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13	14	15	16	17	18	19	20	21	22	23	24
25	26	27	28	29	30	31	32	33	34	35	36
37	38	39	40	41	42	43	44	45	46	47	48
49	50	51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70	71	72
73	74	75	76	77	78	79	80	81	82	83	84
85	86	87	88	89	90	91	92	93	94	95	96
97	98	99	100	101	102	103	104	105	106	107	108
109	110	111	112	113	114	115	116	117	118	119	120
121	122	123	124	125	126	127	128	129	130	131	132

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Deryl S. McCarty, Captain, USAF
Ronald L. Moore, Captain, USAF

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↙ The Department of Defense Management by Objective 9-2 required that all services develop a non-duplicative, inexpensive aircraft maintenance cost accounting system that would provide a data base for determining downstream aircraft life cycle costs. To date, no USAF accounting system has fulfilled these requirements. To develop a comprehensive accounting system that does meet MBO criteria requires that a new accounting system be developed based on an extensive three-phase research program. The three phases include: (1) to identify the maintenance cost elements in use, (2) to identify which of these elements are needed by Air Force managers, and (3) to determine which of these needed elements provide the most information at the least cost. This study starts this three-phase research by determining what maintenance cost elements are currently costed by civilian and military maintenance organizations. This was accomplished through a review of civilian and military aircraft maintenance cost accounting publications using the technique of semantic content analysis. The results of this analysis provided a "core list" of "in-use" aircraft maintenance cost elements and recording techniques. From this core list, the next research phase--identification of AF cost element needs--can be inaugurated. ↘

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AIRCRAFT MAINTENANCE COST ELEMENTS

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

Deryl S. McCarty, BA
Captain, USAF

Ronald L. Moore, MS
Captain, USAF

September 1977

This thesis, written by

Captain Deryl S. McCarty

and

Captain Ronald L. Moore

has been accepted by the undersigned on behalf of the
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Harrell N. Fulton

COMMITTEE CHAIRMAN

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TABLE OF CONTENTS

ACKNOWLEDGMENTS	iii
Chapter	
1. INTRODUCTION	1
Statement of the Problem	1
Background	2
Existing measurement systems	5
Visibility and management of operating and support cost MBOs	6
Approaches to provide cost visibility	8
Justification	9
Objectives	10
Research Questions	11
2. METHODOLOGY	12
Sampling Plan	12
Universe	12
Population	13
Sample	13
Sampling procedures	13
Data Collection Plan	15
Assumptions and Limitations of Content Analysis	16
Content Analysis Methodology	17
Content analysis application	19
Coding Scheme Changes	24
Coding Distillation	24
Assumptions and Limitations of the Research	26
Criteria Testing and Analysis	28
Summary	30
3. OBSERVATIONS AND ANALYSIS	32
Overview	32
Observations--Military	33
Observations--Air Force	43
Observations--Army	54
Observations--Navy	58
Observations--Civil Aviation	62
Observations--Civil Aeronautics Board	65
Observations--civil air carriers	79
Observations--civil air carriers (summary)	103

Analysis	110
Cost elements	120
Cost recording techniques	124
Cost recording techniques and associated cost elements	125
The research questions answered	144
Summary	150
4. CONCLUSIONS AND RECOMMENDATIONS	152
Overview	152
Conclusions	152
Recommendations	154
Summary	157
APPENDIXES	
A. DEFINITIONS	159
B. SEMANTIC CONTENT ANALYSIS CODING SYSTEM-- DEFINITIONS	161
C. AIR CARRIERS	176
D. MILITARY MAINTENANCE COST ACCOUNTING LITERATURE	180
E. MAINTENANCE WORK ORDER REQUESTS	183
F. LETTER	188
G. AIR CARRIERS WHICH REPLIED	190
H. AIR CARRIER LETTER REPLIES	192
SELECTED BIBLIOGRAPHY	205
BIOGRAPHICAL SKETCHES	213

LIST OF TABLES

1.	Resource Categories Added to the Pilot Study Coding Scheme	25
2.	Allocation Technique Codes Added To/Deleted From Pilot Study Coding Scheme	26
3.	Resource Categories (Maintenance Cost Elements)-- All Military Services	34
4.	Cost Recording Techniques in Use by All Military Services	38
5.	Resource Categories Associated with Cost Record- ing Technique 1/1/2/0--All Military Services	40
6.	Resource Categories Associated with Cost Record- ing Technique 1/2/2/5--Air Force and Navy	42
7.	Resource Categories Associated with Cost Record- ing Technique 2/2/2/5--Air Force and Navy	43
8.	Resource Categories (Maintenance Cost Elements)-- Air Force	45
9.	Cost Recording Techniques in Use by the Air Force	46
10.	Resource Categories Associated with Cost Record- ing Techniques--Air Force	50
11.	Resource Categories (Maintenance Cost Elements)-- Army	55
12.	Cost Recording Techniques in Use by the Army	56
13.	Resource Categories Associated with Cost Record- ing Techniques--Army	57
14.	Resource Categories (Maintenance Cost Elements)-- Navy	59
15.	Cost Recording Techniques in Use by the Navy	61

16.	Resource Categories Associated with Cost Recording Techniques--Navy	63
17.	Resource Categories (Maintenance Cost Elements)--Civil Aeronautics Board	66
18.	Cost Recording Techniques in Use by the Civil Aeronautics Board	70
19.	Resource Categories Associated with Cost Recording Techniques--Civil Aeronautics Board	74
20.	Resource Categories (Maintenance Cost Elements)--Aloha Airlines, Inc.	80
21.	Cost Recording Techniques in Use by Aloha Airlines, Inc.	80
22.	Resource Categories Associated with Cost Recording Techniques--Aloha Airlines, Inc.	81
23.	Resource Categories (Maintenance Cost Elements)--American Airlines	82
24.	Cost Recording Techniques in Use by American Airlines	83
25.	Resource Categories Associated with Cost Recording Techniques--American Airlines	84
26.	Resource Categories (Maintenance Cost Elements)--Eastern Air Lines, Inc.	86
27.	Cost Recording Techniques in Use by Eastern Air Lines, Inc.	87
28.	Resource Categories Associated with Cost Recording Techniques--Eastern Air Lines, Inc.	88
29.	Resource Categories (Maintenance Cost Elements)--Frontier Airlines, Inc.	90
30.	Resource Categories (Maintenance Cost Elements)--Hawaiian Airlines	92
31.	Cost Recording Techniques in Use by Hawaiian Airlines	93
32.	Resource Categories Associated with Cost Recording Techniques--Hawaiian Airlines	95

33.	Resource Categories (Maintenance Cost Elements)-- Hughes Airwest	96
34.	Cost Recording Techniques in Use by Hughes Air- west	96
35.	Resource Categories Associated with Cost Record- ing Techniques--Hughes Airwest	98
36.	Resource Categories (Maintenance Cost Elements)-- United Airlines	99
37.	Cost Recording Techniques in Use by United Air- lines	99
38.	Resource Categories Associated with Cost Record- ing Techniques--United Airlines	101
39.	Resource Categories (Maintenance Cost Elements)-- Western Airlines	102
40.	Cost Recording Techniques in Use by Western Air- lines	104
41.	Resource Categories Associated with Cost Record- ing Techniques--Western Airlines	105
42.	Resource Categories (Maintenance Cost Elements)-- Civil Air Carriers	107
43.	Cost Recording Techniques in Use by Civil Air Carriers	109
44.	Resource Categories Associated with Cost Record- ing Techniques--Civil Air Carriers	111
45.	Resource Categories (Maintenance Cost Elements)-- All Sources	121
46.	Cost Recording Techniques in Use by All Sources .	126
47.	Resource Categories Associated with Cost Record- ing Techniques--All Sources	130
48.	Resource Code Categorization--Program or Control	146

Chapter 1

INTRODUCTION

Statement of the Problem

Each year between 1974 and 1976, the Department of Defense (DOD) initiated a management by objective (MBO) entitled "Visibility and Management of Operating and Support Costs." The current (1976) version, MBO 9-2, was similar to its predecessors, directing that the military departments "develop and implement a system to identify maintenance and other operations costs by weapon system . . . [5:1; 9:8; 24:2]." To fulfill this requirement, MBO 9-2 specified three basic subgoals that the services would pursue. The first subgoal required that a weapons systems operating and support cost data plan would be developed and that such cost data would be related to logistics planning and weapon acquisition processes. The second subgoal required that the services develop a standardized accounting and reporting system for obtaining maintenance costs for three weapons systems types common to all of the services, specifically, jet engines, trucks, helicopters. The third subgoal directed that the services develop a uniform production costing and recording procedure (9:Encl 5). In a memorandum to the Secretaries of the Military Departments, Deputy

Secretary of Defense William P. Clements re-emphasized the need to fulfill these goals. He stated,

The key to effective O&S [Operations and Support] cost management is determining historical weapon system costs. Without these costs, DOD will be unable to control the costs incurred in using its weapon systems and will continue to experience rising operations and support costs which will consume ever increasing portions of the defense budget [7:11].

Even with this emphasis from the Secretarial level, DOD cost measurement systems efforts did not meet the goals set forth in MBO 9-2 and its predecessors. Thus, the Air Force needed to develop cost measuring systems that met the goals of the MBO.

Background

During the 1960's, under the direction of Secretary of Defense McNamara, the Planning-Programming-Budgeting System (PPBS) was developed to allow a Performance Budgeting System, implementing a Hoover Commission recommendation that called for "a budget based on functions, activities, and projects [10:9-1--9-3]," to develop to its full potential. The PPBS was intended to integrate the separate planning and budgeting systems to allow for the generation of total cost estimates for DOD programs, multi-year estimation, and to provide total costs for weapons systems. Furthermore, the PPBS was intended to result in budget requirements to fulfill these objectives, which required:

1. Resource input. The management of people, equipment, materials, and funds.
2. Various categories of outputs. The variety of DOD missions and activities provide output in the forms of production, services, performance, and capability to perform.
3. Managerial time frame. This includes not only the current fiscal year, but also the several prior years (data base), and the subsequent five-year period (planning horizon) [28:2].

Because military resources have been limited, the measure of various categories of output has been crucial for both control and planning purposes. Especially important have been the measure of effectiveness and efficiency of output over scarce input. The DOD must know that it operates efficiently--using its allocated resources, people and money as wisely as can be--while still being able to fulfill its defense objectives effectively (42:3). However, in the time since its inception, the official measure of output, the DOD Output Measures Program, ". . . has lost momentum and vitality [20:3]." Additionally, the application of the zero-based budgeting (ZBB) concept on the DOD planning, programming, and budgeting process (beginning with FY 1979 cycle) made it imperative that a viable output measures program be available for evaluating decision or specific activity packages.

The ZBB concept required that management evaluate the decision packages and rank them according to

. . . the program by which the goals are to be achieved, the benefits expected from the program, the alternatives to the program, the consequences of not

approving the package, and the expenditures of funds and personnel that the activity requires [31:113].

"Top management can use the ranking to analyze the trade-offs and to compare the marginal cost of funding additional decision packages against national security needs [49:111]." Both the ranking and marginal cost analyses, therefore, require measurement of program output in order to be able to compare the effectiveness or efficiency of alternative programs.

Reorganizations of some of the offices of the Secretary of Defense created a larger policy organization within the Office of the Comptroller, the Directorate for Program and Performance Measurement, to revitalize the Output Measures Program (20:3). This directorate was charged with monitoring and providing output (performance) measurement policy guidance for all DOD programs. However, the directorate left the specific determination of which output measures to use to the lowest management level possible in each of the military departments.

In the case of the Air Force, the Cost Center Performance Measurement System (CCPMS) was designed to allow major commands to calculate and evaluate output, a ". . . production indicator used as a quantitative measure of mission accomplishment [55:2-3]," for the various cost centers or shops at the Air Force base. CCPMS was established as an output measurement system for the lowest levels of Air

Force management. However, the CCPMS was not implemented Air Force-wide; and, though mandatory at first, CCPMS became optional so that each major command had the option of publishing the "mandatory" monthly report (34). Furthermore, the CCPMS ". . . did not provide a ready-made answer to the 'why' and 'how' for major variances and deviations . . . [38:1]." The CCPMS was cancelled 9 February 1977 (37:1).

Existing measurement systems. One of the first comprehensive attempts to measure maintenance output for Air Force weapons systems was the combination of the Maintenance Data Collection (MDC) System and the Exception Time Accounting (ETA) System. The MDC System required the maintenance technician to account for his time by recording the time spent repairing, removing and replacing, and checking parts determined to be faulty. For ETA, he was to record exceptions (time that was not spent performing direct maintenance). This indication of time lost because of transportation to the work site or in the performance of special duties and training, for example, was intended to provide some indication of the indirect labor (management and staff overhead) required to maintain Air Force aircraft.

The MDC System still exists, but it has been modified substantially. At this writing, the MDC provides for recording direct labor hours, indicates in which labor

categories the hours were expended (i.e., civilian, military, overtime, normal time), what parts were used, and what action was specifically taken to return the aircraft or a component part to a usable condition (48). ETA no longer exists.

Visibility and management of operating and support cost MBOs. On 25 January 1974, the Deputy Secretary of Defense established the DOD Weapon System Support Cost Visibility Group. The overall objective of this group was ". . . to develop a plan of action to establish a cost effective system for identifying DOD operating and support costs by weapons system [5:Atch 1]." The Deputy Secretary wanted cost information for decision making because "all decisions, military and otherwise have financial implications to some degree [36:Atch 1]." His intent was

. . . to quantify on a recurring basis, those DOD costs which can be affected by specific defense decisions on force size, operating and maintenance policies, equipment support planning (e.g., aircrew training rates), improvements in new and current equipment design, reliability, and maintainability [5:Atch 1].

"Visibility of operations and maintenance costs by weapon support system is necessary to obtain our [United States] goal of optimum readiness within budget constraints [16:1]."

As a result of Mr. Clements' request, MBO 8-1 was established, followed each year by virtually identical MBOs.

The objective of these MBOs was to ". . . develop a cost effective system to identify maintenance and other

operations costs by weapons systems [24:1]." These MBOs also required that a management information system be developed which would:

- (1) Emphasize visibility
 - (a) Cost elements definitions
 - (b) High cost subsystems of each weapon system
 - (c) O & S cost data source
- (2) Rely on current accounting systems for O & S cost visibility wherever possible.
- (3) Minimize additional data collection requirements and costs.
- (4) Permit rapid updating of cost data to identify the operating and support cost of a specific weapon system or sets within 30 days after request and on all weapon systems annually.
- (5) Summarize cost data at the subsystem and replaceable component levels.
- (6) Permit sensitivity analysis so as to sort systems on the basis of cost, reliability performance and maintainability performance [9:Encl 4].

The advantages of a program of total cost visibility accrued primarily to high-level managers within the DOD and ultimately to the Congress. These advantages included a total picture of the fixed and variable costs which would have allowed for consistent information upon which to base future cost estimates for not only annual base operating budgets but for weapons systems development cost projections. In addition, cost and budget managers at all levels could then gain a better sense of proportions of the costs of operating the DOD than previously. Finally, total cost accounting visibility would have allowed others outside of the DOD (e.g., the President, the Congress, and the public) to see and appreciate how well the DOD was managed (36:3).

Approaches to provide cost visibility. One approach to provide total cost visibility was the Maintenance Cost System (MCS). It was designed to provide reliable total maintenance cost by aircraft model/design/series (MDS), with no additional paperwork to be levied on the aircraft maintenance technician other than that already required for MDC. Additionally, computers were to be used to reduce base level workloads of the existing MDC system. MCS also incorporated inputs from contractor-operated facilities and major command-funded maintenance activities which had to that date not been included in a formal cost-measuring system (17:4). The specific objectives of the MCS were:

- (A) To accumulate costs of organizational and intermediate level maintenance activities by MDS.
- (B) To provide the capability to consolidate depot and base level maintenance costs at HQ USAF level.
- (C) To improve OSD [Office of the Secretary of Defense]/USAF responsiveness to OMB [Office of Management and Budget] and Congress regarding total maintenance costs.
- (D) To provide data for life cycle costing.
- (E) To improve the basis for determining whether to perform maintenance contractually or in-house.
- (F) To provide base level maintenance cost per flying hour.
- (G) To purify program element reporting for the five year force structure and the AF budget submission.
- (H) To provide cost of total maintenance labor expenditures (direct, indirect, and overhead) [51:2-1].

Overall, the designers expected that MCS ". . . will provide reliable total maintenance cost by MDS [47:4]." Since the MCS provided a total cost package for the aircraft maintenance portion of the overall operations and support costs, it appeared to fulfill the objectives of MBO 9-2. However,

the authors of the Operating and Support Cost Reporting (OSCR) System felt that they had developed a system which met the objectives of MBO 9-2 at "less cost and with less documentation [16:1,3]" than MCS.

OSCR, established as a DOD program, was developed by the USAF Task Group on Visibility and Management of Support Costs. This task group was established under the direction of an OSD Group of the same name.

The OSD Group directed that each of the military services bring together a cohesive management information system using Fiscal Year 1974 data. The Air Force, viewing the task as a pilot effort, proceeded on the premise that sole reliance had to be placed upon existing data sources, . . . without recourse to the establishment of a new appropriation cost system [47:3].

OSCR was implemented in three phases. The first was limited to collecting, formatting, and analyzing data for four selected weapons systems. The second phase expanded the scope of the first to include all Air Force weapons systems. The third and final phase included analysis of the problems encountered in the first two phases and formulation of the procedures for maintaining and building the data base. OSCR, which used MDC data generated at base level, was maintained only at Headquarters USAF (35).

Justification

MBO 9-2 required that there be a standardized maintenance cost accounting and reporting system to identify weapons systems operating and support costs for use in the

logistics planning and the weapon acquisition process. The Air Force had three systems identified to meet these requirements: MDC, which provided resource usage measures which must be translated into monetary costs; and MCS and OSCR, which provided monetary costs directly. However, the MBO 9-2 requirements still existed. Thus, the Air Force was still required to develop an aircraft maintenance cost accounting and reporting system that meets the requirements of the MBO. The purpose of this research was to identify two basic elements which support this development effort. These two elements were the maintenance cost elements and the cost recording techniques needed to process those cost elements. After identifying these elements and techniques, they will be related to the subgoals of the MBO.

Objectives

The objectives of this research were:

1. To identify maintenance cost elements which measured the inputs in aircraft maintenance production,
2. To identify methods to convert maintenance cost data to information useful for decision making as outlined in the MBOs,
3. To categorize the cost elements and techniques as to which MBO subgoal an element/technique may apply.

Research Questions

1. What cost elements were available to measure aircraft maintenance costs?
2. What cost recording techniques were available to convert maintenance cost elements into useful information?
3. To which subgoals of MBO 9-2 would the cost recording techniques and cost elements apply?

Chapter 2

METHODOLOGY

This chapter describes the methodology that was used to determine what maintenance cost elements and cost recording techniques were basic to fulfilling the subgoals of MBO 9-2. To obtain these maintenance cost elements and cost recording techniques, the researchers analyzed maintenance cost accounting organizational policies as reflected in directives and letter replies. The methodology chosen to conduct the analysis was semantic content analysis. Along with a discussion of semantic content analysis, this chapter outlines the sampling plan, the data collection plan, and the assumptions and limitations inherent in the methodology chosen. This chapter also outlines the criteria and analysis processes that were used to answer the research questions.

Sampling Plan

Universe. The universe of aircraft maintenance cost elements and recording techniques included all those used by all military and civil aircraft maintenance organizations worldwide.

Population. The population for this research was defined as those cost elements and recording techniques used by US-based organizations primarily engaged in maintaining civil and military aircraft.

Sample. Because the population was large, the maintenance cost element and recording technique data for this research was collected from a returned sample of the population of currently used maintenance cost recording elements and techniques. For organizations maintaining military aircraft, the researchers reviewed a sample of regulations, manuals, and policy statements of the US Army, Navy, and Air Force dealing with base-level maintenance cost elements and recording techniques. For organizations maintaining civil aircraft, the sample consisted of policy statements and manuals from the scheduled local service and trunk airlines, along with the regulations and policy statements of the Civil Aeronautics Board (CAB). The scheduled airline sample was drawn from the population of interstate and intrastate/commuter airline companies listed in the Official Airline Guide, North American Edition (30:1278-80).

Sampling procedures. The procedures this research employed to obtain the sample data involved several actions. Applicable military maintenance cost accounting literature and manual/regulation indexes were reviewed. These references and applicable manuals/regulations were obtained from

sources at the School of Systems and Logistics. Other military manuals/regulations/policy statements were obtained via telephone requests to applicable military aircraft maintenance agencies. A list of these maintenance manuals/regulations is found in Appendix D. Letter requests (with return envelopes) for civil maintenance cost accounting literature were sent to US airline carriers as listed in the Official Airline Guide, North American Edition (30:1278-80).

Twenty-nine letter requests for information were sent to interstate airline companies and 164 letter requests were sent to intrastate/commuter airline companies. Of the 193 letter requests, 21 airline companies replied for a 10.8 percent return rate. Of the 29 letter requests sent to the interstate airline companies, 11 companies replied for a 37.9 percent return rate. Of the replies, 8 contained sufficient information applicable for coding maintenance cost element data. Of the 164 letter requests sent to the intrastate/commuter airline companies, 10 companies replied for a 6.1 percent return rate. All 10 intrastate/commuter replies were deemed not applicable for coding maintenance cost data. The replies which were deemed not applicable consisted of replies such as,

Please be advised that the information that you requested from us is not in a format which could be useful to you and therefore we are unable to comply with your request [23].

to

Our system of costing out maintenance on aircraft would be of no value to you because we are not gov't subsidized nor can we use a cost + [plus] system. We are just what is left of the free enterprise system, hard at work trying to keep it so [33].

The letter request sent to the airline companies is in Appendix F, the interstate and intrastate/commuter airline companies are listed in Appendix C, and a listing of the air carriers which replied is in Appendix G.

Data Collection Plan

Semantic content analysis was chosen as the most useful technique to glean usable research data from the sample to be reviewed. Content analysis was particularly appropriate for this purpose because it reduced both data volume and semantic bias; and the data needed for this research was both voluminous and biased. The data was extracted from Air Force, Navy, Army, and CAB regulations, manuals, and technical directives. This was in addition to the data provided by the scheduled airlines. Although the CAB required some cost data to be maintained and presented in a specified format for tax and fares regulation considerations, each airline company could still determine its own internal management accounting system. Since different words and jargon were used to express similar concepts within the internal accounting systems, semantic content analysis was thus appropriate to reduce this jargon to basic concepts (4; 13). The means used to glean these

common elements from each of the diverse sources must also have been comprehensive, consistent, and useful. Content analysis has these characteristics (8:64).

Content analysis was also chosen because during the literature review, strong bias was "detected" concerning the current and future direction of several Air Force maintenance cost accounting systems. For example, during an interview, Air Force Accounting and Finance Center (AFAFC) personnel stated that the Maintenance Cost System (MCS) was accomplishing its assigned task as intended, albeit not without minor, though correctable, problems (22). HQ USAF personnel, on the other hand, stated that MCS wouldn't work and hasn't (15). Content analysis allowed for an objective evaluation of these data sources. Another reason content analysis was chosen was to counter the researchers' bias on which cost data elements were to be considered "important." Again, content analysis helped to minimize observer bias (8:55-56).

