
01515 GO TO X
01520 13 CALL ABRT(REC)
01525 GO TO X

01530C
01535C
01540 14 REMIND 10
01545 REMIND 11
01550 REMIND 12
01555 REMIND 13
01560 REMIND 14
01565 REMIND 15
01570 REMIND 16
01575 REMIND 17
01580 REMIND 18
01585 REMIND 19
01590 REMIND 20
01595 REMIND 21
01600 REMIND 22
01605 REMIND 23
01610 REMIND 24
01615 REMIND 27
01620 REMIND 28
01625 REMIND 29

01630C
01635C
01640 CALL LISTFILE(20)
01645 CALL LISTFILE(21)
01650 CALL LISTFILE(22)
01655 CALL LISTFILE(23)
01660 CALL LISTFILE(24)
01665 CALL LISTFILE(28)
01670 CALL LISTFILE(29)
01675 CALL LISTFILE(16)
01680 CALL LISTFILE(10)
01685 CALL DETACH(10)
01690 CALL DETACH(11)
01695 CALL DETACH(12)
01700 CALL DETACH(13)
01705 CALL DETACH(14)
01710 CALL DETACH(15)
01715 CALL DETACH(16)
01720 CALL DETACH(17)
01725 CALL DETACH(18)
01730 CALL DETACH(19)
01735 CALL DETACH(20)
01740 CALL DETACH(21)
01745 CALL DETACH(22)
01750 CALL DETACH(23)
01755 CALL DETACH(24)
01760 CALL DETACH(27)
01765 CALL DETACH(28)
01770 CALL DETACH(29)
01775C
01780 CALL FEND
01785 STOP "NORMAL TERMINATION"
01790C
01795C


```

021000 -----
021050 CONSTANT USED = 2
021100 -----
021150 THE ABOVE CONSTANT TELLS
021200 IRS THAT AN ABORT IS BEING
021250 PROCESSED
021300 -----
021350 -----
021400 -----
021450 -----
021500 COMMON IXT, IJUL, KJUL, LJUL, MJUL, NJUL, OJUL, PJUL, QJUL, RJUL,
021550 CHARACTER MUCX5, NOMEN10, CS901, MNIS3
021600 -----
021650 -----
021700 PRINT THE HEADING INCLUDING CURRENT MONTH FOR
021750 NUMBER OF ABORTS REPORT
021800 -----
021850 -----
021900 -----
021950 PRINT 7005
022000 PRINT, " "
022050 PRINT 7001, MNIS
022100 PRINT, " "
022150 PRINT, " "
022200 PRINT 7002
022250 PRINT 7003
022300 PRINT 7002
022350 REMIND IN
022400 J = 0
022450 -----
022500 -----
022550 -----
022600 -----
022650 IPRINT IS SET TO (0)ZERO... IF A RECORD IS
022700 PRINTED THEN IT IS CHANGED TO ONE. THIS IS A
022750 PARAMETER USED TO DETERMINE WHETHER TO PRINT
022800 THE NO ABORTS MESSAGE.
022850 -----
022900 -----
022950 IPRINT = 0
023000 -----
023050 NO 2 K = 1, I
023100 HEAD10, 2007, END=31050, MUCX, NOMEN, IABORTX, IFALLY, TOTMANK
023150 IF (IABORTX.EQ.0)GO TO 2
023200 I IPRINT = 1
023250 -----
023300 J = THE MARK FOR ABORTS
023350 -----
023400 -----
023450 J = J + 1
023500 PRINT 7004, J, MUCX, NOMEN, IABORTX
023550 IFALLY = 0
023600 TOTMANK = 0.00
023650 CALL FPCJ, MUCX, NOMEN, IABORTX, IFALLY, TOTMANK, 2)
023700 PRINT 7000
023750 -----
023800 ? CONTINUE
023850 -----
023900 -----
023950 -----
024000 -----
024050 IF NO ABORTS PRINTED / PRINT NO ABORTS MESSAGE
024100 -----
024150 -----

```


AD-A044 212

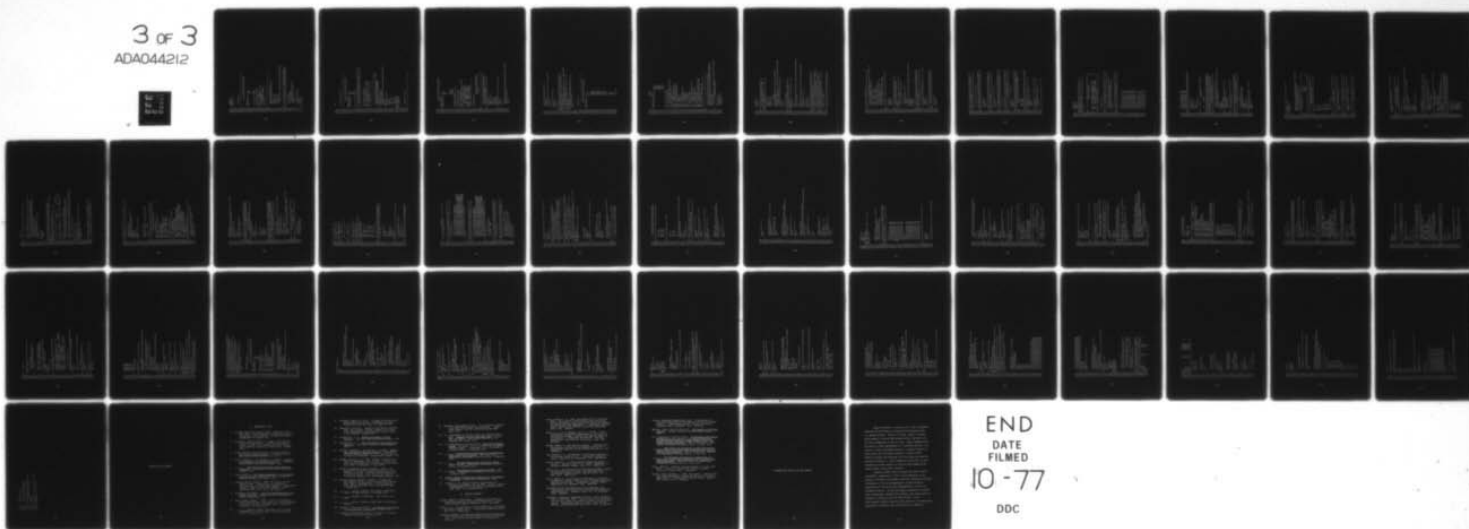
AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB OHIO SCH0--ETC F/G 5/1
A REQUIREMENTS STUDY FOR AN AUTOMATED MAINTENANCE DATA COLLECTI--ETC(U)
JUN 77 W J CALLAHAN, D C PAYNE