Assumptions and Limitations of Content Analysis

The "meanings" which were associated with the content by assigning them to certain categories correspond to the "meanings" implied by the communicator and/or inferred by the audience. Another content analysis assumption is that the quantitative description of communications content

was meaningful (6:19-20). In addition to these assumptions are the following limitations:

1. The content analysis technique depended on the quantity and quality of data contained in the sample.
2. Content analysis was restricted for use in answering the first two research questions.

Content Analysis Methodology

Content analysis required implementation in five phases; these were the analytic approach phase, the recording unit definition phase, the coding phase, the pilot study, and reliability testing phases (12:646-649,669-672; 21:25-26,37-38).

The first phase, the analytic approach phase, was to determine which of the two types of content analysis levels were to be used--manifest or latent. In the manifest level, the data is analyzed with regard only to what is written, without reference to intent or motive. In the latent level, on the other hand, there is an attempt to define inference or motive from "between the lines."

The second phase was to develop the definitions for the recording and context units used.

The recording unit is the smallest body of content in which a specific reference characteristic is counted (the occurrence of a single content element). The context unit is the largest content unit examined in characterizing a recording unit. The recording unit can be a phrase, a word, sentence, paragraph, article or book [21:26].

The third phase--establishing the categories and coding methodology--was "the key to success or failure" of content analysis (21:26). This phase was also the least structured portion of content analysis. There were few rules for establishing the codes. The overall codification process, however, should have been homogeneous, inclusive, useful, and mutually exclusive (12:675). Homogeneity required that the chosen categories logically relate to the variables under consideration. Inclusive meant that the coding scheme should have allowed for all conceivable variations in the data, thereby permitting all applicable data to be coded. Usefulness required that, as a modification to the inclusiveness characteristic, the code be appropriate to the variable under study. The fourth requirement, mutually exclusive, dictated that a data element fit one and only one category, not several categories simultaneously.

The fourth phase, the pilot study, was used to validate the coding format. Once the coding was tentatively established, a sample of two elements of the population was to be taken and encoded. The encoded sample was then to be analyzed to insure that no single code is so broad that the mutual exclusiveness criteria was violated. Consequently, if 5 percent or more of the total coded information were placed in a category labeled "Other," additional substantive categories were to be considered (12:669). This constituted a trial-and-error refinement process of the coding

system, so that one coding session was usually followed by an intended time lapse and then another coding session using the same data in order to gain the validity needed (12:672).

This process was also to be used to assure coder reliability, which is the fifth and final phase of content analysis and which is the "primary virtue a code must possess [12:669]."

Using the pilot study samples, several pages from a sample data source were to be chosen at random and coded by the coders--independently. The sets of codes were then to be compared. Then the percentage of the matching codes for the identical material was to be computed using the formula:

$$\text{Percentage Agreement} = \frac{\text{Identically Coded Data}}{\text{Total Units Coded}} \times 100$$

For the first two substantive digits, a 90 percent reliability must be attained, and for the first three digits, 85 percent, before a "reliability virtue" was said to be extant in the code. If the 90 or 85 percent level was not attained the first time, discussion and subsequent coder reliability tests were to be performed until the desired 85/90 percent reliability was achieved (12:679).

Content analysis application. For purposes of this research, the choice made during the analytic approach phase was to use the manifest level, in which the data were analyzed with regard only to what was said, not implied.

This level was deemed more appropriate for three reasons. First, it was imperative to avoid the introduction of bias into the data. Additionally, future use of the data by other researchers would thereby remain unencumbered by these researchers' bias. Second, the subject matter itself was not amenable to inference. Third, the research questions did not require that the rationale or "reason behind" management's choices of techniques and cost elements be discovered, only that the choices be identified.

In the second phase, the recording unit definition phase, the content unit chosen was the phrase, with the context unit the sentence. This was done because maintenance cost elements were normally found "in phrase" and not expressible in a single word.

The coding system chosen for this research during the third phase used an eight-digit number. The first digit signified whether the factor strongly influences maintenance costs in that organization or has little effect. The second digit referred to the general resource or input cost areas found in the US private capital economic system-- labor, capital (money), material, and opportunity. The third and fourth digits indicated specific subcategories of those costs that were applicable to aircraft maintenance. The last four digits of the code indicated the cost recording techniques associated with the specific cost element. The rationale for this coding scheme follows.

This research was based on the assumption that not all cost elements equally affect maintenance costs. Some organizations would depend more heavily on one or another or combinations of cost elements depending on managerial requirements and policies. The content analysis coding system in this research used the first digit to weight the cost elements and cost collection methods.

The choice of categories for use with the second digit reflects the appropriate resource categories that needed to be measured. "Cost measures the use of resources [3:306];" and the commonly accepted capital economy measurable resources are money (capital), men (labor), materials, and opportunities lost. Costs, however, must also be useful--"appropriate to the stated purposes"--which required that the resource categories be refined into the aircraft maintenance appropriate categories of labor, material (equipment and supplies), money (capital), and opportunities (whether foregone or provided for) and a miscellaneous category (3:307). The "specific" or sub-resource categories (digits 3 and 4) reflected those items or cost elements which resulted from the extensive and continuous trial-and-error refinement procedure required for coding system validation.

The cost accounting portion of the coding scheme reflected the cost accounting systems in use (digits 5, 6, and 7), as well as the specific allocation technique

(digit 8) for indirect costs. Cost accounting texts listed two systems for costing: direct and absorption. There were also two methods of accumulating those costs: job order and process. Finally, there were two bases upon which to determine the costs: actual and standard. (See Appendix A for accounting definitions.) Each of these sets of systems, accumulation methods, and bases was represented in digits 5, 6, and 7 so that any of the eight combinations could be reflected in a code (3:316-321). The eighth digit, the allocation technique, indicated the bases which might have been used to allocate any indirect costs to the maintenance function. Four allocation "bases" were in use: labor (payroll or labor hours), material, activity (e.g., sales, production), and aircraft flight hours (3:323-333). Each of the bases was reflected in the coding scheme. The definition of each of the codes in detail is contained in Appendix B.

During the fourth phase, the pilot study phase, selected portions of the CAB Uniform System of Accounts and Reports for Certificated Air Carriers (39) and TM 38-750, The Army Maintenance Management System (TAMMS) (52) were used. These sources were chosen because they each represented a major segment of the population, military and civil aircraft maintenance cost elements and techniques. The results of the pilot studies, ten in all, yielded two major changes in the coding scheme. The first change (at the

fifth coding session) resulted from more than 5 percent of supplies and equipment codes occurring in the "Other" category. As a result, three codes were added, generically labeled for "parts."¹ The second major change, at the tenth coding session, resulted in changing the cost recording techniques from two to three cost recording technique codes. This was because the original codes did not meet the inclusiveness criteria.

During the fifth, or coder reliability, phase, parts of the pilot study references were again used. The two coders each independently coded a section of the references, then compared the resultant codes for agreement. Since there are two distinct and independent portions of the code, one for cost elements and the other for techniques, it was deemed appropriate that coder reliability be established for both portions. For the first portion, cost elements, it required 21 coding sessions to achieve a 100 percent coder reliability for the first two digits and an 88 percent reliability for the first three digits. For the second, or accounting technique, portion, 12 coding sessions were necessary to establish a 92 percent reliability for the first two digits (digits 5 and 6) and 15 coder sessions

¹The researchers made other changes to the coding scheme as other maintenance literature was reviewed and coded. These changes are summarized later in this chapter.

were required to achieve an 88 percent reliability for the first three digits (digits 5, 6, and 7).

Coding Scheme Changes

As noted earlier, the researchers needed to change the coding scheme based on pilot test results. Resource categories (cost elements) were added to the coding definitions used in the pilot study due to the fact that more than 5 percent of the elements were identified as belonging in the "Other" category. An allocation recording technique was added because each air carrier develops its own internal management allocating methods; the CAB does not require a standardized "throughout-the-industry" allocation technique (39:2-1). The deletion of allocation techniques during the pilot study occurred because the researchers were unable to find two of the allocation techniques in the returned sample of air carrier maintenance cost element literature. The allocation techniques used in the pilot study coding scheme were based on the researchers' ideas on what allocation techniques the air carriers might use. A summary of the added resource codes and the added and deleted allocation techniques is found in tables 1 and 2 below. The final coding scheme is found in Appendix B.

Coding Distillation

Once the literature had been reviewed and coded, the eight-digit code strings for each organization

TABLE 1

RESOURCE CATEGORIES ADDED TO THE
PILOT STUDY CODING SCHEME

Category 1 (Labor)

115--Direct Labor, Aircraft Engines
131--Direct Labor, Inspection
132--Direct Labor, Servicing
140--Contractor Maintenance/Services

Category 2 (Capital)

210--Maintenance Buildings
215--Installed Equipment, Added Cost
216--Aircraft Depreciation
217--Aircraft Interest
218--Aircraft, Added Cost
219--Cost of Parts Retired
220--Engines, Added Cost
221--Foreign Currency
222--Engine Depreciation
291--Depreciation, Other
292--Interest, Other
293--Added Cost, Other

Category 3 (Supplies and Equipment)

324--Bench Stock, Engine
334--Parts, Engine
345--Storage Equipment
351--Weapons Equipment, On-Equipment
352--Weapons

Category 4 (Opportunity Costs)

411--Awaiting Parts
412--Awaiting Maintenance, Maintenance
Duties
413--Awaiting Maintenance, Lack of
Facilities
414--Awaiting Maintenance, Lack of Funds
415--Awaiting Maintenance, Lack of Tools
416--Awaiting Maintenance, Cannot
Duplicate Malfunction
417--Awaiting Maintenance, Lack of
People, Overload
418--Awaiting Maintenance, Non-Maintenance
Duties
419--Awaiting Maintenance, Other
420--Awaiting Maintenance, In Work

TABLE 2

ALLOCATION TECHNIQUE CODES ADDED TO/
DELETED FROM PILOT STUDY
CODING SCHEME

<u>Allocation Technique</u>	<u>Definition</u>
2	Space**
3	Number of Personnel**
6	Aircraft Hours*

*Added.

**Deleted.

(individual air carrier or military service) were entered into a computer. Two computer programs were then used to distill coded data. The first program was FORTRAN-based which listed in numerical order the resource codes and the cost recording techniques in use by the selected organization. The second program used the computer subprograms' Cross Tabs and Frequencies as found in Statistical Package for the Social Science (Version 6) (26:194-202,218-248). The second program provided tables which matched cost recording techniques with resource codes and also served to verify that no "Other" category contained 5 percent or more of the coded data.

Assumptions and Limitations of the Research

The following assumptions were made for purposes of this research:

1. Data on maintenance cost elements was available from aircraft maintenance and operating organizations, as well as regulating bodies.

2. Cost elements were uniquely identifiable in that the specific elements and cost recording techniques were a result of management decisions within the maintaining organization or by regulatory decisions that may have reflected organization size, type, and structure.

3. Unique cost elements were weighted in that the same element might be treated unequally in different organizations.

4. Data obtained from operating and maintaining organizations are applicable to USAF purposes in fulfilling the goals of MBO 9-2.

In addition to the above assumptions, the findings of this research are limited in their application in some ways. The recorded resource codes and maintenance cost recording techniques are limited by the degree of coder standardization. In addition, the findings are limited to the recording of resource codes and cost recording techniques found in a sample of military cost element literature (Appendix D), the CAB's Uniform System of Accounts and Reports for Certificated Air Carriers (39; 40; 41), and the returned sample of maintenance cost element information from air carriers.

Criteria Testing and Analysis

This research can essentially be divided into two parts, the determination of the cost elements and techniques in use (research questions 1 and 2) and the preliminary categorizing of those identified elements into the decision circumstances in which each might be more useful (research question 3).

Content analysis was chosen to provide the substance for addressing the first part of this research, by providing an unbiased "register" with which to record the type and kinds of maintenance cost elements in use and through what cost recording techniques they were provided in each organization. In this research if a data element was coded with a unique number, it stood as having answered the first two of the research questions by having identified the maintenance cost elements and techniques in use by aircraft maintaining organizations.

Once a unique set of codes was determined, the second part of the research--categorization--began. MBO 9-2 specified that maintenance cost information was required for use in two general areas. The first was to provide historical data useful for short-range logistical planning and management control; and the second was for long-range programming or strategic planning, especially for use in the weapons acquisition process. The categorization,

therefore, reflected these two potential use areas--control and programming.

As specified in the original MBO,

knowledge of actual weapons systems operating and support costs are of considerable importance in our planning process since an understanding of current weapons system costs is very helpful in making new weapons systems acquisitions decisions [5:2].

The MBO further specified that the "thrust of the effort . . . to capture the variable costs to DOD of operating and supporting its weapons systems [5:2]."

By variable cost, we don't mean an allocation of all the costs of defense against our major weapons systems, but a specific identification of those costs which vary as a result of the deployment and operation of a given weapon [5:2].

Based on the requirement to identify variable costs for weapons acquisition decisions, the categorization was determined through an analysis of each coded cost element. The analysis consisted of answering the question, Could the data element be expected to significantly change in direct consequence of an increase or decrease in the operation of the aircraft (i.e., more/less sorties or flying hours)? A positive answer indicated that the information would be more useful for management control purposes. A negative answer, however, still allows for cost information to be useful for both strategic planning and management control. In that case, therefore, to determine for which of the two, programming or control, the cost data would be more useful, the following four dimensions were considered:

a. How precise was the information?

for management control purposes the measure of the costs must . . . be more precise in order to be credible. For strategic planning, rough estimates . . . are satisfactory [2:151].

b. How direct was the causality between the effort of the organization and the cost factor?

For management control there should be a quite plausible link between the effort . . . and the output measure. For strategic planning, the connection can be more tenuous [2:151].

c. How directly responsible is an individual or organizational unit for the cost element?

For management control, the output measure must be related to the responsibility of a specific person or organizational unit. For strategic planning, this is unnecessary [2:152].

d. How timely is the cost data available after the effort has changed? "For management control, data on output must be available shortly after the event. For strategic planning this is less important [2:152]."

The questions noted above were applied to each of the resource codes to reveal whether they were more applicable for management control or programming.

Summary

Data was collected from a sample of military and civilian directives and policy statements concerning maintenance accounting systems. This data was summarized using semantic content analysis. This methodology allowed the researchers to minimize semantic bias and allowed for

efficient reduction of the volume of the data source. Data was coded into meaningful groups based on resource costs and cost recording techniques. A pilot study was used to validate the coding format and to assure the reliability of the coders. Once coded, the data was subject to computer distillation and was categorized as either "control" or "program," or both. The codes themselves identified the cost recording techniques and cost elements in use, thereby answering research questions 1 and 2. The categorization answered research question 3.

Chapter 3

OBSERVATIONS AND ANALYSIS

Overview

This chapter presents the findings gleaned from semantic content analysis of approximately 1,500 pages of military department, CAB, and airline policy statements and publications concerning aircraft maintenance cost element data at the local level. The chapter is divided into three major areas. First, there is a description of the findings from military services' publications, followed by an extensive review of the findings from civilian industry, including applicable CAB regulations. The final area is a limited analysis of the major differences between military and civilian aircraft maintenance cost element and recording schemes evidenced through the application of content analysis. This section will also include special emphasis on the differences and similarities between the Air Force and the other military departments and the Air Force and civilian industry. Finally, the analysis portion will contain a categorization of a final list of cost elements into a determination of whether each element is more applicable as management control information, program information, or both.

Observations--Military

This section presents the findings from content analysis of military directives and policy statements. The section is divided into four subsections. The first subsection contains general observations which apply to all three military services. The next three subsections present observations relating to each of the services: Air Force, Army, and Navy.

The United States military maintenance cost accounting literature which contained maintenance cost element data reviewed is found in Appendix D. The resource categories (maintenance cost elements) used by the military are presented first, followed by the in-use cost recording techniques. Finally, a cross match of the cost recording techniques and resource categories is depicted. The above information is depicted in tabular form (to allow for comparison) of which resource categories (maintenance cost elements) were in use by which service (tables 3, 4, and 5).

The resource categories recorded from military maintenance cost accounting literature are shown in table 3. Comments on the resource categories unique to one service will be presented in that particular service's discussion. Comments on the resource categories recorded by two of the three services are presented as follows. There were five resource categories which were recorded only from Navy and

TABLE 3

RESOURCE CATEGORIES (MAINTENANCE COST ELEMENTS)--
ALL MILITARY SERVICES

Resource Category and Definition	Military Service		
	Air Force	Army	Navy
<u>Labor</u>			
111--Direct Labor, Aircraft	x	x	x
112--Direct Labor, Fringe Benefit Costs	x		
113--Direct Labor, Components	x	x	x
114--Direct Labor, Non-Aircraft	x	x	x
115--Direct Labor, Aircraft Engines	x	x	x
121--Salaried Management and Staff	x		x
122--Direct Supervision	x	x	x
131--Direct Labor, Inspection	x	x	x
132--Direct Labor, Servicing	x	x	x
140--Contractor Maintenance/ Services	x		
191--Labor, Other	x		x
<u>Capital</u>			
215--Installed Equipment, Added Cost	x		
218--Aircraft, Added Cost	x		
219--Cost of Parts Retired	x		
220--Engines, Added Cost	x		
293--Added Cost, Other	x	x	
<u>Supplies and Equipment</u>			
311--Aircraft Consumable Fluids	x		
312--Aircraft Consumable Fluids, Fuel	x		
321--Bench Stock, Aircraft Airframe	x	x	
322--Bench Stock, Aircraft Component	x	x	
323--Bench Stock, Non-Aircraft	x	x	
324--Bench Stock, Engine	x	x	
331--Parts, Aircraft	x	x	x
332--Parts, Components	x	x	x
333--Parts, Non-Aircraft	x	x	x
334--Parts, Engine	x	x	x
341--Tools	x		x
342--Aircraft Support Equipment	x	x	x
343--Vehicular Support, General	x	x	x
344--Test Equipment	x	x	x
351--Weapons Equipment, On-Equipment	x	x	x

TABLE 3--Continued

Resource Category and Definition	Military Service		
	Air Force	Army	Navy
<u>Opportunity Costs</u>			
411--Awaiting Parts	x	x	x
412--Awaiting Maintenance, Maintenance Duties	x	x	x
413--Awaiting Maintenance, Lack of Facilities	x	x	x
414--Awaiting Maintenance, Lack of Funds	x	x	
415--Awaiting Maintenance, Lack of Tools	x	x	x
416--Awaiting Maintenance, Cannot Duplicate Malfunction	x		
417--Awaiting Maintenance, Lack of People, Overload	x		x
418--Awaiting Maintenance, Non-Maintenance Duties	x		x
419--Awaiting Maintenance, Other	x		
420--Awaiting Maintenance, In Work	x		
499--Extraordinary	x		
<u>Miscellaneous Costs</u>			
511--Utilities	x		
531--Administrative Supplies and Services	x		

Air Force maintenance cost element literature. Resource category: Labor, Other, was a unique code and is discussed in the Navy and Air Force comments sections. Resource categories: Labor--Salaried Management and Staff; Supplies and Equipment--Tools; Opportunity Costs--Awaiting Maintenance, Lack of People, Overload; and Opportunity Costs--Awaiting Maintenance, Non-Maintenance Duties, were not observed in and thus were not recorded from The Army Maintenance

Management System (TAMMS) technical manual (52). There were also five resource categories which were recorded only from Army and Air Force maintenance cost element literature. The four resource categories depicting bench stock were not noted in Volumes III and IV of the Naval Aviation Maintenance Program (NAMP) (53; 54). Also, resource category: Opportunity Costs--Awaiting Maintenance, Lack of Funds, was not noted in Navy maintenance cost element literature.

Thirteen cost recording techniques were recorded from military maintenance cost accounting literature. These techniques are found in table 4. Only one cost recording technique, 1/1/2/0, Direct Costing (Costing System)/Job Order Costing (Costing Method)/Actual Costing (Costing Basis)/Not Applicable (Allocation Technique) was common to all services. The resource categories associated with this cost recording technique are listed in table 5. This cost recording technique was coded from the Air Force, Army, and Navy maintenance cost element literature where maintenance jobs are documented by job order number. For example, the Air Force used an AFTO Form 349, Work Order Request; the Army used a DA Form 2407, Maintenance Request; and the Navy used an OPNAV Form 4790/40, Maintenance Action Form (50:3-3,3-4; 52:3-63; 53:3-85) (see Appendix E). Two cost recording techniques were used by two of the three services, the Air Force and the Navy. These cost recording techniques were 1/2/2/0, Direct Costing (Costing System)/Process

TABLE 4
COST RECORDING TECHNIQUES IN USE BY ALL MILITARY SERVICES

Costing System	Costing Method	Costing Basis	Allocation Technique	Military Service		
				Air Force	Army	Navy
Direct Costing (1)	Cannot be Determined (0)	Actual Costing (2)	Not Applicable (0)			x
Direct Costing (1)	Job Order Costing (1)	Cannot be Determined (0)	Not Applicable (0)		x	
Direct Costing (1)	Job Order Costing (1)	Standard Costing (1)	Not Applicable (0)		x	
Direct Costing (1)	Job Order Costing (1)	Actual Costing (2)	Not Applicable (0)	x		x
Direct Costing (1)	Process Costing (2)	Standard Costing (1)	Not Applicable (0)	x		
Direct Costing (1)	Process Costing (2)	Actual Costing (2)	Not Applicable (0)	x		x
Absorption Costing (2)	Cannot be Determined (0)	Standard Costing (1)	Cannot be Determined (0)			x
Absorption Costing (2)	Cannot be Determined (0)	Actual Costing (2)	Labor (1)			x

TABLE 4--Continued

Absorption Costing (2)	Process Costing (2)	Standard Costing (1)	Labor (1)	x
Absorption Costing (2)	Process Costing (2)	Standard Costing (1)	Activity (5)	x
Absorption Costing (2)	Process Costing (2)	Actual Costing (2)	Labor (1)	x
Absorption Costing (2)	Process Costing (2)	Actual Costing (2)	Material (4)	x
Absorption Costing (2)	Process Costing (2)	Actual Costing (2)	Activity (5)	x

TABLE 5

RESOURCE CATEGORIES ASSOCIATED WITH COST
RECORDING TECHNIQUE 1/1/2/0*--
ALL MILITARY SERVICES

Category 1 (Labor)

111--Direct Labor, Aircraft
112--Direct Labor, Fringe Benefit Costs
113--Direct Labor, Components
114--Direct Labor, Non-Aircraft
115--Direct Labor, Aircraft Engines
122--Direct Supervision
131--Direct Labor, Inspection
132--Direct Labor, Servicing
191--Labor, Other

Category 2 (Capital)

213--Installed Equipment, Depreciation
218--Aircraft, Added Cost
219--Cost of Parts Retired
220--Engines, Added Cost
293--Added Cost, Other

Category 3 (Supplies and Equipment)

311--Aircraft Consumable Fluids
312--Aircraft Consumable Fluids, Fuel
321--Bench Stock, Aircraft Airframe
322--Bench Stock, Aircraft Component
323--Bench Stock, Non-Aircraft
324--Bench Stock, Engine
331--Parts, Aircraft
332--Parts, Components
333--Parts, Non-Aircraft
334--Parts, Engine
341--Tools
342--Aircraft Support Equipment
343--Vehicular Support, General
344--Test Equipment
351--Weapons Equipment, On-Equipment

*Direct Costing (Costing System)/
Job Order Costing (Costing Method)/Actual
Costing (Costing Basis)/Not Applicable
(Allocation Technique)

TABLE 5--Continued

Category 4 (Opportunity Costs)

411--Awaiting Parts
412--Awaiting Maintenance, Maintenance
Duties
413--Awaiting Maintenance, Lack of
Facilities
414--Awaiting Maintenance, Lack of Funds
415--Awaiting Maintenance, Lack of Tools
416--Awaiting Maintenance, Cannot
Duplicate Malfunction
417--Awaiting Maintenance, Lack of
People, Overload
418--Awaiting Maintenance, Non-Maintenance
Duties
419--Awaiting Maintenance, Other
420--Awaiting Maintenance, In Work
499--Extraordinary

Costing (Costing Method)/Actual Costing (Costing Basis)/Not
Applicable (Allocation Technique), and 2/2/2/5, Absorption
Costing (Costing System)/Process Costing (Costing Method)/
Actual Costing (Costing Basis)/Activity (Allocation Tech-
nique). The resource categories related to these codes are
in tables 6 and 7. Cost recording techniques and the
related resource categories that are unique to a particular
service are presented in the discussion on that particular
service.

Of 400 bits of data related to the strength indica-
tors coded to the resource categories, 285 bits (71.3 per-
cent) were coded No Indicated Strength, 47 bits (11.8
percent) were coded Weak, and 68 bits (17.0 percent) were
coded Strong. No conclusions were drawn from this data
since the neutral indicator dominated each resource

TABLE 6

RESOURCE CATEGORIES ASSOCIATED WITH COST
RECORDING TECHNIQUE 1/2/2/5*--
AIR FORCE AND NAVY

Category 1 (Labor)

111--Direct Labor, Aircraft
113--Direct Labor, Components
114--Direct Labor, Non-Aircraft
115--Direct Labor, Aircraft Engines
131--Direct Labor, Inspection
132--Direct Labor, Servicing

Category 2 (Capital)

218--Aircraft, Added Cost
220--Engines, Added Cost
293--Added Cost, Other

Category 3 (Supplies and Equipment)

321--Bench Stock, Aircraft Airframe
322--Bench Stock, Aircraft Component
323--Bench Stock, Non-Aircraft
324--Bench Stock, Engine
331--Parts, Aircraft
332--Parts, Components
333--Parts, Non-Aircraft
334--Parts, Engine
342--Aircraft Support Equipment
343--Vehicular Support, General
344--Test Equipment

Category 4 (Opportunity Costs)

412--Awaiting Maintenance, Maintenance
Duties
413--Awaiting Maintenance, Lack of
Facilities
415--Awaiting Maintenance, Lack of Tools
418--Awaiting Maintenance, Non-Maintenance
Duties

*Direct Costing (Costing System)/
Process Costing (Costing Method)/Actual
Costing (Costing Basis)/Activity (Allocation
Technique)

TABLE 7

RESOURCE CATEGORIES ASSOCIATED WITH COST
RECORDING TECHNIQUE 2/2/2/5*--
AIR FORCE AND NAVY

Category 1 (Labor)

112--Direct Labor, Fringe Benefit Costs
113--Direct Labor, Components
114--Direct Labor, Non-Aircraft
115--Direct Labor, Aircraft Engines
122--Direct Supervision
131--Direct Labor, Inspection
132--Direct Labor, Servicing

Category 4 (Opportunity Costs)

413--Awaiting Maintenance, Lack of
Facilities
418--Awaiting Maintenance, Non-Maintenance
Duties

*Absorption Costing (Costing System)/
Process Costing (Costing Method)/Actual Cost-
ing (Costing Basis)/Activity (Allocation
Technique)

category. Furthermore, resource categories were recorded with all three strength indicators.

Observations--Air Force. Three basic USAF data sources were reviewed and coded: the 00-20 series technical orders (for titles see Appendix E), which govern the base-level aircraft cost recording system; AFM 66-1, Maintenance Management (45), which provides the policy guidance for aircraft maintenance management; and AFM 177-380, USAF Standard Base Level Maintenance Cost System (B3500) (51), which establishes and guides the aircraft maintenance cost system. The resource categories (maintenance cost elements) and

cost recording techniques gleaned from these directives are listed in tables 8 and 9.

Air Force resource categories noted during content analysis were the widest ranging of the military services. Those resource categories used at the local level were in every major category--Labor, Capital, Supplies and Equipment, Opportunity Costs, and Miscellaneous Costs--which was unlike the other services. Fifteen resource categories that were found to be costed at the lowest or base level in the Air Force were not found in the equivalent level in the other military service directives. These are in every major resource category as shown below:

a. Category 1 (Labor)

(1) 112--Direct Labor, Fringe Benefit Costs, were "actual civilian salaries and wages, including overtime and employers share of fringe benefits . . . are included in the computation . . . [51:2-15]." For Air Force military personnel, however, "The composite standard rates used do not include accrued leave, holidays, retirement and other benefits paid by the USAF for military personnel [51:2-20]."

(2) 140--Contractor Maintenance/Services were costs associated with

. . . cost of maintenance accomplished by contract, but excluding contractor facilities . . . [and the]
. . . cost of materials furnished to contractors without charge . . . [51:3-67].

TABLE 8

RESOURCE CATEGORIES (MAINTENANCE COST
ELEMENTS)--AIR FORCECategory 1 (Labor)

111--Direct Labor, Aircraft
 112--Direct Labor, Fringe Benefit Costs
 113--Direct Labor, Components
 114--Direct Labor, Non-Aircraft
 115--Direct Labor, Aircraft Engines
 121--Salaried Management and Staff
 122--Direct Supervision
 131--Direct Labor, Inspection
 132--Direct Labor, Servicing
 140--Contractor Maintenance/Services
 191--Labor, Other

Category 2 (Capital)

215--Installed Equipment, Added Cost
 218--Aircraft, Added Cost
 219--Cost of Parts Retired
 220--Engines, Added Cost
 293--Added Cost, Other

Category 3 (Supplies and Equipment)

311--Aircraft Consumable Fluids
 312--Aircraft Consumable Fluids, Fuel
 321--Bench Stock, Aircraft Airframe
 322--Bench Stock, Aircraft Component
 323--Bench Stock, Non-Aircraft
 324--Bench Stock, Engine
 331--Parts, Aircraft
 332--Parts, Components
 333--Parts, Non-Aircraft
 334--Parts, Engine
 341--Tools
 342--Aircraft Support Equipment
 343--Vehicular Support, General
 344--Test Equipment
 351--Weapons Equipment, On-Equipment

Category 4 (Opportunity Costs)

411--Awaiting Parts
 412--Awaiting Maintenance, Maintenance
 Duties
 413--Awaiting Maintenance, Lack of
 Facilities
 414--Awaiting Maintenance, Lack of Funds
 415--Awaiting Maintenance, Lack of Tools

TABLE 8--Continued

Category 4 (Opportunity Costs)

- 416--Awaiting Maintenance, Cannot Duplicate Malfunction
- 417--Awaiting Maintenance, Lack of People, Overload
- 418--Awaiting Maintenance, Non-Maintenance Duties
- 419--Awaiting Maintenance, Other
- 420--Awaiting Maintenance, In Work
- 499--Extraordinary

Category 5 (Miscellaneous Costs)

- 511--Utilities
- 531--Administrative Supplies and Services

TABLE 9

COST RECORDING TECHNIQUES IN USE BY THE AIR FORCE

Costing System	Costing Method	Costing Basis	Allocation Technique
Direct Costing (1)	Job Order Costing (1)	Actual Costing (2)	Not Applicable (0)
Direct Costing (1)	Process Costing (2)	Standard Costing (1)	Not Applicable (0)
Direct Costing (1)	Process Costing (2)	Actual Costing (2)	Not Applicable (0)
Absorption Costing (2)	Process Costing (2)	Standard Costing (1)	Labor (1)
Absorption Costing (2)	Process Costing (2)	Actual Costing (2)	Labor (1)
Absorption Costing (2)	Process Costing (2)	Actual Costing (2)	Activity (5)

b. Category 2 (Capital)

(1) 215--Installed Equipment, Added Cost, and 218--Aircraft, Added Cost, were costs associated primarily with Time Compliance Technical Order (TCTO) additions or deletions to the value of real property installed equipment and aircraft.

(2) 219--Cost of Parts Retired was associated with "disposing of expired shelf life items [44:1-9]."

(3) 220--Engines, Added Cost, was associated with engines TCTOs which are "provided by AFLC [Air Force Logistics Command] for modification of aircraft and components . . . [49:2-20]."

(4) 293--Added Cost, Other, included TCTO costs added to or deleted from the value of Precision Measuring Equipment (PME).

c. Category 3 (Supplies and Equipment)

(1) 311--Aircraft Consumable Fluids included the "cost of aviation POL [petroleum, oils, and lubricants] consumed during the month . . . for non-flying functions [51:3-74]."

(2) 312--Aircraft Consumable Fluids, Fuel, included aviation gasoline costs (51:3-74).

d. Category 4 (Opportunity Costs)

(1) 416--Awaiting Maintenance, Cannot Duplicate Malfunction, included man time and aircraft time in which

the aircraft is not operationally ready maintenance (NORM) because of an inability to locate a malfunction (45; 50).

(2) 419--Awaiting Maintenance, Other, included NORM time costs associated with TCTO/modification of calibration equipment, aircraft support equipment, and trainers (46).

(3) 420--Awaiting Maintenance, In Work, indicated costs associated with parts beginning with the "date the item was removed [46:4-3]."

(4) 499--Extraordinary (Costs) indicated time (costs) associated with work performed and equipment lost "when an aircraft or aeronautical equipment is suspected to have been contaminated [nuclear, biological, chemical] [43:1-32]."

e. Category 5 (Miscellaneous Costs)

(1) 511--Utilities indicated costs associated with rents and utilities (51:3-73).

(2) 531--Administrative Supplies and Services indicated costs and "expenses identifiable to the general and administrative (G & A) function of maintenance [51:3-67]."

The cost recording techniques coded from Air Force directives are listed in table 9. Three of these cost recording techniques were unique to the Air Force at the local level. Cost recording technique 1/2/1/0, Direct

Costing (Costing System)/Process Costing (Costing Method)/Standard Costing (Costing Basis)/Not Applicable (Allocation Technique), was coded to associate the events connected with the Air Force's Maintenance Data Collection System which allowed for ". . . documentation of a monthly accumulation of man-hours against a specific task [50:6-1]."

Cost recording technique 2/2/1/1, Absorption Costing (Costing System)/Process Costing (Costing Method)/Standard Costing (Costing Basis)/Labor (Allocation Technique), was recorded to indicate supervisory labor costs which are ". . . distributed to the MDS/TMS [mission, design, and series/type, model, and series] based on the ratio of direct labor hours [51:2-12]."

Cost recording technique 2/2/2/1, Absorption Costing (Costing System)/Process Costing (Costing Method)/Actual Costing (Costing Basis)/Labor (Allocation Technique), was recorded to indicate costs directly attributable to leave, temporary duty, and details, which are ". . . distributed to the MDS/TMS based on the ratio of direct labor hours [51:2-12]."

A match of the Air Force's resource categories with the various cost recording techniques is depicted in table 10.

Two features were gleaned from computer analysis of the Air Force coded data. First, of the 226 bits of data coded to the resource categories from Air Force cost element

TABLE 10

RESOURCE CATEGORIES ASSOCIATED WITH
COST RECORDING TECHNIQUES--
AIR FORCE

1/1/2/0--Direct Costing (Costing System)/
Job Order Costing (Costing Method)/
Actual Costing (Costing Basis)/Not
Applicable (Allocation Technique)

Category 1 (Labor)

111--Direct Labor, Aircraft
113--Direct Labor, Components
114--Direct Labor, Non-Aircraft
115--Direct Labor, Aircraft Engines
131--Direct Labor, Inspection
132--Direct Labor, Servicing
191--Labor, Other

Category 2 (Capital)

215--Installed Equipment, Added Cost
218--Aircraft, Added Cost
219--Cost of Parts Retired
220--Engines, Added Cost
293--Added Cost, Other

Category 3 (Supplies and Equipment)

311--Aircraft Consumable Fluids
312--Aircraft Consumable Fluids, Fuel
321--Bench Stock, Aircraft Airframe
322--Bench Stock, Aircraft Component
323--Bench Stock, Non-Aircraft
324--Bench Stock, Engine
331--Parts, Aircraft
332--Parts, Components
333--Parts, Non-Aircraft
334--Parts, Engine
341--Tools
342--Aircraft Support Equipment
344--Test Equipment
351--Weapons Equipment, On-Equipment

Category 4 (Opportunity Costs)

411--Awaiting Parts
412--Awaiting Maintenance, Maintenance
Duties
413--Awaiting Maintenance, Lack of
Facilities
414--Awaiting Maintenance, Lack of Funds
415--Awaiting Maintenance, Lack of Tools

TABLE 10--Continued

Category 4 (Opportunity Costs)

416--Awaiting Maintenance, Cannot Duplicate Malfunction
417--Awaiting Maintenance, Lack of People, Overload
418--Awaiting Maintenance, Non-Maintenance Duties
419--Awaiting Maintenance, Other
420--Awaiting Maintenance, In Work
499--Extraordinary

1/2/1/0--Direct Costing (Costing System)/
Process Costing (Costing Method)/
Standard Costing (Costing Basis)/
Not Applicable (Allocation Technique)

Category 1 (Labor)

111--Direct Labor, Aircraft

Category 3 (Supplies and Equipment)

342--Aircraft Support Equipment

1/2/2/0--Direct Costing (Costing System)/
Process Costing (Costing Method)/
Actual Costing (Costing Basis)/ Not
Applicable (Allocation Technique)

Category 1 (Labor)

111--Direct Labor, Aircraft
113--Direct Labor, Components
114--Direct Labor, Non-Aircraft
115--Direct Labor, Aircraft Engines
131--Direct Labor, Inspection
132--Direct Labor, Servicing

Category 2 (Capital)

218--Aircraft, Added Cost
220--Engines, Added Cost
293--Added Cost, Other

Category 3 (Supplies and Equipment)

321--Bench Stock, Aircraft Airframe
322--Bench Stock, Aircraft Component
323--Bench Stock, Non-Aircraft
324--Bench Stock, Engine
331--Parts, Aircraft
332--Parts, Components
333--Parts, Non-Aircraft

TABLE 10--Continued

Category 3 (Supplies and Equipment)

334--Parts, Engine
342--Aircraft Support Equipment
343--Vehicular Support, General
344--Test Equipment

Category 4 (Opportunity Costs)

412--Awaiting Maintenance, Maintenance
Duties
413--Awaiting Maintenance, Lack of
Facilities
415--Awaiting Maintenance, Lack of Tools
418--Awaiting Maintenance, Non-Maintenance
Duties

2/2/1/1--Absorption Costing (Costing System)/
Process Costing (Costing Method)/
Standard Costing (Costing Basis)/
Labor (Allocation Technique)

Category 1 (Labor)

111--Direct Labor, Aircraft
113--Direct Labor, Components
114--Direct Labor, Non-Aircraft
115--Direct Labor, Aircraft Engines
121--Salaried Management and Staff
122--Direct Supervision
131--Direct Labor, Inspection
132--Direct Labor, Servicing

2/2/2/1--Absorption Costing (Costing System)/
Process Costing (Costing Method)/
Actual Costing (Costing Basis)/Labor
(Allocation Technique)

Category 1 (Labor)

111--Direct Labor, Aircraft
112--Direct Labor, Fringe Benefit Costs
113--Direct Labor, Components
114--Direct Labor, Non-Aircraft
115--Direct Labor, Aircraft Engines
121--Salaried Management and Staff
122--Direct Supervision
140--Contractor Maintenance/Services

Category 2 (Capital)

220--Engines, Added Cost

TABLE 10--Continued

Category 3 (Supplies and Equipment)

311--Aircraft Consumable Fluids
312--Aircraft Consumable Fluids, Fuel
321--Bench Stock, Aircraft Airframe
322--Bench Stock, Aircraft Component
323--Bench Stock, Non-Aircraft
324--Bench Stock, Engine
331--Parts, Aircraft
332--Parts, Components
334--Parts, Engine
341--Tools

Category 4 (Opportunity Costs)

412--Awaiting Maintenance, Maintenance
Duties
418--Awaiting Maintenance, Non-Maintenance
Duties

Category 5 (Miscellaneous Costs)

511--Utilities
531--Administrative Supplies and Services

2/2/2/5--Absorption Costing (Costing System)/
Process Costing (Costing Method)/
Actual Costing (Costing Basis)/Activ-
ity (Allocation Technique)

Category 1 (Labor)

112--Direct Labor, Fringe Benefit Costs
115--Direct Labor, Aircraft Engines
131--Direct Labor, Inspection
132--Direct Labor, Servicing

Category 4 (Opportunity Costs)

413--Awaiting Maintenance, Lack of
Facilities
418--Awaiting Maintenance, Non-Maintenance
Duties

literature, 132 bits (58.4 percent) were coded No Indicated Strength, 42 bits (18.6 percent) were coded Weak, and 52 bits (23.0 percent) were coded Strong. No conclusions could be drawn about which resource categories were more important since the same resource category might be coded

Weak, Strong, and Neutral. Second, because of the wide range of resource categories coded from Air Force maintenance cost element data, the Air Force more nearly approximated the civilian scheme than did the other services. More specifically, the Air Force costs, at the local level, had more emphasis in Opportunity and Capital Costs than did the Army and the Navy schemes.

Observations--Army. The Army Maintenance Management System (TAMMS) technical manual, the purpose of which was to prescribe equipment record-keeping procedures, was reviewed and coded (50:1-1). The codes and consequent resource categories (maintenance cost elements) and cost recording techniques, plus appropriate comments, are presented below.

The resource categories recorded are found in table 11. All of these resource categories, except one, were also found in the Navy and Air Force maintenance cost element literature. Resource Category 293 (Added Cost, Other) was recorded with reference to warranty claim actions dealing with assemblies, which are other than parts or components (52:3-37).

Cost recording techniques used by the Army which were recorded are found in table 12. Cost recording technique 1/1/0/0, Direct Costing (Costing System)/Job Order Costing (Costing Method)/Cannot be Determined (Costing

TABLE 11

RESOURCE CATEGORIES (MAINTENANCE
COST ELEMENTS)--ARMY

Category 1 (Labor)

111--Direct Labor, Aircraft
113--Direct Labor, Components
114--Direct Labor, Non-Aircraft
115--Direct Labor, Aircraft Engines
122--Direct Supervision
131--Direct Labor, Inspection
132--Direct Labor, Servicing

Category 2 (Capital)

293--Added Cost, Other

Category 3 (Supplies and Equipment)

321--Bench Stock, Aircraft Airframe
322--Bench Stock, Aircraft Component
323--Bench Stock, Non-Aircraft
324--Bench Stock, Engine
331--Parts, Aircraft
332--Parts, Components
333--Parts, Non-Aircraft
334--Parts, Engine
342--Aircraft Support Equipment
343--Vehicular Support, General
344--Test Equipment
351--Weapons Equipment, On-Equipment

Category 4 (Opportunity Costs)

411--Awaiting Parts
412--Awaiting Maintenance, Maintenance
Duties
413--Awaiting Maintenance, Lack of
Facilities
414--Awaiting Maintenance, Lack of Funds
415--Awaiting Maintenance, Lack of Tools

Basis)/Not Applicable (Allocation Technique), and cost recording technique 1/1/1/0, Direct Costing (Costing System)/Job Order Costing (Costing Method)/Standard Costing (Costing Basis)/Not Applicable (Allocation Technique), were unique to the Army. Cost recording technique 1/1/0/0 was

TABLE 12

COST RECORDING TECHNIQUES IN USE BY THE ARMY

Costing System	Costing Method	Costing Basis	Allocation Technique
Direct Costing (1)	Job Order Costing (1)	Cannot be Determined (0)	Not Applicable (0)
Direct Costing (1)	Job Order Costing (1)	Standard Costing (1)	Not Applicable (0)
Direct Costing (1)	Job Order Costing (1)	Actual Costing (2)	Not Applicable (0)

recorded with reference to the Army's Exchange Tag (DA Form 2402). This tag was used ". . . as an identification tag for equipment improvement recommendation (EIR) and warranty claim exhibits [52:3-1]." The costing basis could not be determined; however, through the Army's DA Form 2407, Maintenance Request, and the cross-referencing of the tag job number and the Form 2407 job number, direct labor was actual costed. Cost recording technique 1/1/1/0 was recorded with reference to warranty claims where man-hours required for the task of replacing defective parts were recorded using a job standard (52:3-37).

A match of the Army's resource codes with the various cost recording techniques is depicted in table 13.

Of the 109 bits of data recorded from Army maintenance cost element literature, 89 bits (81.7 percent) were coded No Indicated Strength, 4 bits (3.7 percent) were

TABLE 13

RESOURCE CATEGORIES ASSOCIATED WITH
COST RECORDING TECHNIQUES--ARMY

1/1/0/0--Direct Costing (Costing System)/
Job Order Costing (Costing Method)/
Cannot be Determined (Costing Basis)/
Not Applicable (Allocation Technique)

Category 3 (Supplies and Equipment)

332--Parts, Components

344--Test Equipment

1/1/1/0--Direct Costing (Costing System)/
Job Order Costing (Costing Method)/
Standard Costing (Costing Basis)/
Not Applicable (Allocation Technique)

Category 2 (Capital)

293--Added Cost, Other

Category 3 (Supplies and Equipment)

331--Parts, Aircraft

332--Parts, Components

333--Parts, Non-Aircraft

1/1/2/0--Direct Costing (Costing System)/
Job Order Costing (Costing Method)/
Actual Costing (Costing Basis)/Not
Applicable (Allocation Technique)

Category 1 (Labor)

111--Direct Labor, Aircraft

113--Direct Labor, Components

114--Direct Labor, Non-Aircraft

115--Direct Labor, Aircraft Engines

122--Direct Supervision

131--Direct Labor, Inspection

132--Direct Labor, Servicing

Category 2 (Capital)

293--Added Cost, Other

Category 3 (Supplies and Equipment)

321--Bench Stock, Aircraft Airframe

322--Bench Stock, Aircraft Component

323--Bench Stock, Non-Aircraft

324--Bench Stock, Engine

331--Parts, Aircraft

332--Parts, Components

TABLE 13--Continued

Category 3 (Supplies and Equipment)

333--Parts, Non-Aircraft
334--Parts, Engine
342--Aircraft Support Equipment
343--Vehicular Support, General
351--Weapons Equipment, On-Equipment

Category 4 (Opportunity Costs)

411--Awaiting Parts
412--Awaiting Maintenance, Maintenance
Duties
413--Awaiting Maintenance, Lack of
Facilities
414--Awaiting Maintenance, Lack of Funds
415--Awaiting Maintenance, Lack of Tools

coded Weak, and 16 bits (14.7 percent) were coded Strong. No conclusions could be drawn about which resource categories were more important as compared to one another.