UNCLASSIFIED

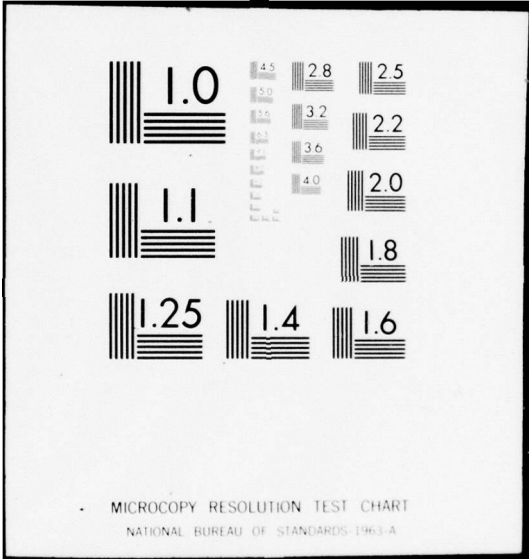
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3 of 3
ADA044212



END
DATE
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DDC



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


```

03400      END
03405      SURROUTINE FAIL(REC)
03410      -----
03415      NOTES AND COMMENTS ABOUT ROUTINE
03420      -----
03425      NAME - FAIL
03430      INPUT ARGUMENT - REC
03435      VARIABLES USED - JDAY
03440      JUL
03445      REC
03450      CALLED FROM - MAINLINE
03455      -----
03460      SUBROUTINE THAT SUPPORT THIS - PRIP
03465      -----
03470      DESCRIPTION OF VARIABLES
03475      -----
03480      JDAY - JULIAN DAY FROM INPUT RECORD
03485      JUL - JULIAN DAY LIMIT
03490      REC - SIMPLE IMAGE OF INPUT RECORD
03495      REC - INPUT RECORD
03500      -----
03505      COMMON INT,JUL,KJUL,I2M,JUL,JUL3,JUL4,MNTS
03510      FILECODES (23-FAIL,27-TEMPORARY)
03515      CHARACTER REC*(100),KIC(00,MNTS*3)
03520      JULIAN DAY
03525      ENCODE(KIC,7001)REC
03530      DECODE(KIC,7002)JDAY
03535      IF(JDAY.GE.JUL4.AND.JDAY.LE.JUL3.AND.JUL.O1.32)OR TO 1
03540      GO TO 2
03545      UPDATE FILE
03550      1 WRITE(21,7003)KIC
03555      I2M = 1
03560      RETURN
03565      2 JUL = JDAY
03570      CALL PRIP
03575      BACKSPACE 27
03580      RETURN
03585      7001 FORMAT(0A1)
03590      7002 FORMAT(I3)
03595      7003 FORMAT(ARD)
03600      END
03605      SURROUTINE FAIL(1)
03610      -----

```

```

01680C      NOTES AND COMMENTS ABOUT ROUTINE
01681C      -----
01682C      NAME - FAILR
01683C      INPUT ARGUMENT - I
01684C      VARIABLES USED - MUCK
01685C                      WOMEN
01686C                      CS9
01687C                      I
01688C                      J
01689C                      K
01690C      IABORIX
01691C      IFAILX
01692C      TOTMANY
01693C
01694C      CALLED FROM - FAN
01695C      SUPPORTING SUBROUTINES - FRS
01696C
01697C      DESCRIPTION OF VARIABLES
01698C      -----
01699C      MUCK - WORK UNIT CODE
01700C      WOMEN - NOMENCLATURE OF WORK UNIT CODE
01701C      CS9 - WHEN DISCOVERED CODE
01702C      I - NUMBER OF WORK UNIT CODES
01703C      J - RANK OF WORK UNIT CODE
01704C      K - LOOP INCREMENT AND POINTER
01705C      IABORIX - NUMBER OF AOBITS
01706C      IFAILX - NUMBER OF FAILURES
01707C      TOTMANY - NUMBER OF MAN-HOURS
01708C      -----
01709C      CONSTANT USED - I
01710C      -----
01711C      THE ABOVE CONSTANT TELLS
01712C      FRS THAT A FAILURE IS BEING
01713C      PROCESSED
01714C      -----
01715C
01716C      COMMON IXT, NJUL, KJUL, LJUL, JUL3, JUL4, NMTS
01717C      CHARACTER MUCKX45, WOMEN45R, CS945I, NMTS4J
01718C      FILECODE (10-TEMPORARY)
01719C      PRINT 7007
01720C      PRINT, " "
01721C      PRINT 7003, NMTS
01722C      PRINT, " "
01723C      PRINT, " "
01724C      PRINT 7004
01725C      PRINT 7005
01726C      PRINT 7004
01727C      REMIND IA
01728C      J = 0
01729C      IPRINT = 0
01730C
01731C      DO I = 1, I
01732C      WFAIC(17, 2001, FND=2)CS9, MUCK, WOMEN, IABORIX, IFAILX, TOTMANY
01733C      IF (IFAILX.CO.P)GO TO 1
01734C      IPRINT = I
01735C      J = J + 1

```


04200C TOTMAN
 04205C MUC
 04210C MUCK
 04215C CALLED FROM - PART
 04220C SUPPORTING SUBROUTINES - LIMIT
 04225C LIMIT
 04230C SORT
 04235C FALL
 04240C ARORIP
 04245C HANUR
 04250C UNIDUF
 04255C F500
 04260C LASTHS

DESCRIPTION OF VARIABLES

 C50 - WHEN DISCOVERED CUBI
 C50X - WHEN DISCOVERED CODE ACCUMULATOR
 F - POINTER AND INDEX FOR JORS
 I10 - FILL POSITION
 IARORIP - ARORIP ACCUMULATOR
 IARORIP - TEMPORARY HOURS COUNTER
 IARORIP - TEMPORARY MINUTES COUNTER
 IARORIP - CREW SIZE ACCUMULATOR
 IARORIP - CREW SIZE
 IARORIP - HOURS
 IARORIP - MINUTES
 IARORIP - MINUTES (REAL)
 IARORIP - FALLURES ACCUMULATOR
 IARORIP - START MINUTES
 IARORIP - STOP MINUTES
 IARORIP - START HOURS
 IARORIP - STOP HOURS
 J - POINTER AND INDEX
 JUL - JULIAN DAY LIMIT
 JUL2 - JULIAN DAY FROM INPUT OF FILE
 JUL3 - JULIAN DAY LIMIT - 1
 JUL4 - JULIAN DAY LIMIT - 2
 JORS - FILECODES TO BE READ
 K - POINTER AND INDEX
 MOMEA - NOMENCLATURE OF WORK UNIT CODE
 TOTMAN - HANOURS (FROM FACHS AND IARORIP)
 MUC - WORK UNIT CODE
 MUCK - WORK UNIT CODE ACCUMULATOR

04430C -----
 04435C
 04440C COMMAND TEXT: JUL. K JUL. 17M. JUL. JUL. 3. JUL. 4. MHS
 04445C CHARACTER MUCX55, MOMEA10, C50X1, MUC5(100), C50X01(100)
 04450C INTEGER IARORIP(100), IARORIP(100), IARORIP(100), JORS(13)/23.27.29/
 04455C REAL TOTMAN(100)
 04460C CHARACTER MUC5-3
 04465C FILECODES (17-TEMPORARY, 10-TEMPORARY, 22-ARORIP, 23-FALL, 29-PROD)
 04470C (14-SCHATCH, 16-SUMMARY)
 04475C I10 = 0
 04480C MUC 1 10 = 1.100
 04485C IARORIP = 0
 04490C IARORIP = 0
 04495C IARORIP = 0.0

```

04500  ICREM(J) = 0
04505  1 CONTINUE
04510  REMIND IN
04515C
04520C.....
04525C MERGE THE FAILURES,ADDRES, & PROD
04530C FILES TOGETHER TO PRODUCE THE FAILURE
04535C RATE SUMMARY REPORT.
04540C.....
04545  2 DO 4 J = 1,3
04550  JOURS(J) = 23
04555  JOURS(J) = 22
04560  JOURS(J) = 29
04565  NFININ JOURS(J)
04570C
04575  NO 3 I = 1,99999
04580  READ(JOURS(J),7889,FND=4)JUL2,MUCX,C59,ISTART,100,
04585  ISTOP,ICRME,ICREMS
04590  IF(JUL2-LE,JUL3-AND,JUL2-OF,JUL4)WRITE(10,7881)MUCX,C59,ISTART
04595  A,100,ISTOP,ICRME,ICREMS
04600  IF(JUL2-LE,JUL3-AND,JUL2-OF,JUL4)110 = 1
04605  3 CONTINUE
04610C
04615  4 CONTINUE
04620C
04625  IF(110.EQ.0)RETURN
04630C.....
04635C SCAN MERGE FILE PULLING UNIQUE
04640C MORE-CENTERS.
04645C.....
04650  PENDING IN
04655  I = 0
04660  I = I + 1
04665  READ(10,7891,FND=10)MUC(I),C59X(I),ISTART,100,ISTOP,100NF,ICRME(I)
04670  ICREMS = ICREM(I)
04675  J = 1
04680  DO 10 7
04685  5 READ(10,7881,FND=10)MUCX,C59,ISTART,100,ISTOP,100NF,ICREMS
04690  DO 6 J = 1,1
04695  IF(MUCX.FO.MUC(J))GO TO 7
04700  6 CONTINUE
04705  I = I + 1
04710  MUC(I) = MUCX
04715  C59X(I) = C59
04720  J = 1
04725C.....
04730C IF COLUMN (59)OF AF149 IS "A" OR "C" ADD 1 TO
04735C THE NUMBER OF ACCUMULATED ADDRES.
04740C.....
04745  7 IF(C59.EQ."A".OR.C59.EQ."C")IARNT(J) = IARNT(J) + 1
04750  IF(C59.EQ."A".OR.C59.EQ."C")GO TO 8
04755C.....
04760C IF COLUMN (59)OF AF149 IS NOT "A" OR "C" ADD 1
04765C TO THE NUMBER OF ACCUMULATED FAILURES.
04770C.....
04775  IF(115(I) = IFAILS(J)) 1
04780  8 ICREM(I) = ICREMS
04785C
04790C.....
04795C COMPUTE USING THIS TIME PHASE THE MAN-HOURS FOR

```



```

05480 REMIND 27
05485 REMIND 28
05490 REMIND 29
05495 P1TURN
05500 7001 FORMAT(4X,A1,5X,12,12,1X,12,12,12,11)
05505 7002 FORMAT(13,4X,A5,1X,A1,5X,12,12,1X,12,12,11)
05510 7003 FORMAT(45,1X,A10)
05515 7004 FORMAT(1X,A5,1X,A10,1X,14,1X,14,1X,14,1X,14,2)
05520 END
05445C
05450C
05455C
05460C
05465C
05470C
05475C
05480C
05485C
05490C
05495C
05500C
05505C
05510C
05515C
05520C
05525C
05530C
05535C
05540C
05545C
05550C
05555C
05560C
05565C
05570C
05575C
05580C
05585C
05590C
05595C
05600C
05605C
05610C
05615C
05620C
05625C
05630C
05635C
05640C
05645C
05650C
05655C
05660C
05665C
05670C
05675C
05680C
05685C
05690C
05695C
05700C

```

VARIABLE EXPLANATION

```

JUL3 -- HIGH RANGE OF CURRENT JULIAN DAY
JUL2 -- JULIAN DAY FROM IMPHIFILE
JULB -- HIGH RANGE OF MAINTENANCE PERIOD
JUL9 -- LOW RANGE OF MAINTENANCE PERIOD
114 -- FILE CONTROL NUMBER

```

SUBROUTINE ENHANT

```

COMMON INT, N, JUL, K, JUL, 17M, JUL, JUL, JUL, 4, MMIS
CHARACTER RS1=73, MMIS=3, CARD=00
FILE=0005 (22-ABORT, 23-FALL, 14-SCRATCH)
CARD = -