Observations--Navy. The four volumes of the United States Navy's Naval Aviation Maintenance Program (NAMP) were reviewed and coded. Two of the four volumes, Volume III, Maintenance Data Collection Subsystem; and Volume IV, Machine Records, Reports, and Data Analysis (53; 54); contained maintenance cost element data applicable to this study. The resource categories and maintenance cost elements used by the Navy are presented first, followed by the cost recording techniques which were in use; then a match of the cost recording techniques and resource categories is depicted.

The resource categories recorded are found in table 14. None of the 24 resource categories recorded from

TABLE 14

RESOURCE CATEGORIES (MAINTENANCE
COST ELEMENTS)--NAVY

Category 1 (Labor)

111--Direct Labor, Aircraft
 113--Direct Labor, Components
 114--Direct Labor, Non-Aircraft
 115--Direct Labor, Aircraft Engines
 121--Salaried Management and Staff
 122--Direct Supervision
 131--Direct Labor, Inspection
 132--Direct Labor, Servicing
 191--Labor, Other

Category 3 (Supplies and Equipment)

331--Parts, Aircraft
 332--Parts, Components
 333--Parts, Non-Aircraft
 334--Parts, Engine
 341--Tools
 342--Aircraft Support Equipment
 343--Vehicular Support, General
 344--Test Equipment
 351--Weapons Equipment, On-Equipment

Category 4 (Opportunity Costs)

411--Awaiting Parts
 412--Awaiting Maintenance, Maintenance
 Duties
 413--Awaiting Maintenance, Lack of
 Facilities
 415--Awaiting Maintenance, Lack of Tools
 417--Awaiting Maintenance, Lack of
 People, Overload
 418--Awaiting Maintenance, Non-Maintenance
 Duties

Navy references were unique to the Navy as compared to the Air Force and the Army. Resource Category 191 (Labor, Other) was recorded three times. Each Category 191 reflected the Navy's man-hour accounting where the Navy reports exceptions to a forty-hour work week (54:2-1).

Cost recording techniques used by the Navy which were recorded are found in table 15. A summary of the cost recording techniques unique to the Navy follows. Cost recording technique 1/0/2/0, Direct Costing (Costing System)/Cannot be Determined (Costing Method)/Actual Costing (Costing Basis)/Not Applicable (Allocation Technique), was recorded with reference to the Navy's Personnel Utilization Chart. This chart provides Navy managers with an overall picture of how their personnel are being employed and allows them to compare current utilization rates with pre-determined goals (54:4-5). Cost recording technique 2/0/1/0, Absorption Costing (Costing System)/Cannot be Determined (Costing Method)/Standard Costing (Costing Basis)/Cannot be Determined (Allocation Technique), was recorded with reference to the Navy's man-hour accounting system when the Navy records exceptions to a standard forty-hour week (53:2-1--2+3). Cost recording technique 2/0/2/1, Absorption Costing (Costing System)/Cannot be Determined (Costing Method)/Actual Costing (Costing Basis)/Labor (Allocation Technique), also relates to the Navy's man-hour accounting system. This cost recording technique was recorded to reflect the actual hours (exceptions) to the standard forty-hour week used by the Navy. Cost recording technique 2/2/1/5, Absorption Costing (Costing System)/Process Costing (Costing Method)/Standard Costing (Costing Basis)/Activity (Allocation Technique), was recorded to

TABLE 15

COST RECORDING TECHNIQUES IN USE BY THE NAVY

Costing System	Costing Method	Costing Basis	Allocation Technique
Direct Costing (1)	Cannot be Determined (0)	Actual Costing (2)	Not Applicable (0)
Direct Costing (1)	Job Order Costing (1)	Actual Costing (2)	Not Applicable (0)
Direct Costing (1)	Process Costing (2)	Actual Costing (2)	Not Applicable (0)
Absorption Costing (2)	Cannot be Determined (0)	Standard Costing (1)	Cannot be Determined (0)
Absorption Costing (2)	Cannot be Determined (0)	Actual Costing (2)	Labor (1)
Absorption Costing (2)	Process Costing (2)	Standard Costing (1)	Activity (5)
Absorption Costing (2)	Process Costing (2)	Actual Costing (2)	Activity (5)

reflect information found in the Navy's System and Component Maintenance Report (MDR-5). This report allows Navy managers to compare man-hours used in the upkeep of each specific type of equipment to determine average man-hours of maintaining/servicing a particular type of equipment, system, or subsystem (54:3-9). Cost recording technique 2/2/2/5, Absorption Costing (Costing System)/Process Costing (Costing Method)/Actual Costing (Costing Basis)/Activity (Allocation Technique), was recorded to reflect the actual number of man-hours expended on a particular type

aircraft by a particular activity/work center. The work center manager can see how much, in man-hours, his work center adds to the overall cost of maintaining a particular type of aircraft (54:4-9--4-10).

A match of the Navy's resource categories with the various cost recording techniques is depicted in table 16.

Of the 65 bits of data recorded from Navy maintenance cost element literature, 64 bits (98.5 percent) were coded No Indicated Strength and 1 bit (1.5 percent) was coded Weak. The Weak Code was recorded with reference to the Navy's man-hour accounting system. "Man-hour accounting is optional, at the direction of the cognizant Type Commander. However, all activities are required to maintain a Master Roster . . . [53:2-1]."

Observations--Civil Aviation

In the second of the three major areas considered in this chapter is presented the information gained from published directives or letters from the civilian portion of the air transportation industry. This includes the review of data from both the airlines and their regulatory agency--the CAB. This section will therefore be divided into two major subareas, (1) the CAB and (2) civil air carriers. Within each are presented the findings concerning the resources and accounting techniques in use.

TABLE 16

RESOURCE CATEGORIES ASSOCIATED WITH
COST RECORDING TECHNIQUES--NAVY

1/0/2/0--Direct Costing (Costing System)/
Cannot be Determined (Costing
Method)/Actual Costing (Costing
Basis)/Not Applicable (Allocation
Technique)

Category 4 (Opportunity Costs)

412--Awaiting Maintenance, Maintenance
Duties
413--Awaiting Maintenance, Lack of
Facilities
414--Awaiting Maintenance, Lack of Funds
418--Awaiting Maintenance, Non-Maintenance
Duties

1/1/2/0--Direct Costing (Costing System)/
Job Order Costing (Costing Method)/
Actual Costing (Costing Basis)/Not
Applicable (Allocation Technique)

Category 1 (Labor)

111--Direct Labor, Aircraft
113--Direct Labor, Components
114--Direct Labor, Non-Aircraft
115--Direct Labor, Aircraft Engines
122--Direct Supervision
131--Direct Labor, Inspection
132--Direct Labor, Servicing

Category 3 (Supplies and Equipment)

331--Parts, Aircraft
332--Parts, Components
333--Parts, Non-Aircraft
334--Parts, Engine
341--Tools
342--Aircraft Support Equipment
343--Vehicular Support, General
344--Test Equipment
351--Weapons Equipment, On-Equipment

Category 4 (Opportunity Costs)

411--Awaiting Parts
412--Awaiting Maintenance, Maintenance
Duties
413--Awaiting Maintenance, Lack of
Facilities

TABLE 16--Continued

Category 4 (Opportunity Costs)

415--Awaiting Maintenance, Lack of Tools

417--Awaiting Maintenance, Lack of
People, Overload

1/2/2/0--Direct Costing (Costing System)/
Process Costing (Costing Method)/
Actual Costing (Costing Basis)/Not
Applicable (Allocation Technique)

Category 1 (Labor)

111--Direct Labor, Aircraft

113--Direct Labor, Components

114--Direct Labor, Non-Aircraft

122--Direct Supervision

Category 3 (Supplies and Equipment)

342--Aircraft Support Equipment

2/0/1/0--Absorption Costing (Costing Sys-
tem)/Cannot be Determined (Costing
Method)/Standard Costing (Costing
Basis)/Cannot be Determined (Allo-
cation Technique)

Category 1 (Labor)

191--Labor, Other

2/0/2/1--Absorption Costing (Costing Sys-
tem)/Cannot be Determined (Costing
Method)/Actual Costing (Costing
Basis)/Labor (Allocation Technique)

Category 1 (Labor)

111--Direct Labor, Aircraft

113--Direct Labor, Components

114--Direct Labor, Non-Aircraft

121--Salaried Management and Staff

122--Direct Supervision

191--Labor, Other

TABLE 16--Continued

2/2/1/5--Absorption Costing (Costing System)/Process Costing (Costing Method)/Standard Costing (Costing Basis)/Activity (Allocation Technique)

Category 1 (Labor)

111--Direct Labor, Aircraft
113--Direct Labor, Components

2/2/2/5--Absorption Costing (Costing System)/Process Costing (Costing Method)/Actual Costing (Costing Basis)/Activity (Allocation Technique)

Category 1 (Labor)

113--Direct Labor, Components
114--Direct Labor, Non-Aircraft
122--Direct Supervision

Observations--Civil Aeronautics Board. The CAB's Uniform System of Accounts and Reports for Certificated Air Carriers (39) and the CAB Regulations ER-980 (40) and ER-986 (41) were reviewed and coded. The resource codes and maintenance cost elements required for use by the CAB are presented first, followed by the cost recording techniques which were required; then a match of the cost recording techniques and resource categories is depicted. Applicable comments are presented for each area.

The resource categories recorded are found in table 17. The CAB required the specific cost breakout of Maintenance Buildings (Resource Category 210). Also, CAB required the breakout of depreciation and interest accounts. These areas of costs were reflected in Resource Categories

TABLE 17

RESOURCE CATEGORIES (MAINTENANCE COST
ELEMENTS)--CIVIL AERONAUTICS BOARD

Category 1 (Labor)

111--Direct Labor, Aircraft
 112--Direct Labor, Fringe Benefit Costs
 113--Direct Labor, Components
 114--Direct Labor, Non-Aircraft
 115--Direct Labor, Aircraft Engines
 131--Direct Labor, Inspection
 132--Direct Labor, Servicing

Category 2 (Capital)

210--Maintenance Buildings
 211--Maintenance Buildings, Depreciation
 212--Maintenance Buildings, Interest
 214--Installed Equipment, Interest
 215--Installed Equipment, Added Cost
 216--Aircraft Depreciation
 217--Aircraft Interest
 218--Aircraft, Added Cost
 219--Cost of Parts Retired
 221--Foreign Currency
 222--Engine Depreciation
 291--Depreciation, Other
 292--Interest, Other
 293--Added Cost, Other

Category 3 (Supplies and Equipment)

300--Custodial Supplies
 311--Aircraft Consumable Fluids
 312--Aircraft Consumable Fluids, Fuel
 321--Bench Stock, Aircraft Airframe
 322--Bench Stock, Aircraft Component
 323--Bench Stock, Non-Aircraft
 324--Bench Stock, Engine
 331--Parts, Aircraft
 332--Parts, Components
 333--Parts, Non-Aircraft
 334--Parts, Engine
 341--Tools
 342--Aircraft Support Equipment
 343--Vehicular Support, General
 344--Test Equipment
 345--Storage Equipment

TABLE 17--Continued

Category 4 (Opportunity Costs)

418--Awaiting Maintenance, Non-Maintenance
Duties

421--Research and Development

Category 5 (Miscellaneous Costs)

511--Utilities

531--Administrative Supplies and Services

211 (Maintenance Buildings, Depreciation), 212 (Maintenance Buildings, Interest), 213 (Installed Equipment, Depreciation), 214 (Installed Equipment, Interest), 216 (Aircraft Depreciation), 217 (Aircraft Interest), 222 (Engine Depreciation), 291 (Depreciation, Other), and 292 (Interest, Other). Engine Interest was not seen in CAB literature and thus was not recorded. The method for computing depreciation is left to the air carriers themselves. However, the CAB stipulates that

. . . each air carrier shall file with the Civil Aeronautics Board a statement which shall clearly and completely describe for each classification of property and equipment the methods, service lives, and residual values used for computing depreciation on the different subcategories of property or equipment included therein. This statement shall be sufficiently descriptive to permit a pro forma construction of the depreciation calculation of each accounting period and shall include identification of those categories depreciated on a unit basis and those categories depreciated on a group basis, as well as the mathematical bases employed for allocating applicable costs to the different accounting periods [39:2-7].

Taxes as maintenance cost elements were not recorded.

Fourteen cost recording techniques were recorded from CAB maintenance cost accounting literature. These techniques are found in table 18. Cost recording techniques 0/0/1/0, Cannot be Determined (Costing System)/Cannot be Determined (Costing Method)/Standard Costing (Costing Basis)/Cannot be Determined (Allocation Technique), and 0/0/2/0, Cannot be Determined (Costing System)/Cannot be Determined (Costing Method)/Actual Costing (Costing Basis)/Cannot be Determined (Allocation Technique), were both recorded with reference to foreign currency transactions. Actual gains or losses due to foreign currency transactions were required to be recorded in an Incidental Revenue Account per CAB direction (39:2-2). Cost recording techniques 1/0/1/0, Direct Costing (Costing System)/Cannot be Determined (Costing Method)/Standard Costing (Costing Basis)/Not Applicable (Allocation Technique), and 1/0/2/0, Direct Costing (Costing System)/Cannot be Determined (Costing Method)/Actual Costing (Costing Basis)/Not Applicable (Allocation Technique), were recorded with reference to the capitalization of interest. Interest capitalized is required to be recorded directly to equipment/buildings based on an interest rate

. . . representative of the current rate for long-term debt of the carrier. . . . Interest may be capitalized on funds actually employed in developmental and preoperating projects other than property acquisitions and construction up to the date the related operations are initiated [39:2-5].

TABLE 18
COST RECORDING TECHNIQUES IN USE BY THE CIVIL AERONAUTICS BOARD

Costing System	Costing Method	Costing Basis	Allocation Technique
Cannot be Determined (0)	Cannot be Determined (0)	Standard Costing (1)	Cannot be Determined (0)
Cannot be Determined (0)	Cannot be Determined (0)	Actual Costing (2)	Cannot be Determined (0)
Direct Costing (1)	Cannot be Determined (0)	Standard Costing (1)	Not Applicable (0)
Direct Costing (1)	Cannot be Determined (0)	Actual Costing (2)	Not Applicable (0)
Direct Costing (1)	Job Order Costing (1)	Standard Costing (1)	Not Applicable (0)
Direct Costing (1)	Job Order Costing (1)	Actual Costing (2)	Not Applicable (0)
Direct Costing (1)	Process Costing (2)	Actual Costing (2)	Not Applicable (0)
Absorption Costing (2)	Cannot be Determined (0)	Cannot be Determined (0)	Labor (1)
Absorption Costing (2)	Cannot be Determined (0)	Standard Costing (1)	Cannot be Determined (0)

TABLE 18--Continued

Absorption Costing (2)	Cannot be Determined (0)	Actual Costing (2)	Cannot be Determined (0)
Absorption Costing (2)	Job Order Costing (1)	Standard Costing (1)	Cannot be Determined (0)
Absorption Costing (2)	Process Costing (2)	Standard Costing (1)	Cannot be Determined (0)
Absorption Costing (2)	Process Costing (2)	Actual Costing (2)	Cannot be Determined (0)
Absorption Costing (2)	Process Costing (2)	Actual Costing (2)	Material (4)

Cost recording technique 2/0/0/1, Absorption Costing (Costing System)/Cannot be Determined (Costing Method)/Cannot be Determined (Costing Basis)/Labor (Allocation Technique), was recorded with Resource Category 418 (Awaiting Maintenance, Non-Maintenance Duties). This cost recording technique related to CAB's profit and loss classification scheme, thus the two 0 codes (39:7-1). Cost recording technique 2/0/1/0, Absorption Costing (Costing System)/Cannot be Determined (Costing Method)/Standard Costing (Costing Basis)/Cannot be Determined (Allocation Technique), was recorded from CAB agreement to air carriers' complaints so as not to have to figure United States dollar equivalency of each and every foreign currency transaction (40:8,9). It was also used to reflect estimates of liability for accrued vacation or dismissal compensation where the precise liability was not determined (39:2-2). Cost recording technique 2/2/1/0, Absorption Costing (Costing System)/Process Costing (Costing Method)/Standard Costing (Costing Basis)/Cannot be Determined (Allocation Technique), was used for the gaining of an airframe (39:23-24).

The reason for the allocation technique being coded Cannot be Determined with the Absorption Costing System was due to CAB's not requiring air carriers to use a standardized "throughout-the-industry" allocation technique. The general accounting policy for establishing a basis of allocation between entities is as follows:

For purposes of this Uniform System of Accounts and Reports, all revenues shall be assigned to or apportioned between accounting entities on bases which will fully recognize the services provided by each entity, and expenses, or costs, shall be apportioned between accounting entities on such bases as will result:

(1) With respect to transport-related services, in the assignment thereto of proportionate direct overheads, as well as direct labor and materials, of the applicable expense functions prescribed by this system of accounts and reports, and (2) with respect to separate ventures, in the assignment thereto of proportional general and administrative overheads as well as the direct overheads, labor, and materials [39:2-1].

More specifically, Section 2-2, Distribution of Revenues and Expenses within Entities, stated,

(a) Revenues and expenses attributable to a single natural objective account or functional classification shall be assigned accordingly.

(b) Revenue and expense items which are common to two or more natural objective accounts shall be recorded in the objective accounts to which they predominantly relate.

(c) Expense items contributing to more than one function shall be charged to the general overhead functions to which applicable except that where only incidental contribution is made to more than a single function an item may be included in the function to which primarily related, provided such function is not distorted by including an aggregation of amounts applicable to other functions. When assignment of expense items on the basis of the primary activity to which related does not in the aggregate result in a fair presentation of the expenses applicable to each function, apportionment shall be made between functions based upon a study of the contribution to each function during a representative period [39:2-1].

The CAB required that,

. . . each air carrier shall file a statement with the Civil Aeronautics Board which details the practices and techniques used in directly assigning and prorating revenues and expenses, or costs . . . [39:2-1].

A match of the CAB's resource categories with the various cost recording techniques is depicted in table 19.

TABLE 19

RESOURCE CATEGORIES ASSOCIATED WITH
COST RECORDING TECHNIQUES--
CIVIL AERONAUTICS BOARD

0/0/1/0--Cannot be Determined (Costing System)/Cannot be Determined (Costing Method)/Standard Costing (Costing Basis)/Cannot be Determined (Allocation Technique)

Category 2 (Capital)
221--Foreign Currency

0/0/2/0--Cannot be Determined (Costing System)/Cannot be Determined (Costing Method)/Actual Costing (Costing Basis)/Cannot be Determined (Allocation Technique)

Category 2 (Capital)
221--Foreign Currency

1/0/1/0--Direct Costing (Costing System)/Cannot be Determined (Costing Method)/Standard Costing (Costing Basis)/Not Applicable (Allocation Technique)

Category 2 (Capital)
212--Maintenance Buildings, Interest
214--Installed Equipment, Interest
217--Aircraft Interest

1/0/2/0--Direct Costing (Costing System)/Cannot be Determined (Costing Method)/Actual Costing (Costing Basis)/Not Applicable (Allocation Technique)

Category 4 (Opportunity Costs)
421--Research and Development

TABLE 19--Continued

1/1/1/0--Direct Costing (Costing System)/
Job Order Costing (Costing Method)/
Standard Costing (Costing Basis)/Not
Applicable (Allocation Technique)

Category 1 (Labor)

132--Direct Labor, Servicing

Category 2 (Capital)

215--Installed Equipment, Added Cost

218--Aircraft, Added Cost

Category 3 (Supplies and Equipment)

324--Bench Stock, Engine

334--Parts, Engine

342--Aircraft Support Equipment

1/1/2/0--Direct Costing (Costing System)/
Job Order Costing (Costing Method)/
Actual Costing (Costing Basis)/Not
Applicable (Allocation Technique)

Category 1 (Labor)

111--Direct Labor, Aircraft

113--Direct Labor, Components

115--Direct Labor, Aircraft Engines

131--Direct Labor, Inspection

132--Direct Labor, Servicing

Category 2 (Capital)

215--Installed Equipment, Added Cost

218--Aircraft, Added Cost

219--Cost of Parts Retired

Category 3 (Supplies and Equipment)

311--Aircraft Consumable Fluids

312--Aircraft Consumable Fluids, Fuel

321--Bench Stock, Aircraft Airframe

322--Bench Stock, Aircraft Component

323--Bench Stock, Non-Aircraft

324--Bench Stock, Engine

331--Parts, Aircraft

332--Parts, Components

333--Parts, Non-Aircraft

334--Parts, Engine

341--Tools

345--Storage Equipment

TABLE 19--Continued

1/2/2/0--Direct Costing (Costing System)/
Process Costing (Costing Method)/
Actual Costing (Costing Basis)/Not
Applicable (Allocation Technique)

Category 2 (Capital)

291--Depreciation, Other
293--Added Cost, Other

Category 3 (Supplies and Equipment)

311--Aircraft Consumable Fluids
312--Aircraft Consumable Fluids, Fuel
341--Tools
345--Storage Equipment

2/0/0/1--Absorption Costing (Costing Sys-
tem)/Cannot be Determined (Costing
Method)/Cannot be Determined (Cost-
ing Basis)/Labor (Allocation
Technique)

Category 4 (Opportunity Costs)

418--Awaiting Maintenance, Non-Maintenance
Duties

2/0/1/0--Absorption Costing (Costing Sys-
tem)/Cannot be Determined (Costing
Method)/Standard Costing (Costing
Basis)/Cannot be Determined (Allo-
cation Technique)

Category 1 (Labor)

112--Direct Labor, Fringe Benefit Costs

Category 2 (Capital)

221--Foreign Currency

2/0/2/0--Absorption Costing (Costing Sys-
tem)/Cannot be Determined (Costing
Method)/Actual Costing (Costing
Basis)/Cannot be Determined (Allo-
cation Technique)

Category 1 (Labor)

112--Direct Labor, Fringe Benefit Costs
114--Direct Labor, Non-Aircraft

TABLE 19--Continued

Category 2 (Capital)

217--Aircraft Interest
219--Cost of Parts Retired

Category 3 (Supplies and Equipment)

311--Aircraft Consumable Fluids
312--Aircraft Consumable Fluids, Fuel
322--Bench Stock, Aircraft Component
323--Bench Stock, Non-Aircraft
331--Parts, Aircraft
332--Parts, Components
333--Parts, Non-Aircraft

2/1/1/0--Absorption Costing (Costing System)/Job Order Costing (Costing Method)/Standard Costing (Costing Basis)/Cannot be Determined (Allocation Technique)

Category 2 (Capital)

216--Aircraft Depreciation

2/2/1/0--Absorption Costing (Costing System)/Process Costing (Costing Method)/Standard Costing (Costing Basis)/Cannot be Determined (Allocation Technique)

Category 2 (Capital)

210--Maintenance Buildings
211--Maintenance Buildings, Depreciation
213--Installed Equipment, Depreciation
216--Aircraft Depreciation
222--Engine Depreciation
291--Depreciation, Other
292--Interest, Other

Category 3 (Supplies and Equipment)

321--Bench Stock, Aircraft Airframe
322--Bench Stock, Aircraft Component
323--Bench Stock, Non-Aircraft
331--Parts, Aircraft
332--Parts, Components
333--Parts, Non-Aircraft
334--Parts, Engine
341--Tools
342--Aircraft Support Equipment
343--Vehicular Support, General
344--Test Equipment

TABLE 19--Continued

Category 5 (Miscellaneous Costs)

531--Administrative Supplies and Services

2/2/2/0--Absorption Costing (Costing System)/Process Costing (Costing Method)/Actual Costing (Costing Basis)/Cannot be Determined (Allocation Technique)

Category 2 (Capital)

219--Cost of Parts Retired

292--Interest, Other

Category 3 (Supplies and Equipment)

341--Tools

Category 5 (Miscellaneous Costs)

511--Utilities

531--Administrative Supplies and Services

2/2/2/4--Absorption Costing (Costing System)/Process Costing (Costing Method)/Actual Costing (Costing Basis)/Material (Allocation Technique)

Category 3 (Supplies and Equipment)

300--Custodial Supplies

311--Aircraft Consumable Fluids

312--Aircraft Consumable Fluids, Fuel

321--Bench Stock, Aircraft Airframe

322--Bench Stock, Aircraft Component

323--Bench Stock, Non-Aircraft

324--Bench Stock, Engine

331--Parts, Aircraft

332--Parts, Components

333--Parts, Non-Aircraft

334--Parts, Engine

341--Tools

345--Storage Equipment

Of the 109 bits of data recorded from CAB cost element literature, 97 bits (89 percent) were coded Neutral and 12 bits (11 percent) were coded Weak. A Strong strength

indicator was not coded due to the CAB provision on "failure to file reports; falsification of records." Maximum fine is not more than \$5,000 (39:01-2).