```

ESTABLISH THE MAINTENANCE PERIOD

```

JULB = M
IF (JUL3.F0.11) JULB = 243
IF (JUL3.F0.59) JULB = 273
IF (JUL3.F0.20) JULB = 304
IF (JUL3.F0.120) JULB = 334
IF (JUL3.F0.151) JULB = 364
IF (JUL3.F0.181) JULB = 431
IF (JUL3.F0.212) JULB = 459
IF (JUL3.F0.243) JULB = 490
IF (JUL3.F0.273) JULB = 520
IF (JUL3.F0.304) JULB = 551
IF (JUL3.F0.334) JULB = 581
IF (JUL3.F0.364) JULB = 612
JUL9 = 0
IF (JUL3.F0.11) JUL9 = 213
IF (JUL3.F0.59) JUL9 = 244
IF (JUL3.F0.20) JUL9 = 274
IF (JUL3.F0.120) JUL9 = 305
IF (JUL3.F0.151) JUL9 = 335
IF (JUL3.F0.181) JUL9 = 401
IF (JUL3.F0.212) JUL9 = 432

```

```

05700 IF (JUL3.F0.243)JUL9 = 06R
05705 IF (JUL3.F0.273)JUL9 = 09I
05710 IF (JUL3.F0.304)JUL9 = 12I
05715 IF (JUL3.F0.334)JUL9 = 15P
05720 IF (JUL3.F0.366)JUL9 = 18P
05725C.....
05730C.....
05735C.....
05740 INTER MFILE(?)
05745 MFILE(1) = 22
05750 MFILE(2) = 23
05755 NO 5 1 = 1.2
05760 114 = 0
05765 REMIND 14
05770 REMIND MFILE(1)
05775C
05780C..... READ FILE - IF DATE IS WITHIN THE RANGE....
05785C DO NOT SAVE.
05790C
05795C
05800C NO 1 J = 1.00000
05805C.....
05810C.....
05815C..... READ A DATA RECORD... IF THE DATE IS GREATER THAN
05820C OR EQUAL TO THE LOWER LIMIT AND THE DATE IS LESS
05825C THAN OR EQUAL TO THE UPPER LIMIT AND THE JULIAN
05830C DAY IS GREATER THAN 32...CONTINUE READING FILE -
05835C DO NOT SAVE THIS RECORD.
05840C.....
05845C.....
05850C READMFILE(1),7001,F00=2)JUL2,REST
05855 IF (JUL2.GT.,JUL9.AND.,JUL2.LE.,JUL9.AND.,JUL.GT.,32)GO TO 1
05860 WRITE(14,7001)JUL2,REST
05865 114 = 1
05870 1 CONTINUE
05875 2 REMIND 14
05880 REMIND MFILE(1)
05885C.....
05890C WRITE FOR MARK TO CLOSE
05895C PROFILE MFILE(1)
05900 REMIND MFILE(1)
05905C.....
05910C.....
05915C IF (114.F0.0)GO TO 5
05920C.....
05925C WRITE ALL RECORDS BACK TO THE PROFILE THAT WERE
05930C SAVED WITH PROPER DATE RANGES.
05935C.....
05940C.....
05945C NO 3 K = 1.00000
05950 READ(14,7001,F00=4)JUL2,REST
05955 WRITE(MFILE(1),7001)JUL2,REST
05960 3 CONTINUE
05965 4 REMIND 14
05970 REMIND MFILE(1)
05975 5 CONTINUE
05980C.....
05985C WRITE FOR MARK TO CLOSE
05990C PROFILE 14
05995 REMIND 14

```

```

06800C .....
06801C RETURN
06815 7001 F0RMA1(13,A73)
06820 7002 F0RMA1(A00)
06825 END
06830C
06835C
06840C
06845 SUBROUTINE FRS(J,MUCK,NUMEN,IARORIX,IFAILX,TOTMANX,159)
06850 CHARACTER MUCK*5,NOMEN*10,ZUC*5,NOM*10
06855 REAL TOTMANX,KK,KILL,IML,IMI
06860C FILEONES (16-SUMMARY,14-SCRATCH)
06865 TOTMANX = TOTMANX
06870C .....
06875C CALLED FROM ----- F A M
06880C .....
06885C .....
06890C .....
06895C .....
06900C .....
06905C .....
06910C .....
06915C .....
06920C .....
06925C .....
06930C .....
06935C .....
06940C .....
06945 .....
06950 .....
06955 .....
06960 .....
06965 .....
06970 .....
06975 .....
06980 .....
06985 .....
06990 .....
06995 .....
07000 .....
07005 .....
07010 .....
07015 .....
07020 .....
07025 .....
07030 .....
07035 .....
07040 .....
07045 .....
07050 .....
07055 .....
07060 .....
07065 .....
07070 .....
07075 .....
07080 .....
07085 .....
07090 .....
07095 .....
07100 .....
07105 .....
07110 .....
07115 .....
07120 .....
07125 .....
07130 IFL = 0
07135 IIT = 0
07140 IFT = 0
07145 IPI = 0
07150 IAL = 0
07155 IAT = 0
07160 IARL = 0
07165 IART = 0
07170 IMI = 0.0
07175 IMI = 0.0
07180 IMPL = 0
07185 IMRT = 0
07190 GO TO(1,2,3,4),159
07195C
07200C .....
07205C .....
07210C .....
07215C .....
07220 1 WRITE(14,7003)MUCK,NOMEN,IFL,IFAILX,IFRL,J,IAI,
07225 IAT,IARL,IART,IMI,IMT,IMPL,IMRT
07230 RETURN
07235C
07240C .....
07245C .....
07250C .....
07255C .....
07260 2 WRITE(14,7004)MUCK,NOMEN,IFL,IFT,IFRL,IFRT,IAI,
07265 IARORIX,IART,J,IMI,IMT,IMPL,IMRT
07270 RETURN
07275C
07280C .....
07285C .....
07290C .....
07295C .....