Observations--civil air carriers. Eight major airlines provided data sufficient to ascertain through content analysis the resource categories costed by the responding air carriers (Appendix G). Additionally, the data were sufficient to determine the cost recording techniques in use and the resources costed through each.

In this study, the findings from each airline are discussed separately in each of three subsections: (1) the resource categories, (2) the cost recording techniques in use, and (3) the resources associated with each technique in use by that airline. Within the discussion of each airline, too, will be any significant trends or comparisons noted during the review and content analysis of the offered information.

1. Observations--Aloha Airlines, Inc. All information concerning Aloha Airlines was drawn from a review of their letter reply (Appendix H: Aloha Airlines) to the initial information request. The resource categories costed, those indicated in table 20, were a result of the content analysis of their letter. All were common to most other airlines, and no special strength or importance was evident in their literature.

TABLE 20

RESOURCE CATEGORIES (MAINTENANCE COST ELEMENTS)--ALOHA AIRLINES, INC.

Category 1 (Labor)

- 111--Direct Labor, Aircraft
- 112--Direct Labor, Fringe Benefit Costs
- 113--Direct Labor, Components
- 115--Direct Labor, Aircraft Engines

Category 3 (Supplies and Equipment)

- 321--Bench Stock, Aircraft Airframe
- 322--Bench Stock, Aircraft Component
- 324--Bench Stock, Engine
- 331--Parts, Aircraft
- 332--Parts, Components
- 334--Parts, Engine

The recording techniques, listed in table 21, also are common to most other airlines, as are the cost recording techniques and associated resources costed as shown in table 22.

Aloha is another airline whose preponderant costs appear to be more in the variable resource categories at the local level.

TABLE 21

COST RECORDING TECHNIQUES IN USE BY ALOHA AIRLINES, INC.

Costing System	Costing Method	Costing Basis	Allocation Technique
Direct Costing (1)	Job Order Costing (1)	Actual Costing (2)	Not Applicable (0)
Direct Costing (1)	Process Costing (2)	Actual Costing (2)	Not Applicable (0)

TABLE 22

RESOURCE CATEGORIES ASSOCIATED WITH
COST RECORDING TECHNIQUES--
ALOHA AIRLINES, INC.

1/1/2/0--Direct Costing (Costing System)/
Job Order Costing (Costing Method)/
Actual Costing (Costing Basis)/
Not Applicable (Allocation Tech-
nique)

Category 1 (Labor)

111--Direct Labor, Aircraft
113--Direct Labor, Components
115--Direct Labor, Aircraft Engines

Category 3 (Supplies and Equipment)

321--Bench Stock, Aircraft Airframe
322--Bench Stock, Aircraft Component
324--Bench Stock, Engine
331--Parts, Aircraft
332--Parts, Components
334--Parts, Engine

1/2/2/0--Direct Costing (Costing System)/
Process Costing (Costing Method)/
Actual Costing (Costing Basis)/
Not Applicable (Allocation Tech-
nique)

Category 1 (Labor)

112--Direct Labor, Fringe Benefit Costs

2. Observations--American Airlines. The informa-
tion on American Airlines was gained from a review and con-
tent analysis of the American Airline Expense Distribution
Manual, Part II (1). This publication describes the job
order numbering system, their accounting system, and pro-
vides guidance for the use of the two systems.

The resource categories costed are listed in
table 23. While no resource category costed is unique in

TABLE 23

RESOURCE CATEGORIES (MAINTENANCE COST
ELEMENTS)--AMERICAN AIRLINES

Category 1 (Labor)

115--Direct Labor, Aircraft Engines
122--Direct Supervision
131--Direct Labor, Inspection
132--Direct Labor, Servicing
140--Contractor Maintenance/Services
191--Labor, Other

Category 2 (Capital)

210--Maintenance Buildings
215--Installed Equipment, Added Cost
218--Aircraft, Added Cost
220--Engines, Added Cost
221--Foreign Currency
293--Added Cost, Other*

Category 3 (Supplies and Equipment)

300--Custodial Supplies
311--Aircraft Consumable Fluids
321--Bench Stock, Aircraft Airframe
322--Bench Stock, Aircraft Component
323--Bench Stock, Non-Aircraft
324--Bench Stock, Engine
331--Parts, Aircraft
332--Parts, Components
333--Parts, Non-Aircraft
334--Parts, Engine
341--Tools
342--Aircraft Support Equipment
343--Vehicular Support, General

Category 4 (Opportunity Costs)

412--Awaiting Maintenance, Maintenance
Duties
418--Awaiting Maintenance, Non-Maintenance
Duties

*"Parts Lost in Transit" and
"Insurance Credit" (1:9931-9942).

itself, the preponderance of Supplies and Equipment resources costed is unique. American Airlines, at the local level, devoted more of its job numbering system to recording parts, supplies, and equipment consumption than any other of the air carriers reviewed. No resource categories were of greater indicated strength than any other.

As indicated in table 24, only two cost recording techniques were found in use by American. These techniques, which were also common to most other carriers, were most applicable to recording the variable resource costs that American preponderantly records.

TABLE 24
COST RECORDING TECHNIQUES IN USE BY AMERICAN AIRLINES

Costing System	Costing Method	Costing Basis	Allocation Technique
Direct Costing (1)	Job Order Costing (1)	Actual Costing (2)	Not Applicable (0)
Direct Costing (1)	Process Costing (2)	Actual Costing (2)	Not Applicable (0)

Table 25 indicates the resource categories associated with each of the two cost recording techniques detected in use. It was noted that three of the resources costed (POL, and Airframe and Component Bench Stocks) were accounted for using both Process and Job Order Costing Methods. For example, POL, which includes grease, thinner,

TABLE 25

RESOURCE CATEGORIES ASSOCIATED WITH
COST RECORDING TECHNIQUES--
AMERICAN AIRLINES

1/1/2/0--Direct Costing (Costing System)/
Job Order Costing (Costing Method)/
Actual Costing (Costing Basis)/
Not Applicable (Allocation Tech-
nique)

Category 1 (Labor)

115--Direct Labor, Aircraft Engines
131--Direct Labor, Inspection
132--Direct Labor, Servicing
140--Contractor Maintenance/Services
191--Labor, Other

Category 2 (Capital)

218--Aircraft, Added Cost
220--Engines, Added Cost
221--Foreign Currency

Category 3 (Supplies and Equipment)

311--Aircraft Consumable Fluids
321--Bench Stock, Aircraft Airframe
322--Bench Stock, Aircraft Component
323--Bench Stock, Non-Aircraft
324--Bench Stock, Engine
331--Parts, Aircraft
332--Parts, Components
333--Parts, Non-Aircraft
334--Parts, Engine
342--Aircraft Support Equipment

1/2/2/0--Direct Costing (Costing System)/
Process Costing (Costing Method)/
Actual Costing (Costing Basis)/
Not Applicable (Allocation Tech-
nique)

Category 1 (Labor)

122--Direct Supervision

Category 2 (Capital)

210--Maintenance Buildings
215--Installed Equipment, Added Cost
293--Added Cost, Other

TABLE 25--Continued

Category 3 (Supplies and Equipment)

300--Custodial Supplies
311--Aircraft Consumable Fluids
321--Bench Stock, Aircraft Airframe
324--Bench Stock, Engine
341--Tools
343--Vehicular Support, General

Category 4 (Opportunity Costs)

412--Awaiting Maintenance, Maintenance
Duties
418--Awaiting Maintenance, Non-Maintenance
Duties

etc., is costed to the overhaul process if used in the shop to repair components, but by job order against a specific aircraft serial number if used on the flight line or, in shop, on a component destined for a specific aircraft (1:4-5).

3. Observations--Eastern Air Lines, Inc. The Eastern Air Lines publications reviewed are listed in Appendix H: Eastern Air Lines.

Based on the content analysis of these documents, the resources listed in table 26 were determined to be costed at the local Eastern maintenance units. The resource category costed that was unique to Eastern Air Lines is shown below:

Category 1 (Labor)

100--Morale and Welfare included time allocated for a "morale day" day off (32:24).

TABLE 26

RESOURCE CATEGORIES (MAINTENANCE COST
ELEMENTS)--EASTERN AIR LINES, INC.

Category 1 (Labor)

100--Morale and Welfare
111--Direct Labor, Aircraft
113--Direct Labor, Components
115--Direct Labor, Aircraft Engines
122--Direct Supervision
131--Direct Labor, Inspection
132--Direct Labor, Servicing

Category 2 (Capital)

210--Maintenance Buildings
218--Aircraft, Added Cost
219--Cost of Parts Retired
220--Engines, Added Cost

Category 3 (Supplies and Equipment)

300--Custodial Supplies
311--Aircraft Consumable Fluids
321--Bench Stock, Aircraft Airframe
322--Bench Stock, Aircraft Component
323--Bench Stock, Non-Aircraft
324--Bench Stock, Engine
331--Parts, Aircraft
332--Parts, Components
333--Parts, Non-Aircraft
334--Parts, Engine
342--Aircraft Support Equipment
343--Vehicular Support, General
345--Storage Equipment

Category 4 (Opportunity Costs)

412--Awaiting Maintenance, Maintenance
Duties
418--Awaiting Maintenance, Non-Maintenance
Duties

Category 5 (Miscellaneous Costs)

531--Administrative Supplies and Services

No determination could be made that any one resource
costed was more or less important than any other.

As indicated in table 27, only three cost recording techniques were gleaned from content analysis of Eastern's publications. One of those techniques, however, is unique to Eastern:

0/2/2/0--Cannot be Determined (Costing System)/ Process Costing (Costing Method)/Actual Costing (Costing Basis)/Cannot be Determined (Allocation Technique), an example of which is the Morale and Welfare (birthday leave) costs which "remain unallocated" at the local level, along with "union business, jury duty, vacations, and sick leave [32:24]."

TABLE 27

COST RECORDING TECHNIQUES IN USE BY EASTERN AIR LINES, INC.

Costing System	Costing Method	Costing Basis	Allocation Technique
Cannot be Determined (0)	Process Costing (2)	Actual Costing (2)	Labor (1)
Direct Costing (1)	Job Order Costing (1)	Actual Costing (2)	Not Applicable (0)
Absorption Costing (2)	Process Costing (2)	Actual Costing (2)	Labor (1)

Table 28 shows the resource categories and through what technique each is costed. It would appear that resources not directly associated with aircraft or with an

TABLE 28

RESOURCE CATEGORIES ASSOCIATED WITH
COST RECORDING TECHNIQUES--
EASTERN AIR LINES, INC.

1/1/2/0--Direct Costing (Costing System)/
Job Order Costing (Costing Method)/
Actual Costing (Costing Basis)/Not
Applicable (Allocation Technique)

Category 1 (Labor)

111--Direct Labor, Aircraft
113--Direct Labor, Components
115--Direct Labor, Aircraft Engines
131--Direct Labor, Inspection

Category 2 (Capital)

210--Maintenance Buildings
218--Aircraft, Added Cost
220--Engines, Added Cost

Category 3 (Supplies and Equipment)

321--Bench Stock, Aircraft Airframe
322--Bench Stock, Aircraft Component
324--Bench Stock, Engine
331--Parts, Aircraft
332--Parts, Components
334--Parts, Engine
342--Aircraft Support Equipment
343--Vehicular Support, General
345--Storage Equipment

0/2/2/1--Cannot be Determined (Costing Sys-
tem)/Process Costing (Costing
Method)/Actual Costing (Costing
Basis)/Labor (Allocation Technique)

Category 1 (Labor)

100--Morale and Welfare

Category 4 (Opportunity Costs)

412--Awaiting Maintenance, Maintenance
Duties
418--Awaiting Maintenance, Non-Maintenance
Duties

TABLE 28--Continued

2/2/2/1--Absorption Costing (Costing System)/Process Costing (Costing Method)/Actual Costing (Costing Basis)/Labor (Allocation Technique)

Category 1 (Labor)

122--Direct Supervision
132--Direct Labor, Servicing

Category 2 (Capital)

219--Cost of Parts Retired

Category 3 (Supplies and Equipment)

300--Custodial Supplies
311--Aircraft Consumable Fluids
323--Bench Stock, Non-Aircraft
333--Parts, Non-Aircraft

Category 5 (Miscellaneous Costs)

531--Administrative Supplies and Services

aircraft are allocated to aircraft based on the direct labor hours otherwise associated with each aircraft.

4. Observations--Frontier Airlines, Inc. The information provided by Frontier Airlines is indicated in Appendix H: Frontier Airlines.

From a content analysis of these data sources, the resource categories listed in table 29 were obtained. The following was unique to Frontier Airlines:

Category 2 (Capital)

292--Interest, Other, which in this case was from interest on "loans to outside firm" or "loans from outside firm [25:18]."

No one resource code was determined to be more or less important (strength codes 1 or 2) than any other.

TABLE 29

RESOURCE CATEGORIES (MAINTENANCE COST
ELEMENTS)--FRONTIER AIRLINES, INC.

Category 1 (Labor)

111--Direct Labor, Aircraft
112--Direct Labor, Fringe Benefit Costs
113--Direct Labor, Components
114--Direct Labor, Non-Aircraft
115--Direct Labor, Aircraft Engines
122--Direct Supervision
131--Direct Labor, Inspection
132--Direct Labor, Servicing
191--Labor, Other

Category 2 (Capital)

211--Maintenance Buildings, Depreciation
213--Installed Equipment, Depreciation
216--Aircraft Depreciation
218--Aircraft, Added Cost
219--Cost of Parts Retired
220--Engines, Added Cost
292--Interest, Other
293--Added Cost, Other

Category 3 (Supplies and Equipment)

300--Custodial Supplies
311--Aircraft Consumable Fluids
321--Bench Stock, Aircraft Airframe
322--Bench Stock, Aircraft Component
323--Bench Stock, Non-Aircraft
324--Bench Stock, Engine
331--Parts, Aircraft
332--Parts, Components
333--Parts, Non-Aircraft
334--Parts, Engine
341--Tools
342--Aircraft Support Equipment

Category 4 (Opportunity Costs)

411--Awaiting Parts
412--Awaiting Maintenance, Maintenance
Duties
418--Awaiting Maintenance, Non-Maintenance
Duties

Category 5 (Miscellaneous Costs)

531--Administrative Supplies and Services

Content analysis also revealed that only one cost recording technique was in evidence, 1/1/2/0, Direct Costing (Costing System)/Job Order Costing (Costing Method)/Actual Costing (Costing Basis)/Not Applicable (Allocation Technique). This system was common to most carriers examined.

Frontier data showed that it used the most extensive of the resource categories lists found; and, though predominately centered in the Labor and Supplies and Equipment resources, the company used other resource categories to a greater degree than the other carriers examined.

5. Observations--Hawaiian Airlines. Information concerning Hawaiian Airlines was gleaned from a review and analysis of data provided by the airline (Appendix H: Hawaiian Airlines).

Listed in table 30 are the exceptional resources costed by Hawaiian. There were three resources that appeared unique to this airline:

Category 2 (Capital)

a. 212--Maintenance Buildings, Interest, which in this case is stated at cost "including capitalized interest on funds associated with deposits [27:1]."

b. 214--Installed Equipment, Interest, which in this case is stated at cost "including capitalized interest on funds associated with deposits [27:1]."

TABLE 30

RESOURCE CATEGORIES (MAINTENANCE COST
ELEMENTS)--HAWAIIAN AIRLINES

Category 1 (Labor)

112--Direct Labor, Fringe Benefit Costs

Category 2 (Capital)

210--Maintenance Buildings

211--Maintenance Buildings, Depreciation

212--Maintenance Buildings, Interest

213--Installed Equipment, Depreciation

214--Installed Equipment, Interest

215--Installed Equipment, Added Cost

216--Aircraft Depreciation

217--Aircraft Interest

218--Aircraft, Added Cost

219--Cost of Parts Retired

220--Engines, Added Cost

222--Engine Depreciation

c. 217--Aircraft Interest, which in this case is stated at cost "including capitalized interest on funds associated with deposits [27:1]."

It is notable that, because of the limited data presented, Hawaiian Airlines appeared to weight Capital allocation and accounting heavily.

Table 31 enumerates the cost recording techniques in use by Hawaiian. Several of these were unique to that airline; they are shown below:

a. 2/2/1/4--Absorption Costing (Costing System)/Process Costing (Costing Method)/Standard Costing (Costing Basis)/Material (Allocation Technique), which was evident in "inventories consisting of flight equipment

TABLE 31

COST RECORDING TECHNIQUES IN USE BY HAWAIIAN AIRLINES

Costing System	Costing Method	Costing Basis	Allocation Technique
Cannot be Determined (0)	Process Costing (2)	Actual Costing (2)	Cannot be Determined (0)
Absorption Costing (2)	Process Costing (2)	Standard Costing (1)	Material (4)
Absorption Costing (2)	Process Costing (2)	Standard Costing (1)	Activity (5)
Absorption Costing (2)	Process Costing (2)	Standard Costing (1)	Cannot be Determined (0)

expendable parts and supplies [which] are stated at average cost, less an allowance for obsolescence [27:1]."

b. 2/2/1/0--Absorption Costing (Costing System)/Process Costing (Costing Method)/Standard Costing (Costing Basis)/Cannot be Determined (Allocation Technique), an example of which is the Hawaiian policy of gain or loss on equipment disposition being directly reflected in income (27:1).

c. 2/2/1/5--Absorption Costing (Costing System)/Process Costing (Costing Method)/Standard Costing (Costing Basis)/Activity (Allocation Technique), for example, "rotable [reparable] parts less any salvage is charged to accumulated depreciation [27:1]."

d. 0/2/2/0--Cannot be Determined (Costing System)/Process Costing (Costing Method)/Actual Costing (Costing Basis)/Cannot be Determined (Allocation Technique), as evidenced in their requirement that accrued vacations in excess of those expected to be taken during the ensuing year remain unallocated as a noncurrent liability (27:1).

The application of content analysis also revealed the resources costed and their associated recording technique as indicated in table 32. Here again the preponderance of Capital resources costed was a result of the data presentation and was not indicative of their whole accounting procedure.

There was no indication of any one resource code being any more or less important than any other.

6. Observations--Hughes Airwest. Hughes Airwest publications reviewed and coded are indicated in Appendix H: Hughes Airwest.

From the source documents were ascertained the resource categories that are listed in table 33. None were unique to the carrier. Note, however, that the majority of resource categories are concentrated in the "Labor" and "Supplies and Equipment" categories.

As indicated in table 34, only two recording techniques were in use at the local level. These were also in use by the other air carriers reviewed.

TABLE 32

RESOURCE CATEGORIES ASSOCIATED WITH
COST RECORDING TECHNIQUES--
HAWAIIAN AIRLINES

0/2/2/0--Cannot be Determined (Costing System)/Process Costing (Costing Method)/Actual Costing (Costing Basis)/Cannot be Determined (Allocation Technique)

Category 1 (Labor)

112--Direct Labor, Fringe Benefit Costs

2/2/1/4--Absorption Costing (Costing System)/Process Costing (Costing Method)/Standard Costing (Costing Basis)/Material (Allocation Technique)

Category 2 (Capital)

217--Aircraft Interest
218--Aircraft, Added Cost
219--Cost of Parts Retired
220--Engines, Added Cost
222--Engine Depreciation

2/2/1/5--Absorption Costing (Costing System)/Process Costing (Costing Method)/Standard Costing (Costing Basis)/Activity (Allocation Technique)

Category 2 (Capital)

216--Aircraft Depreciation

2/2/1/0--Absorption Costing (Costing System)/Process Costing (Costing Method)/Standard Costing (Costing Basis)/Cannot be Determined (Allocation Technique)

Category 2 (Capital)

210--Maintenance Buildings
211--Maintenance Buildings, Depreciation
212--Maintenance Buildings, Interest
213--Installed Equipment, Depreciation
214--Installed Equipment, Interest
215--Installed Equipment, Added Cost

TABLE 33

RESOURCE CATEGORIES (MAINTENANCE COST
ELEMENTS)--HUGHES AIRWESTCategory 1 (Labor)

111--Direct Labor, Aircraft
 112--Direct Labor, Fringe Benefit Costs
 113--Direct Labor, Components
 114--Direct Labor, Non-Aircraft
 115--Direct Labor, Aircraft Engines
 131--Direct Labor, Inspection
 132--Direct Labor, Servicing

Category 2 (Capital)

218--Aircraft, Added Cost
 220--Engines, Added Cost

Category 3 (Supplies and Equipment)

321--Bench Stock, Aircraft Airframe
 322--Bench Stock, Aircraft Component
 324--Bench Stock, Engine
 331--Parts, Aircraft
 332--Parts, Components
 334--Parts, Engine
 341--Tools
 342--Aircraft Support Equipment
 345--Storage Equipment

Category 4 (Opportunity Costs)

412--Awaiting Maintenance, Maintenance
 Duties
 418--Awaiting Maintenance, Non-Maintenance
 Duties

TABLE 34

COST RECORDING TECHNIQUES IN USE BY HUGHES AIRWEST

Costing System	Costing Method	Costing Basis	Allocation Technique
Direct Costing (1)	Job Order Costing (1)	Actual Costing (2)	Not Applicable (0)
Direct Costing (1)	Process Costing (2)	Actual Costing (2)	Not Applicable (0)

An analysis of table 35, the combination of cost recording techniques and resource categories, reveals no unique combination but does reveal again that resources not directly attributable to a specific aircraft serial number were considered Process Costing but appear to be unallocated against the aircraft serial number. These costs were considered "maintenance costs" and remained unallocated.