```



```

00400 4 IERI,FO,R,AND,IERT,FO,R,AND,IMI,FO,R,AND,
00405 4 IMI,FO,R,AND,IMRI,FO,R,AND,IMRI,FO,R,AND TO 1
00410C*
00415C* SAVE THIS MONTH'S VALUES TO LAST MONTH'S VALUES
00420C*
00425 IFL = IFT
00430 IFR = IFR
00435 IAL = IAT
00440 IARI = IART
00445 IML = IMI
00450 IMRI = IMRT
00455C*
00460C* RESET THIS MONTH'S VALUES TO ZERO
00465C*
00470 IFT = 0
00475 IFR = 0
00480 IAL = 0
00485 IARI = 0
00490 IML = 0
00495 IMRT = 0
00500C*
00505 IIS = 1
00510 WRITE(15,700)MUCH,MONTH,IFL,IFT,IERI,IFRI,IAT,IART,
00515 IARI,IMI,IMT,IMRI,IMRT
00520 1 CONTINUE
00525C*
00530 2 REMIND 15
00535 REMIND 16
00540 IF(IIS.CO.0)GO TO 3
00545C*
00550C*
00555C* SORT FILE BY MONTH-UNIT-CODE AND
00560C* WRITE SORTED FILE TO SUMMARY FILE
00565C*
00570C*
00575 CALL SORT(15,67,1,0,1,5,0,16)
00580 3 REMIND 16
00585 REMIND 15
00590C*
00595C* WRITE FOR MARK TO CLOSE
00600 ENDFILE 15
00605 REMIND 15
00610C*
00615C*
00620 RETURN
00625 7001 FORMAT(5,A10,014,2F6.2,214)
00630 7002 FORMAT(A6,3)
00635 END
00640C*
00645C*
00650C* SUBROUTINE LIMIT
00655 COMMON IYI,NJUL,NJUL,I7M,JUL,JUL3,JUL4,MMS
00660 IYI,FOUR LIMITS(14)/12,40,91,121,162,211,244,
00665 R274,385,335,367,432,668/
00670 CHARACTER M1C(5)
00675
00680
00685
00690
00695
00700 1 CONTINUE

```

```

07800
07805
07810
07815
07820
07825
07830
07835
07840
07845
07850
07855
07860
07865
07870
07875
07880
07885
07890
07895
07900
07905
07910
07915
07920
07925
07930
07935
07940
07945
07950
07955
07960
07965
07970
07975
07980
07985
07990
07995
2 JUL3 = LIMITS(I - 2) - 1
RETURN
END

SUBROUTINE LIMITP(JUL5)
COMMON EXT,4JUL,KJUL,17M,JUL,JUL3,JUL4,MNTS
CHARACTER MITS*J
JUL5 = 0
IF(JUL3.FO.712)JUL5 = 102
IF(JUL4.FO.166)JUL5 = 001
RETURN
END

SUBROUTINE LIMITX
COMMON EXT,4JUL,KJUL,17M,JUL,JUL3,JUL4,MNTS
LIMITS(I) = 1.32,60.91,121.152,102.213,244,
4274,305,335,367,032,060/
CHARACTER MITS*J
DO 1 I = 4,15
IF(JUL.FO.LIMITS(I))GO TO 2
1 CONTINUE
2 JUL4 = LIMITS(I - 3)
RETURN
END

SUBROUTINE LIMITZ(CR)
COMMON EXT,4JUL,KJUL,17M,JUL,JUL3,JUL4,MNTS
INTEGER LIMITS(12)/01,121,152,102,213,244,274,305,335,367,032,60/
CHARACTER MITS*3
DO 1 I = 1,12
IF(JUL.FO.LIMITS(I))GO TO 2
1 CONTINUE
2 MX = I
RETURN
END

SUBROUTINE LISTFILE(ICODE)
CHARACTER DATA*120
J = 0
PRINT 7004
PRINT,FILECODE *,ICODE
PRINT,ICODE
1 DO 2 I = 1,9999
IF(ICODE,7001,END=3)DATA
PRINT 7002,DATA
2 CONTINUE
J = J + 1
GO TO 1

```



```

00600C.....
006010 PRINT 7007
006015 PRINT " "
006020 PRINT 7001.MN15
006025 PRINT " "
006030 PRINT 7004
006035 PRINT 7005
006040 PRINT 7004
006045.....
006050C.....
006055C.....
006060C.....
006065 DO I K = 1,1
006070C.....
006075C.....
006080C M S RANK FOR MANHR
006085C.....
006090 M * K
006095 HEAD(10,7002.FMD=2)MUCX,MOMEN,IARORTX,IFAILX,TOTMANX
007000 PRINT 7006.K,MUCX,MOMEN,IOTMANX
007005C.....
007010C.....
007015C SAVE PRINTED VALUES FOR SUMMARY REPORT
007200C.....
007205C.....
007300 CALL FMSCH,MUCX,MOMEN,IARORTX,IFAILX,TOTMANX,3)
007305 PRINT 7003
007400 1 CONTINUE
007405C.....
007500 2 CONTINUE
007505 PRINT 7004
007600 RETURN
007605 7001 FORMAT(143,"MAN-HOURS EXPENDED FOR ",A3,/)
007700 7002 FORMAT(2X,A5,1X,A10,1X,A14,1X,14,1X,F6.2)
007705 7003 FORMAT(126,"",134,"",151,"",167,"",189,"")
007800C.....
007805 7004 FORMAT(126,64(" "))
007900 7005 FORMAT(126,"",RANK * WORK UNIT CODE * NOMENCLATURE",
008000 A * TOTAL MAN-HOURS **)
008005 7006 FORMAT(126,"",1X,15,1X,"",6X,A5,5X,"",4X,
008100 7007 FORMAT(101)
008105 END
008200
008205C.....
008300C.....
008305 SUBROUTINE MDSPEC
008400 COMMON INT,0,JUL,K,JUL,174,JUL,JUL,3,JUL,4,MN15
008405 CHARACTER MCR45,MCRX45(100),RANK145,RANK245(15),MCRM45(100)
008410 REAL ALLTM(100),MURFM(100),DCOST(100),ICOST(100)
008415 REAL MANHNG(100),MIRI(100),INDI(100),OTHERS(100),OTFCOST(100)
008420 INTEGER ASSOC(100),AUTH(100),SHOPIHRS(100),AUTI2,ASSO2,CPEM(100)
008425 INTEGER SIMSAL,TOTSA(100),CPEMS(100)
008430 CHARACTER MNT5*3
008435 I(LEGDES (22-ADPR),23-FALL,24-MURACT,11-MONEY)
008440 (12-MANMOMEN,20-PROD,14-SCRATCH)
008445 (10-TEMPORARY)
008450 CHARACTER PEG407=" "