7. Observations--United Airlines. The information from United Airlines was drawn from a limited outline of the airline's basic costing policies (Appendix H: United Airlines). They stated that they had no "comprehensive manual outlining our cost collection systems at our maintenance operations centers [Appendix H: United Airlines]."

United Airlines costs the resource categories outlined in table 36, none of which is unique to that airline, nor is any strength or importance in evidence for any one resource versus another.

Table 37 indicates the two cost recording techniques in use by United. The second of the two techniques is unique to the airline.

2/1/2/6--Absorption Costing (Costing System)/Process Costing (Costing Method)/Actual Costing (Costing Basis)/Aircraft Hours (Allocation Technique), the example of which is costs which are "on the reserve basis wherein a provision

TABLE 35

RESOURCE CATEGORIES ASSOCIATED WITH
COST RECORDING TECHNIQUES--
HUGHES AIRWEST

1/1/2/0--Direct Costing (Costing System)/
Job Order Costing (Costing
Method)/Actual Costing (Costing
Basis)/Not Applicable (Allocation
Technique)

Category 1 (Labor)

111--Direct Labor, Aircraft
113--Direct Labor, Components
115--Direct Labor, Aircraft Engines
131--Direct Labor, Inspection
132--Direct Labor, Servicing

Category 2 (Capital)

218--Aircraft, Added Cost
220--Engines, Added Cost

Category 3 (Supplies and Equipment)

321--Bench Stock, Aircraft Airframe
322--Bench Stock, Aircraft Component
324--Bench Stock, Engine
331--Parts, Aircraft
332--Parts, Components
334--Parts, Engine
342--Aircraft Support Equipment
345--Storage Equipment

1/2/2/0--Direct Costing (Costing System)/
Process Costing (Costing Method)/
Actual Costing (Costing Basis)/
Not Applicable (Allocation Tech-
nique)

Category 1 (Labor)

112--Direct Labor, Fringe Benefit Costs
114--Direct Labor, Non-Aircraft

Category 3 (Supplies and Equipment)

341--Tools

Category 4 (Opportunity Costs)

412--Awaiting Maintenance, Maintenance
Duties
418--Awaiting Maintenance, Non-Maintenance
Duties

TABLE 36

RESOURCE CATEGORIES (MAINTENANCE COST
ELEMENTS)--UNITED AIRLINES

Category 1 (Labor)

111--Direct Labor, Aircraft
113--Direct Labor, Components
115--Direct Labor, Aircraft Engines
140--Contractor Maintenance/Services

Category 2 (Capital)

218--Aircraft, Added Cost
220--Engines, Added Cost
221--Foreign Currency
222--Engine Depreciation
293--Added Cost, Other

Category 3 (Supplies and Equipment)

324--Bench Stock, Engine
331--Parts, Aircraft
332--Parts, Components
334--Parts, Engine
342--Aircraft Support Equipment

TABLE 37

COST RECORDING TECHNIQUES IN USE BY UNITED AIRLINES

Costing System	Costing Method	Costing Basis	Allocation Technique
Direct Costing (1)	Job Order Costing (1)	Actual Costing (2)	Not Applicable (0)
Absorption Costing (2)	Job Order Costing (1)	Actual Costing (2)	Aircraft Hours (6)

for maintenance is charged to expense and credited to a balance sheet reserve account as the aircraft is operated [Appendix H: United Airlines]."

The combination of resources costed and their associated cost recording technique are listed in table 38. Eight of the fourteen resource categories costed are costed using both recording techniques in use by United Airlines.

It was noted, however, that the "Aircraft Hours" Allocation Technique was used more for Capital resource categories than for either the Labor or Supplies and Equipment variable cost categories.

Overall, United Airlines appeared to cost the Capital, Labor, and Supplies but not in Opportunity or Miscellaneous resource categories.

8. Observations--Western Airlines. The information gleaned from Western Airlines was based on a content analysis of their return letter in response to the researchers' request (Appendix H: Western Airlines).

The resource categories costed by the local maintenance unit are listed in table 39. While no one resource subcategory was discovered to be stronger or more important than any other, there was one category unique to Western Airlines, which is shown below:

Category 5 (Miscellaneous Costs)

511--Utilities, which in this case included, as specified by CAB, only those utilities used by the maintenance organization (39:7-2).

TABLE 38

RESOURCE CATEGORIES ASSOCIATED WITH
COST RECORDING TECHNIQUES--
UNITED AIRLINES

1/1/2/0--Direct Costing (Costing System)/
Job Order Costing (Costing
Method)/Actual Costing (Costing
Basis)/Not Applicable (Alloca-
tion Technique)

Category 1 (Labor)

111--Direct Labor, Aircraft
113--Direct Labor, Components
115--Direct Labor, Aircraft Engines
140--Contractor Maintenance/Services

Category 2 (Capital)

221--Foreign Currency
222--Engine Depreciation

Category 3 (Supplies and Equipment)

324--Bench Stock, Engine
331--Parts, Aircraft
332--Parts, Components
334--Parts, Engine

2/1/2/6--Absorption Costing (Costing Sys-
tem)/Job Order Costing (Costing
Method)/Actual Costing (Costing
Basis)/Aircraft Hours (Allocation
Technique)

Category 1 (Labor)

111--Direct Labor, Aircraft
113--Direct Labor, Components
115--Direct Labor, Aircraft Engines

Category 2 (Capital)

218--Aircraft, Added Cost
220--Engines, Added Cost
221--Foreign Currency
222--Engine Depreciation
293--Added Cost, Other*

*Engine and aircraft overhaul
charged to a Capital reserve account.

TABLE 38--Continued

Category 3 (Supplies and Equipment)

331--Parts, Aircraft
332--Parts, Components
334--Parts, Engine
342--Aircraft Support Equipment

TABLE 39

RESOURCE CATEGORIES (MAINTENANCE COST
ELEMENTS)--WESTERN AIRLINES

Category 1 (Labor)

111--Direct Labor, Aircraft
112--Direct Labor, Fringe Benefit Costs
113--Direct Labor, Components
115--Direct Labor, Aircraft Engines
122--Direct Supervision
131--Direct Labor, Inspection
132--Direct Labor, Servicing
140--Contractor Maintenance/Services
191--Labor, Other

Category 2 (Capital)

219--Cost of Parts Retired

Category 3 (Supplies and Equipment)

300--Custodial Supplies
321--Bench Stock, Aircraft Airframe
322--Bench Stock, Aircraft Component
324--Bench Stock, Engine
331--Parts, Aircraft
334--Parts, Engine
341--Tools
342--Aircraft Support Equipment

Category 4 (Opportunity Costs)

411--Awaiting Parts
412--Awaiting Maintenance, Maintenance
Duties
418--Awaiting Maintenance, Non-Maintenance
Duties

Category 5 (Miscellaneous Costs)

511--Utilities
531--Administrative Supplies and Services

Three cost recording techniques were revealed through content analysis; these are listed in table 40. One of these, as listed below, was unique to Western.

2/1/2/0--Absorption Costing (Costing System)/Job Order Costing (Costing Method)/Actual Costing (Costing Basis)/Cannot be Determined (Allocation Technique), which was specifically used for "outside services--airframe repair [18:C-4]."

Table 41 shows the cost recording technique and resource category match. It is notable again that Western Airlines at the local level was another airline which concentrated on Labor and Supplies and Equipment costs to a greater extent than the Opportunity and Miscellaneous Costs and Capital categories.

Observations--civil air carriers (summary). By law and regulation, certificated air carriers were required to conform to the Uniform System of Accounts and Reports for Certificated Air Carriers, at least for reporting to the CAB for rate proposals and taxes. Therefore, the air carriers reviewed in this study used both their own and CAB systems simultaneously, or used their own as a supplement to CAB basic requirements. This segment of the study is consequently a synthesis of civil air carrier and CAB information.

TABLE 40

COST RECORDING TECHNIQUES IN USE BY WESTERN AIRLINES

Costing System	Costing Method	Costing Basis	Allocation Technique
Direct Costing (1)	Job Order Costing (1)	Actual Costing (2)	Not Applicable (0)
Absorption Costing (2)	Job Order Costing (1)	Actual Costing (2)	Cannot be Determined (0)
Absorption Costing (2)	Job Order Costing (1)	Actual Costing (2)	Activity (5)

The resources costed by the civilian air industry are listed in table 42. It was significant that the Opportunity Costs resource subcategories were not widely used in civilian industry. Additionally, it was in the Opportunity Costs resource category that the majority of the difference existed between CAB requirements and the airlines' internal accounting systems. For example, CAB resource cost data required Opportunity Costs be included for research and development and to account for mechanic time in non-maintenance duties (e.g., vacation, jury duty, etc.). The airlines, on the other hand, also included Opportunity Costs associated with the inability or restricted use of resources and the attendant cost. These include Opportunity Costs associated with lack of parts or a lack of people because of maintenance-related duties, for instance, training.

TABLE 41

RESOURCE CATEGORIES ASSOCIATED WITH
COST RECORDING TECHNIQUES--
WESTERN AIRLINES

1/1/2/0--Direct Costing (Costing System)/
Job Order Costing (Costing
Method)/Actual Costing (Costing
Basis)/Not Applicable (Alloca-
tion Technique)

Category 1 (Labor)

111--Direct Labor, Aircraft

Category 3 (Supplies and Equipment)

321--Bench Stock, Aircraft Airframe

324--Bench Stock, Engine

331--Parts, Aircraft

334--Parts, Engine

Category 4 (Opportunity Costs)

411--Awaiting Parts

2/1/2/0--Absorption Costing (Costing Sys-
tem)/Job Order Costing (Costing
Method)/Actual Costing (Costing
Basis)/Cannot be Determined (Allo-
cation Technique)

Category 1 (Labor)

111--Direct Labor, Aircraft

112--Direct Labor, Fringe Benefit Costs

113--Direct Labor, Components

115--Direct Labor, Aircraft Engines

122--Direct Supervision

131--Direct Labor, Inspection

132--Direct Labor, Servicing

140--Contractor Maintenance/Services

191--Labor, Other

Category 2 (Capital)

219--Cost of Parts Retired

Category 3 (Supplies and Equipment)

300--Custodial Supplies

321--Bench Stock, Aircraft Airframe

322--Bench Stock, Aircraft Component

324--Bench Stock, Engine

341--Tools

342--Aircraft Support Equipment

TABLE 41--Continued

Category 4 (Opportunity Costs)

412--Awaiting Maintenance, Maintenance Duties

418--Awaiting Maintenance, Non-Maintenance Duties

Category 5 (Miscellaneous Costs)

531--Administrative Supplies and Services

2/1/2/5--Absorption Costing (Costing System)/Job Order Costing (Costing Method)/Actual Costing (Costing Basis)/Activity (Allocation Technique)

Category 5 (Miscellaneous Costs)

511--Utilities

There were in the CAB required accounting system items that were more or less important or stronger or weaker than other resource categories costed. There were no such strength indicators in the air carrier internal accounting system.

Table 43 describes the cost recording techniques used by civilian carriers both for internal and CAB recording requirements. The following are those techniques that are in addition to the basic CAB requirements:

a. 0/2/2/0--Cannot be Determined (Costing System)/Process Costing (Costing Method)/Actual Costing (Costing Basis)/Cannot be Determined (Allocation Technique).

b. 0/2/2/1--Cannot be Determined (Costing System)/Process Costing (Costing Method)/Actual Costing (Costing Basis)/Labor (Allocation Technique).

TABLE 42

RESOURCE CATEGORIES (MAINTENANCE COST
ELEMENTS)--CIVIL AIR CARRIERSCategory 1 (Labor)

100--Morale and Welfare
111--Direct Labor, Aircraft
112--Direct Labor, Fringe Benefit Costs
113--Direct Labor, Components
114--Direct Labor, Non-Aircraft
115--Direct Labor, Aircraft Engines
122--Direct Supervision
131--Direct Labor, Inspection
132--Direct Labor, Servicing
140--Contractor Maintenance/Services
191--Labor, Other

Category 2 (Capital)

210--Maintenance Buildings
211--Maintenance Buildings, Depreciation
212--Maintenance Buildings, Interest
213--Installed Equipment, Depreciation
214--Installed Equipment, Interest
215--Installed Equipment, Added Cost
216--Aircraft Depreciation
217--Aircraft Interest
218--Aircraft, Added Cost
219--Cost of Parts Retired
220--Engines, Added Cost
221--Foreign Currency
222--Engine Depreciation
291--Depreciation, Other
292--Interest, Other
293--Added Cost, Other

Category 3 (Supplies and Equipment)

300--Custodial Supplies
311--Aircraft Consumable Fluids
312--Aircraft Consumable Fluids, Fuel
321--Bench Stock, Aircraft Airframe
322--Bench Stock, Aircraft Component
323--Bench Stock, Non-Aircraft
324--Bench Stock, Engine
331--Parts, Aircraft
332--Parts, Components
333--Parts, Non-Aircraft
334--Parts, Engine
341--Tools
342--Aircraft Support Equipment

TABLE 42--Continued

Category 3 (Supplies and Equipment)

343--Vehicular Support, General
344--Test Equipment
345--Storage Equipment

Category 4 (Opportunity Costs)

411--Awaiting Parts
412--Awaiting Maintenance, Maintenance
Duties
418--Awaiting Maintenance, Non-Maintenance
Duties
421--Research and Development

Category 5 (Miscellaneous Costs)

511--Utilities
531--Administrative Supplies and Services

c. 2/1/2/0--Absorption Costing (Costing System)/
Job Order Costing (Costing Method)/Actual Costing (Costing
Basis)/Cannot be Determined (Allocation Technique).

d. 2/1/2/5--Absorption Costing (Costing System)/
Job Order Costing (Costing Method)/Actual Costing (Costing
Basis)/Activity (Allocation Technique).

e. 2/1/2/6--Absorption Costing (Costing System)/
Job Order Costing (Costing Method)/Actual Costing (Costing
Basis)/Aircraft Hours (Allocation Technique).

f. 2/2/1/4--Absorption Costing (Costing System)/
Process Costing (Costing Method)/Standard Costing (Costing
Basis)/Material (Allocation Technique).

g. 2/2/1/5--Absorption Costing (Costing System)/
Process Costing (Costing Method)/Standard Costing (Costing
Basis)/Activity (Allocation Technique).

TABLE 43

COST RECORDING TECHNIQUES IN USE BY CIVIL AIR CARRIERS

Costing System	Costing Method	Costing Basis	Allocation Technique
Cannot be Determined (0)	Process Costing (2)	Actual Costing (2)	Cannot be Determined (0)
Cannot be Determined (0)	Process Costing (2)	Actual Costing (2)	Labor (1)
Direct Costing (1)	Job Order Costing (1)	Actual Costing (2)	Not Applicable (0)
Direct Costing (1)	Process Costing (2)	Actual Costing (2)	Not Applicable (0)
Absorption Costing (2)	Job Order Costing (1)	Actual Costing (2)	Cannot be Determined (0)
Absorption Costing (2)	Job Order Costing (1)	Actual Costing (2)	Activity (5)
Absorption Costing (2)	Job Order Costing (1)	Actual Costing (2)	Aircraft Hours (6)
Absorption Costing (2)	Process Costing (2)	Standard Costing (1)	Material (4)
Absorption Costing (2)	Process Costing (2)	Standard Costing (1)	Activity (5)
Absorption Costing (2)	Process Costing (2)	Standard Costing (1)	Cannot be Determined (0)
Absorption Costing (2)	Process Costing (2)	Actual Costing (2)	Labor (1)

h. 2/2/2/1--Absorption Costing (Costing System)/
Process Costing (Costing Method)/Actual Costing (Costing
Basis)/Labor (Allocation Technique).

Table 44 lists the cost recording techniques and associated resources costed. There is little distinction between CAB and air carrier cost elements and technique other than that determined by cost elements or technique differences individually.

Analysis

In the final part of Chapter 3, the researchers endeavor to identify the major differences and similarities between military and civilian aircraft maintenance cost elements and recording systems which were identified through semantic content analysis. Special attention will also be given to the differences between Air Force and other military and civilian systems, where appropriate. Any significant differences will be evident in one or more of several areas, the resource categories costed (cost elements), the recording techniques in use, and the recording techniques used with each of the cost elements. Tables 45, 46, and 47 contain coded tabular indices of the resources and organizations from which this analysis can be summarized. Additionally in this chapter is the analysis and delineation of the maintenance cost elements and cost recording techniques used in aircraft maintenance organizations within the population. Essentially, this would answer the first two of the three research questions posed in Chapters 1 and 2. Finally, this chapter will be concluded with a listing reflecting the

TABLE 44

RESOURCE CATEGORIES ASSOCIATED WITH
COST RECORDING TECHNIQUES--
CIVIL AIR CARRIERS

1/1/2/0--Direct Costing (Costing System)/
Job Order Costing (Costing
Method)/Actual Costing (Costing
Basis)/Not Applicable (Alloca-
tion Technique)

Category 1 (Labor)

111--Direct Labor, Aircraft
112--Direct Labor, Fringe Benefit Costs
113--Direct Labor, Components
114--Direct Labor, Non-Aircraft
115--Direct Labor, Aircraft Engines
122--Direct Supervision
131--Direct Labor, Inspection
132--Direct Labor, Servicing
140--Contractor Maintenance/Services
191--Labor, Other

Category 2 (Capital)

210--Maintenance Buildings
211--Maintenance Buildings, Depreciation
213--Installed Equipment, Depreciation
215--Installed Equipment, Added Cost
216--Aircraft Depreciation
218--Aircraft, Added Cost
219--Cost of Parts Retired
220--Engines, Added Cost
221--Foreign Currency
222--Engine Depreciation
292--Interest, Other
293--Added Cost, Other

Category 3 (Supplies and Equipment)

300--Custodial Supplies
311--Aircraft Consumable Fluids
312--Aircraft Consumable Fluids, Fuel
321--Bench Stock, Aircraft Airframe
322--Bench Stock, Aircraft Component
323--Bench Stock, Non-Aircraft
324--Bench Stock, Engine
331--Parts, Aircraft
332--Parts, Components
333--Parts, Non-Aircraft
334--Parts, Engine

TABLE 44--Continued

Category 3 (Supplies and Equipment)

341--Tools
342--Aircraft Support Equipment
343--Vehicular Support, General
345--Storage Equipment

Category 4 (Opportunity Costs)

411--Awaiting Parts
412--Awaiting Maintenance, Maintenance
Duties
418--Awaiting Maintenance, Non-Maintenance
Duties

Category 5 (Miscellaneous Costs)

531--Administrative Supplies and Services

0/2/2/0--Cannot be Determined (Costing Sys-
tem)/Process Costing (Costing
Method)/Actual Costing (Costing
Basis)/Cannot be Determined (Allo-
cation Technique)

Category 1 (Labor)

100--Morale and Welfare
112--Direct Labor, Fringe Benefit Costs

Category 4 (Opportunity Costs)

412--Awaiting Maintenance, Maintenance
Duties
418--Awaiting Maintenance, Non-Maintenance
Duties

1/2/2/0--Direct Costing (Costing System)/
Process Costing (Costing Method)/
Actual Costing (Costing Basis)/
Not Applicable (Allocation Tech-
nique)

Category 1 (Labor)

112--Direct Labor, Fringe Benefit Costs
114--Direct Labor, Non-Aircraft
122--Direct Supervision

Category 2 (Capital)

210--Maintenance Buildings
215--Installed Equipment, Added Cost
291--Depreciation, Other
293--Added Cost, Other

TABLE 44--Continued

Category 3 (Supplies and Equipment)

300--Custodial Supplies
311--Aircraft Consumable Fluids
312--Aircraft Consumable Fluids, Fuel
321--Bench Stock, Aircraft Airframe
324--Bench Stock, Engine
341--Tools
343--Vehicular Support, General
345--Storage Equipment

Category 4 (Opportunity Costs)

412--Awaiting Maintenance, Maintenance
Duties
418--Awaiting Maintenance, Non-Maintenance
Duties

2/1/2/0--Absorption Costing (Costing Sys-
tem)/Job Order Costing (Costing
Method)/Actual Costing (Costing
Basis)/Cannot be Determined (Allo-
cation Technique)

Category 1 (Labor)

111--Direct Labor, Aircraft
112--Direct Labor, Fringe Benefit Costs
113--Direct Labor, Components
115--Direct Labor, Aircraft Engines
122--Direct Supervision
131--Direct Labor, Inspection
132--Direct Labor, Servicing
140--Contractor Maintenance/Services
191--Labor, Other

Category 2 (Capital)

219--Cost of Parts Retired

Category 3 (Supplies and Equipment)

300--Custodial Supplies
321--Bench Stock, Aircraft Airframe
322--Bench Stock, Aircraft Component
324--Bench Stock, Engine
341--Tools
342--Aircraft Support Equipment

TABLE 44--Continued

Category 4 (Opportunity Costs)

412--Awaiting Maintenance, Maintenance
Duties
418--Awaiting Maintenance, Non-Maintenance
Duties

Category 5 (Miscellaneous Costs)

531--Administrative Supplies and Services

2/2/2/1--Absorption Costing (Costing Sys-
tem)/Process Costing (Costing
Method)/Actual Costing (Costing
Basis)/Labor (Allocation Technique)

Category 1 (Labor)

122--Direct Supervision
132--Direct Labor, Servicing

Category 2 (Capital)

219--Cost of Parts Retired

Category 3 (Supplies and Equipment)

300--Custodial Supplies
311--Aircraft Consumable Fluids
323--Bench Stock, Non-Aircraft
333--Parts, Non-Aircraft

Category 5 (Miscellaneous Costs)

531--Administrative Supplies and Services

2/2/1/4--Absorption Costing (Costing Sys-
tem)/Process Costing (Costing
Method)/Standard Costing (Costing
Basis)/Material (Allocation Tech-
nique)

Category 2 (Capital)

217--Aircraft Interest
218--Aircraft, Added Cost
219--Cost of Parts Retired
220--Engines, Added Cost
222--Engine Depreciation

TABLE 44--Continued

2/2/1/5--Absorption Costing (Costing System)/Process Costing (Costing Method)/Standard Costing (Costing Basis)/Activity (Allocation Technique)

Category 2 (Capital)

216--Aircraft Depreciation

2/1/2/5--Absorption Costing (Costing System)/Job Order Costing (Costing Method)/Actual Costing (Costing Basis)/Activity (Allocation Technique)

Category 5 (Miscellaneous Costs)

511--Utilities

2/1/2/6--Absorption Costing (Costing System)/Job Order Costing (Costing Method)/Actual Costing (Costing Basis)/Aircraft Hours (Allocation Technique)

Category 1 (Labor)

111--Direct Labor, Aircraft

113--Direct Labor, Components

115--Direct Labor, Aircraft Engines

Category 2 (Capital)

218--Aircraft, Added Cost

220--Engines, Added Cost

221--Foreign Currency

222--Engine Depreciation

293--Added Cost, Other

Category 3 (Supplies and Equipment)