```



```

10200C 3 REMIND UNTIL(I)
10205
10210C
10215C 0FT UNIQUE FROM 3 FILES
10220 REMIND 14
10225C
10230C.....
10235C IF NO APPLICABLE DATA RECORD FOUND RETURN TO PAR
10240C.....
10245C
10250 IF(I14,I0,0)RETURN
10255 I=1
10260 4 READ(I4,7001,END=9)MCN(X(J),I,START,I00,I,STOP,I00ME,CREW(I)
10265 IF(MCN(X(J),I0,"")I00 10 4
10270 ICREM = CREW(I)
10275 GO TO 7
10280 5 READ(I4,7001,END=9)MCH,I,START,I00,I,STOP,I00NF,ICREW
10285C
10290 DO 6 J=1,I
10295 IF(MCH(I,FO,MCN(X(J))I00 TO 7
10300 6 CONTINUE
10305C
10310 I = I + 1
10315 MCN(X(I) = MCH
10320 J = I
10325 7 CREW(J) = ICREW
10330C
10335C.....
10340C TIME PHASE FOR DIRECT LAHOR
10345C.....
10350C
10355 IF(I,STOP,LE,I,START,AND,I00NF,LE,I00,I,STOP = I,STOP + 24
10360 IF(I00ME,LT,I00,I,STOP = I,STOP - 1
10365 IF(I00NF,LT,I00,I00NF = I00NF + 60
10370 I00II = I,STOP - I,START
10375 I00IHS = I00NF - I00
10380 I,FAH = I00II + CREW(J)
10385 I,FAH = I00IHS + CREW(J)
10390 8 IF(I,FAH,GT,60)I,FAH = I,FAH + 1
10395 IF(I,FAH,GT,60)I,FAH = I,FAH - 60
10400 IF(I,FAH,GT,60)GO TO 9
10405 IF(I,FAH,GT,0)I,FAH = (I,FAH / 60,1)
10410C..... TIME ..... PHASE .....
10415 ALLTH(J) = ALLTH(J) + (I,FAH + I,FAH)
10420 GO TO 5
10425 9 REMIND 14
10430C
10435C.....
10440C JAIL = SUBTOTAL UNIQUE WORK-CENTERS
10445C.....
10450C
10455 JAIL = 1
10460C GET UNIQUE FROM MHPACT
10465 REMIND 24
10470C
10475 DO 10 I = 1,99999
10480 READ(I4,7014,END=11)JUL2,MCH,I,START,I00,I,STOP,I00NF,ICREW
10485 IF(JUL2,GT,JUL3,OR,JUL2,LT,JUL3)GO TO 10
10490 WRITE(I4,7013)MCH,I,START,I00,I,STOP,I00NF,ICREW
10495 10 CONTINUE

```

```

10580C 11 REMIND 24
10585 REMIND 14
10590 I = JALL
10595 17 PRAB(14,7001,END=16)MCM,ISTART,100,ISTOP,ICOMF,ICREW
10600 IF(MCN.FO."-)GO TO 12
10605
10610C
10615C
10620C
10625C
10630C
10635C
10640C
10645C
10650C
10655C
10660C
10665C
10670C
10675C
10680C
10685C
10690C
10695C
10700C
10705C
10710C
10715C
10720C
10725C
10730C
10735C
10740C
10745C
10750C
10755C
10760C
10765C
10770C
10775C
10780C
10785C
10790C
10795C

```

DO 13 J = 1,1
IF(MCN.FO.WCHX(J))GO TO 14
13 CONTINUE
I = I + 1
MCM(I) = MCM
J = J + 1
14 CDEMS(J) = ICREW
16680C COMPUTE TIME PHASE FOR INDIRECT LABOR
16685C
16690C
16695C
16700C
16705C
16710C
16715C
16720C
16725C
16730C
16735C
16740C
16745C
16750C
16755C
16760C
16765C
16770C
16775C
16780C
16785C
16790C
16795C

IF(ISTOP.LE.ISTART.AND.ICOMF.IE.100)ISTOP = ISTOP + 24
IF(ICOMF.LT.100)ISTOP = ISTOP - 1
IF(ICOMF.LT.100)ICOMF = ICOMF + 60
ICREW = ISTOP - ICARE
100THS = ICOMF - 100
IFACH = 100THS * CREWS(J)
1EAGUS = 100THS * CREWS(J)
15 IF(ICACHS.DE.60)IFACH = IFACH + 1
1EAGUS = 100THS * CREWS(J)
IF(ICACHS.DE.60)GO TO 15
IF(ICACHS.DE.60)IAGUS = (ICACHS / 60.)
MIRIN(J) = MIRIN(J) + (IFACH * EAGUS)
GO TO 12
16 REMIND 14
16695
16700C
16705C
16710C
16715C
16720C
16725C
16730C
16735C
16740C
16745C
16750C
16755C
16760C
16765C
16770C
16775C
16780C
16785C
16790C
16795C

COMPARA UNIQUES WITH MANPOWER FILE - IF MATCH
OCCURS OPEN MONEY FILE
DO 20 K = 1,99999
READ(12,2002,END=21)MCM,PAHX1,AUTHP,ASSON2
IF(MCM.FO.WCHX(J))GO TO 17
GO TO 20

```

10000C
10005 17 REWIND 11
10010C
10015C
10020C COMPARE BANK FROM MANPOWER FILE WITH MONEY TO
10025C COMPUTE SALARIES
10030C
10035 DO 10 M = 1.99999
10040 HCALL(1,7001,END=20)RANK2(M),SINOSAL
10045 IF(CRANK1.EQ.BANK2(M))GO TO 19
10050 10 CONTINUE
10055C
10060C COMPUTE TOTAL SALARY PER WORKCENTER
10065C COMPUTE TOTAL ASSIGNED PER WORKCENTER
10070C COMPUTE TOTAL AUTHORIZED PER WORKCENTER
10075C
10080C 19 TOTAL(L) = TOTAL(L) + (ASSON2 * SINOSAL)
10085C ASSIGN(L) = ASSIGN(L) + ASSON2
10090C AUTH(L) = AUTH(L) + AUTH2
10095 20 CONTINUE
10100 21 CONTINUE
10105 REWIND 14
10110 DO 22 I = 1,KK
10115
10120C IF TOTAL ASSIGNED & TOTAL AUTHORIZED IS ZERO -
10125C DO NOT SAVE OR REPORT FOR.
10130C
10135C IF(ASSON(L).EQ.0.AND.AUTH(L).EQ.0)GO TO 22
10140C SHOPRS(L) = (ASSON(L) * 176.)
10145 IF(ALLTH(L).GT.0)DIRBL(L) = (ALLTH(L) / SHOPRS(L))
10150 IF(MURTH(L).GT.0)DIRBL(L) = (MURTH(L) / SHOPRS(L))
10155 ICOST(L) = (DIRBL(L) * TOTAL(L))
10160 ICOST(L) = (DIRBL(L) * TOTAL(L))
10165 OTHERS(L) = (SHOPRS(L) - (MURTH(L) + ALLTH(L)))
10170 ICOST(L) = (TOTAL(L) - (ICOST(L) + ICOST(L)))
10175 MANNING(L) = (ASSON(L) * 1.) / AUT H(L)
10180
10185C SAVE VALUES TO FILECODE 14
10190C
10195C WRITE(14,7004)ICRXL(L),ALLTH(L),ICOST(L),MURTH(L),ICOST(L),
10200C A01HPSEL),ICOST(L),AUTH(L),ASSON(L),MANNING(L)
10205 22 CONTINUE
10210
10215C
10220C REWIND 14
10225C
10230C SORT FILE BY WORKCENTERS -- WRITE FILE(SORTED)TO
10235C FILECODE 10
10240C
10245C CALL SORTFILE(63,0,1,5,0,10)
10250C .....
10255C WRITE FOR MARK TO CLOSE
10260C
10265C ENDFILE 14
10270C REWIND 14
10275C
10280C
10285C REWIND 10
10290C
10295C .....
10300C PRINT 7006,UMIS
10305

```

```

11100 PRINT 7007
11105 PRINT 7008
11110 PRINT 7009
11115 PRINT 700R
11120 PRINT 7010
11125 PRINT 7015
11130 PRINT 7011
11135 PRINT 7015
11140 PRINT 7007
11145C COUNT DC RECORDS
11150
11155 PRINT 7015
11160C.....
11165C
11170 DO 23 N = 1,99999
11175 READ(10,7004,END=24)MCM,DLN,DCST,BDLR,BCOST,OTHR,OTCST,
11180 RAUTH2,ASSO2,RM
11185C
11190C IF AUTHORIZED AND ASSIGN IS FOUL TO ZERO -
11195C DO NOT PRINT OR INCLUDE WITH REPORT
11200C
11205C IF (AUTH2.EQ.0.AND.ASSO2.EQ.0)GO TO 23
11210 DLN = DLN + .001
11215 DDLR = DDLR + .001
11220 OTHR = OTHR + .001
11225 RM = RM + .0001
11230 PRINT 7017,MCM,DLN,DCST,BDLR,BCOST,OTHR,OTCST,AUTH2,
11235 ASSO2,RM
11240 PRINT 7015
11245 23 CONTINUE
11250C
11255 24 PRINT 7007
11260 REMIND 1A
11265C.....
11270C WRITE FOR TO CLOSE
11275 ENDFILE 10
11280 REMIND 1A
11285C
11290C.....
11295 REMIND 24
11300 WRITE(25,7005)PLC
11305 REMIND 24
11310C.....
11315C WRITE FOR MARK TO CLOSE
11320 FORTFILE 24
11325 REMIND 24
11330C
11335C.....
11340C RETURN
11345 7001 FORMAT(2X,A5,52X,12,17,3X,17,12,11)
11350 7002 FORMAT(A5,1X,A5,1X,12,1X,12)
11355 7003 FORMAT(A5,1X,1A)
11360 7004 FORMAT(A5,F9.2,16,F9.2,16,F9.2,16,13,13,15,3)
11365 7005 FORMAT(AND)
11370 7006 FORMAT(1A2,"MISMATCHED ACCOUNTING SUMMARY PER WORKCENTER",
11375 A" FOR ",A3,/)
11380 7007 FORMAT(110,121(" "))
11385 7008 FORMAT(110," ",14X," ",3(21X," ")),3(12X," ")
11390 7009 FORMAT(110," ",2X," MISMATCHED ",2X," ",9X,
11395 A" DIRECT LABOR ",4X," ",3X," UNDIRECT LABOR",

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11448 44X,00,5X,OTHER (A00P,5X,00,1X,"AUTHORIZED",1X,
11449 R,00,2X,"ASSIGNED",2X,00,3X,"PERCENT",2X,00)
11450 FORMAT(10,"0",14X,67(00),2(3X,"HANNING",
11451 42X,00),4X,"HANDLED",2X,00)
11452 7011 FORMAT(10,"0",14X,00,3(1X,"MANHOURS",1X,00,
11453 43X,"COST",3X,00),3(12X,00))
11454 7012 FORMAT(10,"0",5X,45,4X,00,3(1X,00,2,1X,00,
11455 4110,00),2(5X,13,4X,00),4X,05,3,3X,00)
11456 7013 FORMAT(10)
11457 7014 FORMAT(10,4X,45,52X,212,3X,212,11)
11458 7015 FORMAT(10,"0",14X,00,3(10X,00,10X,00),
11459 42(12X,00),12X,00)
11460 END
11461
11462 SUBROUTINE MIRA(REC)
11463 -----
11464
11465      NOTES AND COMMENTS ABOUT ROUTINE
11466      -----
11467
11468      NAME - MIRA
11469      INPUT ARGUMENT - REC
11470      VARIABLES USED - JDAY
11471                      JUL
11472                      REC
11473                      REC
11474
11475      CALLED FROM - MAINLINE
11476      SUPPORTING SUBROUTINES - PREP
11477
11478      DESCRIPTION OF VARIABLES
11479      -----
11480
11481      JDAY - JULIAN DAY FROM INPUT RECORD
11482      JUL - JULIAN DAY LIMIT
11483      REC - SINGLE IMAGE OF REC
11484      REC - INPUT RECORD
11485      MNTS - CURRENT MONTH
11486      JUL3 - UPPER LIMIT OF INPUT JULIAN DATES
11487      JUL4 - LOWER LIMIT OF INPUT JULIAN DATES
11488      -----
11489
11490      COMMON /17/,JUL,REC,JUL,17M,JUL,JUL3,JUL4,MNTS
11491      CHARACTER REC*(100),REC000,MNTS*3
11492      ILLCODES (24-MIRACT,27-TEMPORARY)
11493      GET JULIAN DAY
11494      FICOM (REC,7001)REC
11495      RECORD (REC,7002)JDAY
11496      IF (JDAY.GE. JUL4.AND. JDAY.LE. JUL3.AND. JDAY.GT.32100) TO 1
11497      GO TO 2
11498
11499      UPDAT FILE
11500      1 MNTS(24,7003)REC
11501      17M * 1
11502      17M * 1
11503      RETURN
11504
11505      2 JUL * JDAY
11506      CALL PREP
11507      BACKSPACE 27
11508      RETURN
11509
11510      7001 FORMAT(001)
11511      7002 FORMAT(13)