331--Parts, Aircraft

332--Parts, Components

334--Parts, Engine

342--Aircraft Support Equipment

TABLE 44--Continued

2/2/1/0--Absorption Costing (Costing System)/Process Costing (Costing Method)/Standard Costing (Costing Basis)/Cannot be Determined (Allocation Technique)

Category 2 (Capital)

210--Maintenance Buildings
211--Maintenance Buildings, Depreciation
212--Maintenance Buildings, Interest
213--Installed Equipment, Depreciation
214--Installed Equipment, Interest
215--Installed Equipment, Added Cost
216--Aircraft Depreciation
222--Engine Depreciation
291--Depreciation, Other
292--Interest, Other
293--Added Cost, Other

Category 3 (Supplies and Equipment)

321--Bench Stock, Aircraft Airframe
322--Bench Stock, Aircraft Component
323--Bench Stock, Non-Aircraft
331--Parts, Aircraft
332--Parts, Components
334--Parts, Engine
341--Tools
342--Aircraft Support Equipment
343--Vehicular Support, General
344--Test Equipment

1/0/1/0--Direct Costing (Costing System)/
Cannot be Determined (Costing
Method)/Standard Costing (Costing
Basis)/Not Applicable (Allocation
Technique)

Category 2 (Capital)

212--Maintenance Buildings, Interest
214--Installed Equipment, Interest
217--Aircraft Interest

TABLE 44--Continued

0/0/1/0--Cannot be Determined (Costing System)/Cannot be Determined (Costing Method)/Standard Costing (Costing Basis)/Cannot be Determined (Allocation Technique)

Category 2 (Capital)

221--Foreign Currency

1/1/1/0--Direct Costing (Costing System)/Job Order Costing (Costing Method)/Standard Costing (Costing Basis)/Not Applicable (Allocation Technique)

Category 1 (Labor)

132--Direct Labor, Servicing

Category 2 (Capital)

215--Installed Equipment, Added Cost

218--Aircraft, Added Cost

Category 3 (Supplies and Equipment)

324--Bench Stock, Engine

334--Parts, Engine

342--Aircraft Support Equipment

0/0/2/0--Cannot be Determined (Costing System)/Cannot be Determined (Costing Method)/Actual Costing (Costing Basis)/Cannot be Determined (Allocation Technique)

Category 2 (Capital)

221--Foreign Currency

1/0/2/0--Direct Costing (Costing System)/Cannot be Determined (Costing Method)/Actual Costing (Costing Basis)/Not Applicable (Allocation Technique)

Category 4 (Opportunity Costs)

421--Research and Development

TABLE 44--Continued

2/0/1/0--Absorption Costing (Costing System)/Cannot be Determined (Costing Method)/Standard Costing (Costing Basis)/Cannot be Determined (Allocation Technique)

Category 2 (Capital)

221--Foreign Currency

2/1/1/0--Absorption Costing (Costing System)/Job Order Costing (Costing Method)/Standard Costing (Costing Basis)/Cannot be Determined (Allocation Technique)

Category 2 (Capital)

215--Installed Equipment, Added Cost

216--Aircraft Depreciation

2/0/2/0--Absorption Costing (Costing System)/Cannot be Determined (Costing Method)/Actual Costing (Costing Basis)/Cannot be Determined (Allocation Technique)

Category 1 (Labor)

112--Direct Labor, Fringe Benefit Costs

114--Direct Labor, Non-Aircraft

Category 2 (Capital)

217--Aircraft Interest

219--Cost of Parts Retired

Category 3 (Supplies and Equipment)

311--Aircraft Consumable Fluids

312--Aircraft Consumable Fluids, Fuel

322--Bench Stock, Aircraft Component

323--Bench Stock, Non-Aircraft

331--Parts, Aircraft

332--Parts, Components

333--Parts, Non-Aircraft

TABLE 44--Continued

2/1/2/0--Absorption Costing (Costing System)/Job Order Costing (Costing Method)/Actual Costing (Costing Basis)/Cannot be Determined (Allocation Technique)

Category 1 (Labor)

111--Direct Labor, Aircraft
112--Direct Labor, Fringe Benefit Costs
113--Direct Labor, Components
115--Direct Labor, Aircraft Engines
122--Direct Supervision
131--Direct Labor, Inspection
132--Direct Labor, Servicing
140--Contractor Maintenance/Services
191--Labor, Other

Category 2 (Capital)

219--Cost of Parts Retired

Category 3 (Supplies and Equipment)

300--Custodial Supplies
321--Bench Stock, Aircraft Airframe
322--Bench Stock, Aircraft Component
324--Bench Stock, Engine
341--Tools

Category 5 (Miscellaneous Costs)

511--Utilities

2/2/2/0--Absorption Costing (Costing System)/Process Costing (Costing Method)/Actual Costing (Costing Basis)/Cannot be Determined (Allocation Technique)

Category 2 (Capital)

219--Cost of Parts Retired
292--Interest, Other

Category 5 (Miscellaneous Costs)

511--Utilities

TABLE 44--Continued

2/0/0/1--Absorption Costing (Costing System)/Cannot be Determined (Costing Method)/Cannot be Determined (Costing Basis)/Labor (Allocation Technique)

Category 4 (Opportunity Costs)

418--Awaiting Maintenance, Non-Maintenance Duties

2/2/2/4--Absorption Costing (Costing System)/Process Costing (Costing Method)/Actual Costing (Costing Basis)/Material (Allocation Technique)

Category 3 (Supplies and Equipment)

300--Custodial Supplies
311--Aircraft Consumable Fluids
312--Aircraft Consumable Fluids, Fuel
321--Bench Stock, Aircraft Airframe
322--Bench Stock, Aircraft Component
323--Bench Stock, Non-Aircraft
324--Bench Stock, Engine
331--Parts, Aircraft
332--Parts, Components
333--Parts, Non-Aircraft
334--Parts, Engine
341--Tools
345--Storage Equipment

analysis as to which of two of the major MBO 9-2 subgoals each of the cost element/recording techniques would match.

Cost elements. The most significant differences in military versus civilian recording systems came from the cost element area, though in certain categories there was also substantial agreement (table 45). In Resource Category 1 (Labor), for instance, cost elements relating to "Morale and Welfare" were directly recorded against

TABLE 45

RESOURCE CATEGORIES (MAINTENANCE COST ELEMENTS)--
ALL SOURCES

Code and Definition	AF	Civ	Mil
<u>Labor</u>			
100--Morale and Welfare		X	
111--Direct Labor, Aircraft	X	X	X
112--Direct Labor, Fringe Benefit Costs	X	X	X
113--Direct Labor, Components	X	X	X
114--Direct Labor, Non-Aircraft	X	X	X
115--Direct Labor, Aircraft Engines	X	X	X
121--Salaried Management and Staff	X		X
122--Direct Supervision	X	X	X
131--Direct Labor, Inspection	X	X	X
132--Direct Labor, Servicing	X	X	X
140--Contractor Maintenance/ Services	X	X	X
191--Labor, Other	X	X	X
<u>Capital</u>			
210--Maintenance Buildings		X	
211--Maintenance Buildings, Depreciation		X	
212--Maintenance Buildings, Interest		X	
213--Installed Equipment, Depreciation		X	
214--Installed Equipment, Interest		X	
215--Installed Equipment, Added Cost	X	X	X
216--Aircraft Depreciation		X	
217--Aircraft Interest		X	
218--Aircraft, Added Cost	X	X	X
219--Cost of Parts Retired	X	X	X
220--Engines, Added Cost	X	X	X
221--Foreign Currency		X	
222--Engine Depreciation		X	
291--Depreciation, Other		X	
292--Interest, Other		X	
293--Added Cost, Other	X	X	X
<u>Supplies and Equipment</u>			
300--Custodial Supplies		X	
311--Aircraft Consumable Fluids	X	X	X
312--Aircraft Consumable Fluids, Fuel	X	X	X

TABLE 45--Continued

Code and Definition	AF	Civ	Mil
<u>Supplies and Equipment</u>			
321--Bench Stock, Aircraft Airframe	x	x	x
322--Bench Stock, Aircraft Component	x	x	x
323--Bench Stock, Non-Aircraft . .	x	x	x
324--Bench Stock, Engine	x	x	x
331--Parts, Aircraft	x	x	x
332--Parts, Components	x	x	x
333--Parts, Non-Aircraft	x	x	x
334--Parts, Engine	x	x	x
341--Tools	x	x	x
342--Aircraft Support Equipment . .	x	x	x
343--Vehicular Support, General . .	x	x	x
344--Test Equipment	x	x	x
345--Storage Equipment		x	
351--Weapons Equipment, On-Equipment	x		x
352--Weapons	x		x
<u>Opportunity Costs</u>			
411--Awaiting Parts	x	x	x
412--Awaiting Maintenance, Maintenance Duties	x	x	x
413--Awaiting Maintenance, Lack of Facilities	x		x
414--Awaiting Maintenance, Lack of Funds	x		x
415--Awaiting Maintenance, Lack of Tools	x		x
416--Awaiting Maintenance, Cannot Duplicate Malfunction	x		x
417--Awaiting Maintenance, Lack of People, Overload	x		x
418--Awaiting Maintenance, Non-Maintenance Duties	x	x	x
419--Awaiting Maintenance, Other . .	x		x
420--Awaiting Maintenance, In Work	x		x
421--Research and Development . . .		x	
499--Extraordinary	x		x
<u>Miscellaneous Costs</u>			
511--Utilities	x	x	x
531--Administrative Supplies and Services	x	x	x

maintenance activities in the civilian industry but were not recorded by any military service. The military services, on the other hand, charge their higher-level executive salaries against maintenance operations, while airlines do not but appear instead to cost those resources at a higher level in the organization than local maintenance.

In Resource Category 3 (Supplies and Equipment), too, there is substantial agreement. In only four areas were there differences. Civilian airlines directly attribute janitorial supplies and fuels equipment costs to maintenance activities while the military does not. For the latter difference, this may be a reflection of the fact that the fuels organizations are not part of the maintenance organization in the military but are in civilian industry. It is obvious that the military would record weapons costs while the civil air carriers would not, which accounts for the other two differences in Resource Category 3. While in Resource Category 5 (Miscellaneous Costs) there was no difference, in Resource Categories 2 (Capital) and 4 (Opportunity Costs), there was substantial difference.

In recording Capital costs for maintenance equipment, buildings, aircraft, and vehicles, the civil air carriers record all capital charged (modification or demodification), interest and depreciation against the

maintenance organization. Although the Army and Navy did not, the Air Force did record capital changes in engines, aircraft, and installed equipment as a result of TCTO or modification. The Air Force also recorded costs of obsolescence.

With respect to Opportunity Costs, the reverse appears to be the case. The military services, especially the Air Force, had comprehensive recording and reporting systems to continuously monitor resource availability or non-availability. The non-availability portion represented a restriction in the use of the resource, therefore an Opportunity Cost. This reflected the military requirement that it be ready for contingencies and therefore must be aware of its resource availability. The civil air carriers, on the other hand, did not have an extensive Opportunity Cost structure. Additionally, what Opportunity Costs were measured were mainly Labor Costs for labor not available or not performed, as in jury duty, training, and vacation time. This appeared to reflect a philosophy of recording productivity as opposed to recording for a restriction in resource availability.

Cost recording techniques. The main difference between civilian and military cost recording techniques appeared in the range of techniques in use. The military systems were relatively concentrated in Direct Costing Systems,

with some additional preference for Actual Costing Basis as opposed to Standard. The Air Force itself was even more concentrated, using primarily Direct Costing Systems and Actual Costing Bases as depicted in coded form in table 46. On the other hand, there was less concentration visible in the civilian reporting technique and a wider range of techniques in use, especially in Absorption Costing techniques.

In other aspects, there appears no significant difference between the recording techniques in use by the military and civilian aircraft maintenance organizations.

Cost recording techniques and associated cost elements.

Overall, there was little significant difference between the way resources are costed between military and civilian aircraft maintenance organizations. What differences did exist reflected the differences between either the cost elements or recording techniques alone (table 47). There were some minor differences noted, especially within the most prevalent technique, 1/2/2/0, Direct Costing (Costing System)/Process Costing (Costing Method)/Actual Costing (Costing Basis)/Not Applicable (Allocation Technique). For example, the military services used the technique for most of the parts and supplies cost elements while civilian airlines did not. Another minor difference existed in the application of cost recording technique 2/2/2/1, Absorption Costing (Costing System)/Process Costing (Costing Method)/

TABLE 46

COST RECORDING TECHNIQUES IN USE BY ALL SOURCES

Costing System	Costing Method	Costing Basis	Allocation Technique	AF	Civ	Mil
Cannot be Determined (0)	Cannot be Determined (0)	Standard Costing (1)	Cannot be Determined (0)		x	
Cannot be Determined (0)	Cannot be Determined (0)	Actual Costing (2)	Cannot be Determined (0)		x	
Cannot be Determined (0)	Process Costing (2)	Actual Costing (2)	Cannot be Determined (0)		x	
Cannot be Determined (0)	Process Costing (2)	Actual Costing (2)	Labor (1)		x	
Direct Costing (1)	Cannot be Determined (0)	Standard Costing (1)	Not Applicable (0)		x	
Direct Costing (1)	Cannot be Determined (0)	Actual Costing (2)	Not Applicable (0)		x	x
Direct Costing (1)	Job Order Costing (1)	Cannot be Determined (0)	Not Applicable (0)			x
Direct Costing (1)	Job Order Costing (1)	Standard Costing (1)	Not Applicable (0)		x	x

TABLE 46--Continued

Direct Costing (1)	Job Order Costing (1)	Actual Costing (2)	Not Applicable (0)	x	x	x
Direct Costing (1)	Process Costing (2)	Standard Costing (1)	Not Applicable (0)	x	x	x
Direct Costing (1)	Process Costing (2)	Actual Costing (2)	Not Applicable (0)	x	x	x
Absorption Costing (2)	Cannot be Determined (0)	Cannot be Determined (0)	Labor (1)	x	x	
Absorption Costing (2)	Cannot be Determined (0)	Standard Costing (1)	Cannot be Determined (0)	x	x	x
Absorption Costing (2)	Cannot be Determined (0)	Actual Costing (2)	Cannot be Determined (0)	x	x	
Absorption Costing (2)	Cannot be Determined (0)	Actual Costing (2)	Labor (1)			x
Absorption Costing (2)	Job Order Costing (1)	Standard Costing (1)	Cannot be Determined (0)	x	x	
Absorption Costing (2)	Job Order Costing (1)	Actual Costing (2)	Cannot be Determined (0)	x	x	
Absorption Costing (2)	Job Order Costing (1)	Actual Costing (2)	Activity (5)			x

TABLE 46--Continued

Costing System	Costing Method	Costing Basis	Allocation Technique	AF	Civ	Mil
Absorption Costing (2)	Job Order Costing (1)	Actual Costing (2)	Aircraft Hours (6)		x	
Absorption Costing (2)	Process Costing (2)	Standard Costing (1)	Cannot be Determined (0)		x	
Absorption Costing (2)	Process Costing (2)	Standard Costing (1)	Labor (1)	x		x
Absorption Costing (2)	Process Costing (2)	Standard Costing (1)	Material (4)		x	
Absorption Costing (2)	Process Costing (2)	Standard Costing (1)	Activity (5)		x	x
Absorption Costing (2)	Process Costing (2)	Actual Costing (2)	Cannot be Determined (0)		x	
Absorption Costing (2)	Process Costing (2)	Actual Costing (2)	Labor (1)	x	x	x
Absorption Costing (2)	Process Costing (2)	Actual Costing (2)	Material (4)		x	
Absorption Costing (2)	Process Costing (2)	Actual Costing (2)	Activity (5)	x		x

TABLE 47

RESOURCE CATEGORIES ASSOCIATED WITH COST RECORDING
TECHNIQUES--ALL SOURCES

Cost Recording Technique	Resource Category and Definition	AF	Mil	Civ
0/0/2/0--Cannot be Determined (Costing System)/Cannot be Determined (Costing Method)/Actual Costing (Costing Basis)/Cannot be Determined (Allocation Technique)	221--Foreign Currency			x
0/0/1/0--Cannot be Determined (Costing System)/Cannot be Determined (Costing Method)/Standard Costing (Costing Basis)/Cannot be Determined (Allocation Technique)	221--Foreign Currency			x
0/2/2/0--Cannot be Determined (Costing System)/Process Costing (Costing Method)/Actual Costing (Costing Basis)/Cannot be Determined (Allocation Technique)	100--Morale and Welfare 112--Direct Labor, Fringe Benefit Costs 412--Awaiting Maintenance, Maintenance Duties 418--Awaiting Maintenance, Non-Maintenance Duties			x x x x

TABLE 47--Continued

1/0/1/0--Direct Costing (Costing System)/Cannot be Determined (Costing Method)/Standard Costing (Costing Basis)/Not Applicable (Allocation Technique)	212--Maintenance Buildings, Interest	x
	214--Installed Equipment, Interest	x
	217--Aircraft Interest	x
1/0/2/0--Direct Costing (Costing System)/Cannot be Determined (Costing Method)/Actual Costing (Costing Basis)/Not Applicable (Allocation Technique)	412--Awaiting Maintenance, Maintenance Duties	x
	413--Awaiting Maintenance, Lack of Facilities	x
	417--Awaiting Maintenance, Lack of People, Overload	x
	418--Awaiting Maintenance, Non-Maintenance Duties	x
	421--Research and Development	x
1/1/0/0--Direct Costing (Costing System)/Job Order Costing (Costing Method)/Cannot be Determined (Costing Basis)/Not Applicable (Allocation Technique)	332--Parts, Components	x
	344--Test Equipment	x

TABLE 47--Continued

Cost Recording Technique	Resource Category and Definition	AF	Mil	Civ
1/1/1/0--Direct Costing (Costing System)/Job Order Costing (Costing Method)/Standard Costing (Cost-Basis)/Not Applicable (Allocation Technique)	132--Direct Labor, Servicing			x
	215--Installed Equipment, Added Cost			x
	218--Aircraft, Added Cost			x
	293--Added Cost, Other		x	
	324--Bench Stock, Engine		x	
	331--Parts, Aircraft		x	
	332--Parts, Components		x	
	333--Parts, Non-Aircraft		x	
	334--Parts, Engine			x
	342--Aircraft Support Equipment			x
1/1/2/0--Direct Costing (Costing System)/Job Order Costing (Costing Method)/Actual Costing (Costing Basis)/Not Applicable (Allocation Technique)	111--Direct Labor, Aircraft	x		
	112--Direct Labor, Fringe Benefit			
	Costs		x	
	113--Direct Labor, Components	x		
	114--Direct Labor, Non-Aircraft	x		
	115--Direct Labor, Aircraft Engines		x	
	122--Direct Supervision		x	
	131--Direct Labor, Inspection	x		
	132--Direct Labor, Servicing	x		
	140--Contractor Maintenance/Services			x
	191--Labor, Other	x		
	210--Maintenance Buildings		x	
	211--Maintenance Buildings, Depreciation			x
	213--Installed Equipment, Depreciation			x

TABLE 47--Continued

Cost Recording Technique	Resource Category and Definition	AF	Mil	Civ
	414--Awaiting Maintenance, Lack of Funds	x		x
	415--Awaiting Maintenance, Lack of Tools	x		x
	416--Awaiting Maintenance, Cannot Duplicate Malfunction	x		x
	417--Awaiting Maintenance, Lack of People, Overload	x		x
	418--Awaiting Maintenance, Non-Maintenance Duties	x		x
	419--Awaiting Maintenance, Other	x		x
	420--Awaiting Maintenance, In Work	x		x
	499--Extraordinary	x		x
	531--Administrative Supplies and Services			x
1/2/1/0--Direct Costing (Costing System)/Process Costing (Costing Method)/Standard Costing (Costing Basis)/Not Applicable (Allocation Technique)	111--Direct Labor, Aircraft	x		x
	342--Aircraft Support Equipment	x		x
1/2/2/0--Direct Costing (Costing System)/Process Costing (Costing Method)/Acting Costing (Costing Basis)/Not Applicable (Allocation Technique)	111--Direct Labor, Aircraft	x		x
	112--Direct Labor, Fringe Benefit Costs			x
	113--Direct Labor, Components	x		x
	114--Direct Labor, Non-Aircraft	x		x
	115--Direct Labor, Aircraft Engines	x		x

TABLE 47--Continued

Cost Recording Technique	Resource Category and Definition	AF	Mil	Civ
2/0/0/1--Absorption Costing (Costing System)/Cannot be Determined (Costing Method)/Cannot be Determined (Costing Basis)/Labor (Allocation Technique)	418--Awaiting Maintenance, Non-Maintenance Duties	x	x	x
2/0/0/1--Absorption Costing (Costing System)/Cannot be Determined (Costing Method)/Cannot be Determined (Costing Basis)/Labor (Allocation Technique)	418--Awaiting Maintenance, Non-Maintenance Duties			x
2/0/1/0--Absorption Costing (Costing System)/Cannot be Determined (Costing Method)/Standard Costing (Costing Basis)/Cannot be Determined (Allocation Technique)	191--Labor, Other		x	
	221--Foreign Currency			x
2/0/2/0--Absorption Costing (Costing System)/Cannot be Determined (Costing Method)/Actual Costing (Costing Basis)/Cannot be Determined (Allocation Technique)	112--Direct Labor, Fringe Benefit Costs			x
	114--Direct Labor, Non-Aircraft			x
	217--Aircraft Interest			x
	219--Cost of Parts Retired			x
	311--Aircraft Consumable Fluids			x
	312--Aircraft Consumable Fluids, Fuel			x
	322--Bench Stock, Aircraft Component			x

TABLE 47--Continued

Cost Recording Technique	Resource Category and Definition	AF	Mil	Civ
	321--Bench Stock, Aircraft Airframe			x
	322--Bench Stock, Aircraft Component			x
	324--Bench Stock, Engine			x
	341--Tools			x
	342--Aircraft Support Equipment			x
	412--Awaiting Maintenance, Maintenance Duties			x
	418--Awaiting Maintenance, Non-Maintenance Duties			x
	531--Administrative Supplies and Services			x
	511--Utilities			x
2/1/2/5--Absorption Costing (Costing System)/Job Order Costing (Costing Method)/Actual Costing (Costing Basis)/Activity (Allocation Technique)				
	111--Direct Labor, Aircraft			x
	113--Direct Labor, Components			x
	115--Direct Labor, Aircraft Engines			x
	218--Aircraft, Added Cost			x
	220--Engines, Added Cost			x
	221--Foreign Currency			x
	222--Engine Depreciation			x
	293--Added Cost, Other			x
	331--Parts, Aircraft			x
2/1/2/6--Absorption Costing (Costing System)/Job Order Costing (Costing Method)/Actual Costing (Costing Basis)/Aircraft Hours (Allocation Technique)				