```



```

2180 IF(JUL.GE.152)WRITE(20,7001)JUL,1XT,JUL,KJUL
2185 IF(JUL.GE.152)REWIND 20
2190 IF(JUL.GE.152)HJUL = JUL
2195 CALL MAINT
2200 IF(10.CO.1)CALL PSEP
2205 CALL HNSPDC
2210 IF(10.CO.1)CALL PRODEL
2215 REWIND 20
2220 READ(20,7001)JUL,1XT,MJUL,KJUL
2225 IF(JUL.GE.244)REWIND 20
2230 IF(JUL.GE.244)WRITE(20,7001)JUL,1XT,MJUL,JUL
2235 IF(JUL.GE.244)REWIND 20
2240 IF(JUL.GE.244)KJUL = JUL
2245 CALL MAINT
2250 REWIND 20
2255 CALL ICF
2260 IZM = 0
2265 GET NEW JULIAN DAY LIMIT
2270 CALL HEADNC(JUL)
2275 UPDATE JULIAN DAY FILE
2280 CALL PHJUL
2285 RETURN
2290 FORMAT(13,1X,13,1X,13,1X,13)
2295 END
2300
2305 SUBROUTINE PREP
2310 COMMON INT,MJUL,KJUL,17M,JUL,JUL3,JUL4,MN15
2315 CHARACTER MN15*3
2320 INTEGER YEAR(14)/1,32,60,91,121,152,182,213,244,274,305,335,367,32
2325 A/
2330 DD 1 = 2,14
2335 DD 3 = YEAR(1),YEAR(1) - 1
2340 IF(JUL.FO.JJGD TO 3
2345 1 CONTINUE
2350
2355 2 CONTINUE
2360
2365 3 JUL = YEAR(1 + 1)
2370 IF(JUL.FO.367.AND.JUL4.FO.305)RETURN
2375 IF(JUL.FO.837.AND.JUL4.FO.305)GD TO 4
2380 CALL PUTJUL
2385 4 CALL PAPE
2390 RETURN
2395 END
2400
2405 SUBROUTINE PRODECI
2410 COMMON INT,MJUL,KJUL,17M,JUL,JUL3,JUL4,MN15
2415 CHARACTER RIG(100),VIC(00,MN15*3
2420 CHARACTER DTJULIAN DAY
2425 FCODE(KFC,7001)REC
2430 RECORD(KFC,7002)JDAY
2435 IF(JDAY.GE.1014.AND.JDAY.LE.1013.AND.JUL.OF.32)GD TO 1
2440

```



```

13288 IFACHS = ITRINC * ICRWST(J)
13289 IF(IACHS-GE-AM)IACH = IACH + 1
13290 IF(IACHS-GE-AM)IACHS = IACHS - 60
13291 IF(IACHS-GE-60)GO TO 5
13292 IF(IACHS-GE-8)IACHS = (IACHS / 60.)
13293 TIME(J) = TIME(I) + (IACH + IACHS)
13294 GO TO 7
13295 4 REMIND 20
13296 IF(I24-EO-8)GO TO 13
13297 REMIND 14
13298 REMIND 13
13299 REAL LEFT
13300 I14 = 0
13301 OPEN MDSMNS FILE
13302 DO 9 K = 1,00000
13303 HOLD = 0.0
13304 OVER = 0.0
13305 LEFT = 0.0
13306 NEAR(1,7841,END=10)MD,TAUTH
13307 COMPARE FILE WITH UNIQUE MDS FOUND
13308 DO 7 L = 1,1
13309 IF(MD-EO-MDS(L))GO TO 0
13310 7 CONTINUE
13311 GO TO 9
13312 8 HOLD = (TAUTH * 1.) - TIME(I)
13313 I14 = 1
13314 COMPARE MAN-HOURS LEFT TO WORK OR WORKED OVER
13315 IF(UNH-LT-0.0)OVER = (HOLD * (-1.))
13316 IF(HOLD-GE-0.0)LEFT = HOLD
13317 WRITE(14,2002)MDS(L),SER(L),TAUTH,TIME(L),LEFT,OVER
13318 9 CONTINUE
13319 10 REMIND 14
13320 REMIND 13
13321 IF(I14-EO-8)GO TO 13
13322 SORT BY SERIAL NUMBER WRITE SORTED FILE TO
13323 FILECODE IN
13324 CALL SORT(14,37,1-0,0,0,10)
13325 REMIND 14
13326 .....
13327 WRITE FOR NAME TO CLOSE
13328 EXECUTE 14
13329 REMIND 14
13330 .....
13331 .....
13332 .....
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14489      S CONTINUE
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14491      K I = K - 1
14492      REMIND 10
14493      RETURN
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14495      7001 FORMAT(A5)
14496      END
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15600 PERIOD 14
15605 TC114,0,0,0,0,0,0,0
15610C
15615C SORT FILE BY WORK-UNIT-CODE..
15620C UNIT SORTED FILE TO SUMMARY
15625C
15630C CALL SORT1(14,67,1,0,1,5,0,16)
15635C .....
15640C UNIT FILE MADE TO CLOSE
15645C PERIOD 14
15650C
15655C .....
15660C
15665C RETURN
15670 7001 TOPHAT(CAS,ATP,014,216,2,214)
15675 END

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BIOGRAPHICAL SKETCH OF THE AUTHORS

Captain Callahan, a native of St. Paul, Minnesota, received his BA Degree in International Relations from St. Thomas College. While at college, Captain Callahan participated in the AF ROTC program which resulted in an Air Force commission in May of 1970. After commissioning, he served in many assignments as a logistics officer, the latest of these assignments being as a Supply Officer at Korat Royal Thai Air Base, Thailand. While at AFIT Captain Callahan was selected into the Sigma Iota Epsilon honorary fraternity. After graduation from AFIT, he was assigned as career advisor to the Air Force Reserve Personnel Center, Lowry AFB, Colorado.

Squadron Leader Payne attended the King's School Parramatta, graduating in 1967; he was admitted to the degree of Bachelor of Economics from the Australian National University in 1970 and subsequently joined the Royal Australian Air Force and was commissioned in 1971 as an Equipment Officer. He has had supply experience in equipment warehousing, barracks and messing, and three years as Officer in Charge of the 7SD Cadet Flight. After AFIT Squadron Leader Payne has been posted to the Australian Department of Defense (Air Force Office) in Canberra.