TABLE 47--Continued

	332--Parts, Components	x
	334--Parts, Engine	x
	342--Aircraft Support Equipment	x
2/2/1/0--Absorption Costing (Costing System)/Pro- cess Costing (Costing Method)/Standard Cost- ing (Costing Basis)/ Cannot be Determined (Allocation Technique)	210--Maintenance Buildings	x
	211--Maintenance Buildings, Depreciation	x
	212--Maintenance Buildings, Interest	x
	213--Installed Equipment, Depreciation	x
	214--Installed Equipment, Interest	x
	215--Installed Equipment, Added Cost	x
	216--Aircraft Depreciation	x
	222--Engine Depreciation	x
	291--Depreciation, Other	x
	292--Interest, Other	x
	321--Bench Stock, Aircraft Airframe	x
	322--Bench Stock, Aircraft Component	x
	323--Bench Stock, Non-Aircraft	x
	331--Parts, Aircraft	x
	332--Parts, Components	x
	333--Parts, Non-Aircraft	x
	334--Parts, Engine	x
	341--Tools	x
	342--Aircraft Support Equipment	x
	343--Vehicular Support, General	x
	344--Test Equipment	x

TABLE 47--Continued

Cost Recording Technique	Resource Category and Definition	AF	Mil	Civ
2/2/1/1--Absorption Costing (Costing System)/Process Costing (Costing Method)/Standard Costing (Costing Basis)/Labor (Allocation Technique)	111--Direct Labor, Aircraft	x	x	x
	113--Direct Labor, Components	x	x	x
	114--Direct Labor, Non-Aircraft	x	x	x
	115--Direct Labor, Aircraft Engines	x	x	x
	121--Salaried Management and Staff	x	x	x
	122--Direct Supervision	x	x	x
	131--Direct Labor, Inspection	x	x	x
	132--Direct Labor, Servicing	x	x	x
	217--Aircraft Interest			x
	218--Aircraft, Added Cost			x
2/2/1/4--Absorption Costing (Costing System)/Process Costing (Costing Method)/Standard Costing (Costing Basis)/Material (Allocation Technique)	219--Cost of Parts Retired			x
	220--Engines, Added Cost			x
	222--Engine Depreciation			x
2/2/1/5--Absorption Costing (Costing System)/Process Costing (Costing Method)/Standard Costing (Costing Basis)/Activity (Allocation Technique)	111--Direct Labor, Aircraft		x	
	113--Direct Labor, Components		x	
	216--Aircraft Depreciation			x

TABLE 47--Continued

2/2/2/0--Absorption Costing (Costing System)/Pro- cess Costing (Costing Method)/Actual Costing (Costing Basis)/Cannot be Determined (Alloca- tion Technique)	219--Cost of Parts Retired	x
	292--Interest, Other	x
	341--Tools	x
	511--Utilities	x
2/2/2/1--Absorption Costing (Costing System)/Pro- cess Costing (Costing Method)/Actual Costing (Costing Basis)/Labor (Allocation Technique)	111--Direct Labor, Aircraft	x
	112--Direct Labor, Fringe Benefit Costs	x
	113--Direct Labor, Components	x
	114--Direct Labor, Non-Aircraft	x
	115--Direct Labor, Aircraft Engines	x
	121--Salaried Management and Staff	x
	122--Direct Supervision	x
	132--Direct Labor, Servicing	x
	140--Contractor Maintenance/Services	x
	219--Cost of Parts Retired	x
	220--Engines, Added Cost	x
	300--Custodial Supplies	x
	311--Aircraft Consumable Fluids	x
	312--Aircraft Consumable Fluids, Fuel	x
	321--Bench Stock, Aircraft Airframe	x
	322--Bench Stock, Aircraft Component	x
	323--Bench Stock, Non-Aircraft	x
	324--Bench Stock, Engine	x
	331--Parts, Aircraft	x
	332--Parts, Components	x
	333--Parts, Non-Aircraft	x
	334--Parts, Engine	x

TABLE 47--Continued

Cost Recording Technique	Resource Category and Definition	AF	Mil	Civ
	341--Tools	X		
	412--Awaiting Maintenance, Maintenance Duties	X		
	418--Awaiting Maintenance, Non-Maintenance Duties	X		
	511--Utilities	X		
	531--Administrative Supplies and Services	X		
	300--Custodial Supplies			X
	311--Aircraft Consumable Fluids			X
	312--Aircraft Consumable Fluids, Fuel			X
	321--Bench Stock, Aircraft Airframe			X
	322--Bench Stock, Aircraft Component			X
	323--Bench Stock, Non-Aircraft			X
	324--Bench Stock, Engine			X
	331--Parts, Aircraft			X
	332--Parts, Components			X
	333--Parts, Non-Aircraft			X
	334--Parts, Engine			X
	341--Tools			X
	345--Storage Equipment			X
2/2/2/4--Absorption Costing (Costing System)/Process Costing (Costing Method)/Actual Costing (Costing Basis)/Material (Allocation Technique)				

Actual Costing (Costing Basis)/Labor (Allocation Technique). The military, the Air Force especially, used this recording technique for more parts and supplies subcategories than was the case in the civilian airlines. Civilian airlines, on the other hand, used more of other recording techniques for these parts and supplies subcategories.

The research questions answered. As indicated in Chapter 1, this study was to answer three basic questions:

1. What cost elements were available to measure aircraft maintenance costs?
2. What cost recording techniques were available to convert maintenance cost elements to useful information?
3. To which subgoals of MBO 9-2 would the cost elements apply?

To answer the first two of these requires the review and semantic content analysis of all available data so as to produce a list of the elements and techniques in use by the aircraft maintenance population. Tables 42 and 43 (pages 107-109) provide the answers to research questions 1 and 2 in tabular form.

To discern the answer to question 3, the final list of cost elements had to be evaluated as to whether each combination was more logically categorized as program information, management control information, or both. This was accomplished by reviewing each of the cost element

codes and asking whether or not the resource subcategory could be expected to directly and quickly vary with increases or decreases in aircraft operations (flying hours, sorties). If the answer were "no," then the other four data dimensions--Precision, Timeliness, Responsibility, and Causality--were evaluated (yes or no)¹ and the resultant categorization depicted.

Table 48 indicates the answers to that research question. Code sets are listed under program information, management control information, or both.

In analyzing the results of the categorization, a pattern seemed to emerge. Those cost elements, Resource Categories 1 (Labor) and 3 (Supplies and Equipment) were mainly determined to be for management control purposes. Resource Category 4 (Opportunity Costs) was evenly divided between management and program information, with several subcategories listed as "both." Resource Category 2 (Capital) was always considered a program cost.

These categorization findings are borne out in other literature and in accounting principles.

¹The "Yes" or "No" (Y or N) indications in table 48 denote: More Precision = Yes, Less = No; More Timely = Yes, Less = No; More Direct Responsibility = Yes, More Indirect = No; More Direct Causality = Yes, More Indirect = No.

TABLE 48

RESOURCE CODE CATEGORIZATION--PROGRAM OR CONTROL

Resource Category	Direct Conseq		Dimensions			MC Prog
	Yes	No	Prec	Time Resp	Caus	
Labor						
100--Morale and Welfare		X	N	N	N	X
111--Direct Labor, Aircraft	X					X
112--Direct Labor, Fringe Benefit Costs		X	N	N	N	X
113--Direct Labor, Components	X					X
114--Direct Labor, Non-Aircraft	X					X
115--Direct Labor, Aircraft Engines	X					X
121--Salaried Management and Staff		X	Y	Y	N	X
122--Direct Supervision	X					X
131--Direct Labor, Inspection	X					X
132--Direct Labor, Servicing	X					X
140--Contractor Maintenance/Services		X	Y	Y	Y	X
191--Labor, Other	-	-	-	-	-	-
Capital						
210--Maintenance Buildings	X		N	N	Y	X
211--Maintenance Buildings, Depreciation	X		Y	N	N	X

TABLE 48--Continued

Resource Category	Direct Conseq		Dimensions			MC Prog
	Yes	No	Prec	Time Resp	Caus	
334--Parts, Engine	X					X
341--Tools		X	Y	Y	N	X
342--Aircraft Support Equipment		X	Y	Y	N	X
343--Vehicular Support, General		X	Y	Y	N	X
344--Test Equipment		X	Y	Y	N	X
345--Storage Equipment		X	Y	Y	N	X
351--Weapons Equipment, On-Equipment	X					X
352--Weapons	X					X
Opportunity Costs						
411--Awaiting Parts		X	N	Y	Y	X
412--Awaiting Maintenance, Maintenance Duties	X					X
413--Awaiting Maintenance, Lack of Facilities		X	N	Y	N	X
414--Awaiting Maintenance, Lack of Funds		X	N	Y	Y	X
415--Awaiting Maintenance, Lack of Tools		X	N	Y	N	X
416--Awaiting Maintenance, Cannot Duplicate Malfunction	X					X
417--Awaiting Maintenance, Lack of People, Overload	X					X
418--Awaiting Maintenance, Non-Maintenance Duties		X	N	Y	N	X

Direct material and labor costs can be specifically identified with some quantity of products or vary so closely . . . that a direct relationship is presumed to exist. Direct material and labor costs thus fall within the variable concept [14:55].

Resource Categories 1 (Labor) and 3 (Supplies and Equipment) fall into the direct or variable areas that were basically designed to internal management needs--management control. On the other hand,

In contra-distinction to direct costs, an overhead (or indirect) cost may be defined . . . as those costs originating from production-related expenditures but which cannot be directly associated with the products being produced [14:55].

Resource Category 2 (Capital) and parts of the other categories, especially 4 (Opportunity Costs), fall into this area of indirect costs that are the basic costs included in a perspective or ongoing program. These were more applicable for future programming or strategic planning than for management control.

Summary

In this chapter have been summarized the observations and findings gleaned from semantic content analysis of literature that was made available from the Army, Navy, Air Force, CAB, and responding civil air carriers. Additionally, an analysis was performed to highlight the significant differences between military and civilian cost elements, cost recording techniques, and combinations of cost elements and cost recording techniques extant in the

data available. Finally, the total lists of cost elements, cost recording techniques, and categorization of resource categories into "management control" and "program" applications were used to provide the answers to the research questions posed in Chapter 1.

Chapter 4

CONCLUSIONS AND RECOMMENDATIONS

Overview

In this chapter, the researchers endeavor to place in perspective the findings and observations gained through the semantic content analysis of maintenance cost information from military and civilian aircraft maintenance organizations. Additionally, the researchers suggest some directions future research might take for maximum benefit to the Air Force.

Conclusions

In Chapter 3, the research methodology yielded responses to the three research questions. In the case of the first question, the response was a list of maintenance cost elements that represented the resources being costed by the aircraft maintenance activities in the sample population. This resource category list provided a core or data base from which the various maintenance organizations have drawn the resource categories that were most applicable to their accounting system. The total list, therefore, represented the collective wisdom and practice of aircraft

maintenance organizations and therefore represented the total resources that could have been accounted for.

The list of recording techniques provided in response to research question 2, "What are the recording techniques in use by aircraft maintaining organizations?," also yielded a list of techniques in use by aircraft maintaining organizations. It, too, was a core or data base that represented the collective wisdom and experience of the sampled organizations. Since this sample represented nearly 40 percent of the civilian major airline industry and 100 percent of the military aircraft maintenance population, the collective lists were considered complete.

The response to the third research question also yielded a core or data base list. This time cost elements were each subjectively categorized as more useful as program information, more useful as management control information, or both.

One of the main premises upon which the study is based is that the cost elements and cost recording techniques resulted from the different organizations' geographic and physical environment.

Consequently, the collective lists were considered as representative of the economic and physical environment of the military services as well as the civilian maintenance organizations.

In effect, MBO 9-2 provides DOD agencies with guidance on which cost elements and which techniques were to be used. As indicated previously, there are two reasons that Air Force officials ought to carefully review the core lists to develop a more comprehensive cost element and cost recording system that will meet the requirements of MBO 9-2. First, DOD has determined that the MBO is still unfulfilled. Second, comparisons between Air Force and other organizations' core cost elements and recording techniques revealed considerable disparity.

Recommendations

Careful analysis of the results of this research suggested several future avenues for continued study in both long and short term. First, there were three short-term research recommendations. To facilitate the Air Force choice of a "best" set of cost elements and recording techniques for its use, it is suggested that future research be directed at ascertaining the most comprehensive yet efficient combination of elements and techniques to be selected. This might be accomplished through a study that would, for example, examine each of the cost element/cost recording technique combinations that were determined applicable to both programming and management control information to determine which would be the least expensive method of accumulating the greatest number of cost elements.

This could result in a preferred "core" list from which could be determined a least expensive, most effective master reporting and cost collecting system.

In another, but related, area, a comprehensive study should also be undertaken to determine the effects of not costing capital in the Air Force. A study of Air Force capital costing would be envisioned to be able to ascertain the amount of understatement extant in current Air Force aircraft maintenance costs. For example, in Air Force maintenance costs, interest is not considered. Yet monies were paid in consequence of Treasury bills and bonds, monies which were used at least in part by the Air Force. Additionally, depreciation, while not costed in the Air Force, could, in part however, be useful. Most think of depreciation solely as ". . . a tax shield, because it protects that amount of income from taxation [19:491]." This definition would, of course, not have been applicable to the Air Force since it had neither profit nor was it subject to taxation.

But the alternate consideration that depreciation is "a process of allocation, not of valuation [3:141]" might be useful. The allocation process in this case is one of allocating or dividing the cost of an asset, like equipment or aircraft, over its useful life. The useful life of an asset is

limited for one of two reasons: deterioration, which is the physical process of wearing out; and obsolescence which refers to loss of usefulness because of the development of new equipment or processes, changes in style, or other causes not related to the physical condition of the asset [3:141].

Since the Air Force, with heavy investment in high technology fixed assets, is extremely susceptible to both deterioration and obsolescence and since depreciation refers to both concepts, it could be of significant management value to indicate how quickly or slowly the useful life of the Air Force asset base is being depleted or is becoming technologically outdated (3:142).

Another suggested research area relates to an alternate use for semantic content analysis. During the researchers' review of military and civilian maintenance publications, it was noted that much duplication of information reporting systems appeared to occur in the military directives nor was that duplication easily determined. In many cases it appeared that different items or costs were being requested; but when coded, the information required by a higher authority duplicated other data requirements. Semantic content analysis could be used to determine what and where such content duplication exists.

In the long term a program to improve the Air Force aircraft maintenance cost recording system should include a three-phase research effort. This study represented the first phase of that effort, identifying what cost elements,

cost recording techniques, and combinations of cost recording techniques and cost elements exist in the aircraft maintenance population.

A second part or phase of the research effort should consider the element and technique "needs" of the Air Force--in other words, what cost elements and cost recording techniques are needed by the Air Force for use at local and higher levels in making both program decisions and the daily controlling of maintenance operations.

A third research effort would be directed toward determining the most effective and efficient technique available for providing the information needed by Air Force maintenance managers.

In essence, this proposed three-phase research can provide an outline for an aircraft maintenance economic decision model, which could help managers understand the financial parameters around which the most economic aircraft maintenance decisions could be made.

Summary

In this chapter, the research concluded from the findings that there is a core list of cost elements, cost recording techniques, and element and technique combinations that represents the "wisdom of the group." The existence of such lists suggests further short- and long-term research into the most effective and efficient information

output and the most effective and efficient method for extracting those cost elements. It was also suggested that the methodology used in this research, semantic content analysis, might also be applied to determine where and what duplicative information is required by higher authority. Finally, for the long term, consider a three-phase research effort, this research being the first phase, to also determine what the Air Force needs in the way of cost elements and accounting techniques, followed by the third effort, which is developing an economic decision model for USAF maintenance managers.

APPENDIX A

DEFINITIONS

1. Absorption Costing: "A system of measuring . . . costs that assigns a fair share of production costs of material, labor, variable factory overhead, and fixed factory overhead to the product [11:710]."
2. Actual Costing: An accounting system where costs are recorded as they actually were.
3. Direct Costing: "A system of measuring . . . costs that assigns variable production costs of material, labor, and variable factory overhead to the product unit cost [11:732]."
4. Direct Costs: ". . . items of costs that are specifically traceable to or directly caused by a cost objective [3:307]."
5. Indirect Costs: ". . . elements of costs that are associated with or caused by two or more cost objectives jointly, but that are not directly traceable to each of them individually [3:308]."
6. Job Order Costing: An accounting system which provides for a separate record of the cost of each particular quantity of product that passes through an organization (29:513).
7. Maintenance Cost Elements: Those elements which reflect the cost of maintaining aircraft, material, labor, or services.
8. Process Costing: "A method of determining the unit cost of manufacturing where production costs are divided by units produced during a given time period [11:726]."
9. Standard Costing: An accounting system where costs are recorded at what they should have been rather than what they actually were (3:358).
10. Variable Costs: "Costs that vary in total dollar amount in direct proportion to changes in production volume. The cost per unit of output is constant over the relevant range of activity [11:732]."

APPENDIX B

SEMANTIC CONTENT ANALYSIS CODING SYSTEM--
DEFINITIONS

A. Digit 1: Weight Factor

0--No Indicated Strength. This code was used when the researchers could not ascertain the importance of a maintenance cost element to an organization's cost accounting system. An example of a phrase that was recorded as No Indicated Strength follows: "It is emphasized, however, that the summary is principally a local document for local management use [54:4-28]."

1--Weak. This code was used to indicate by-product or "nice-to-have" information generated by a cost accounting system. Phrases which contained the word "optional" or the word "may" were keyed to this code. An example of a phrase that was coded as Weak follows: "Standard burden rates may be employed for quarterly allocation of maintenance burden provided the rates are reviewed at the close of each fiscal year, at least [39:10-2]."

2--Strong. This code was used to indicate the portions of an organization's aircraft maintenance cost accounting system that were identified, for example, as "vital," "important," or "urgent." An example phrase recorded to this code follows:

. . . provides for the Department of the Army Staff and commanders at all levels, information as to the readiness status of equipment in the hands of using organizations, identification of reasons for shortfalls and provides a basis for corrective action [52:3-9].

B. Digit 2: Resource Categories

1--Labor. This code was used whenever labor or personnel costs were indicated, whether management or direct maintenance effort. Also included were peripheral labor costs--fringe benefits, morale and welfare activities, and insurance (39:10-1,11-1).

2--Capital. This code was used to reflect capital costs of providing maintenance. This included costs associated with buildings, installed equipment and mobile equipment, depreciation, and interest on borrowed money.

3--Supplies and Equipment. This code was used to record material costs in maintaining and operating the aircraft support equipment and to support the maintenance organization.

4--Opportunity. This is the cost code of resources foregone as a result of decisions made. This code included not only those resources (revenue) foregone, but also those current resources foregone when providing for future revenue as in the case of research and development (7:9-11). Too, it included "non-available" time (lost or restricted use) which resulted from maintenance difficulties.

9--Miscellaneous. Codes in this category were used to record costs in categories which were not directly

identifiable with other categories or which were shared between several categories.

C. Digits 3 and 4: Resource Subcategories

Category 1 (Labor)

Subcategory

00--Morale and Welfare. This code was used to record costs associated with items which "improved" employee morale and welfare. This included, for example, birthday leave (32:24).

11--Direct Labor, Aircraft. This code was used to indicate the direct maintenance man-hour costs expended to repair aircraft. Specifically, ". . . direct labor is [was] defined as the 'touch' labor of personnel actually performing the tasks or operations associated with the process [51:2-12]."

12--Direct Labor, Fringe Benefit Costs. This code was to indicate vacation pay, dismissal compensation, pensions, etc. An example of a phrase which was coded as Direct Labor, Fringe Benefit Costs, follows:

. . . compensation, including vacation and sick leave pay of instructors and personnel in an off-the-job training status; direct maintenance personnel compensation not assigned to specific projects; and vacation or sick leave pay of direct maintenance personnel [39:12-6].

13--Direct Labor, Components. This code was used to indicate the direct maintenance man-hours expended to

repair aircraft parts off the aircraft. An example of this code is component testing.

14--Direct Labor, Non-Aircraft. This code was used to record cost elements associated with direct man-hours expended on other than aircraft items. Examples of these other than aircraft items include support equipment, test equipment, vehicles, and stands.

15--Direct Labor, Aircraft Engines. This code was used to indicate direct maintenance man-hours expended to repair aircraft engines.

21--Salaried Management and Staff. This code was used for costs recorded to management and staff but distinct from the direct management/supervision of the maintenance work force.

22--Direct Supervision. This code was used to record costs associated with supervision other than those under code 21.

31--Direct Labor, Inspection. This code was used to indicate direct man-hours expended in the inspection of aircraft and engines. It did not include "touch labor" (i.e., hands-on labor).

32--Direct Labor, Servicing. This code was used to indicate direct man-hours incurred on the ground incident to readying for arrival and take-off of aircraft. It includes fueling and parking of aircraft.

40--Contractor Maintenance/Services. This code was used to indicate direct labor costs per the provisions of maintenance/service contracts.

91--Labor, Other.

Category 2 (Capital)

Subcategory

10--Maintenance Buildings. This code was used to indicate the cost of buildings dedicated to maintenance use.

11--Maintenance Buildings, Depreciation.¹ This code was used to indicate depreciation costs associated with buildings dedicated to maintenance use.

12--Maintenance Buildings, Interest. This code was used to indicate interest on borrowed money for capital improvements or construction of maintenance-dedicated buildings.

13--Installed Equipment, Depreciation. This code was used to record the cost of installed equipment.

¹CAB defines depreciation as follows:

Depreciation (of depreciable property and equipment)--the loss in service value, not restored by current maintenance, incurred in the course of service from causes known to be in current operations, against which the carrier is not protected by insurance, and the effect of which can be forecast with reasonable accuracy. The causes of depreciation include wear and tear, decay, action of elements . . . [39:03-3].

14--Installed Equipment, Interest. This code was used to indicate interest costs on borrowed money in support of installed equipment.

15--Installed Equipment, Added Cost. This code reflected the added cost of equipment, called "betterment" by the CAB. Specifically,

When superior parts are substituted for old parts in existing units of property or equipment as an incident to normal maintenance operations where normal retirement procedures are not practicable, the excess cost of the new parts over the estimated current cost of new parts of the kind replaced shall be charged to the related property and equipment account [39:2-5].

Equipment TCTOs were included in this code.

16--Aircraft Depreciation. This code was used to indicate depreciation costs associated with aircraft.

17--Aircraft Interest. This code was used to indicate interest costs on borrowed money in support of aircraft.

18--Aircraft, Added Cost. This code reflected the added cost of aircraft. (See explanation of "betterment" under Installed Equipment, Added Cost, above.) Aircraft (airframe) TCTOs were included in this code.

19--Cost of Parts Retired. This code was used to indicate, as a Capital expense, the cost of parts retired due to obsolescence/deterioration.

20--Engines, Added Cost. This code reflected the added cost of engines. (See explanation under Installed Equipment, Added Cost, above.) Engine TCTOs were included in this code.

21--Foreign Currency. This code was used to indicate costs or revenues due to the exchange of foreign currency (40).

22--Engine Depreciation. This code was used to indicate depreciation costs associated with engines.

91--Depreciation, Other.

92--Interest, Other.

93--Added Cost, Other.

Category 3 (Supplies and Equipment)

Subcategory

00--Custodial Supplies. This code was used to indicate costs of janitorial supplies in addition to degreasing aircraft and facility-cleaning equipment and supplies. For example, CAB has an account entitled "Shop and Servicing" in which ". . . the cost of supplies and expendable small tools and equipment used in maintaining, servicing and cleaning property or equipment . . . [39:12-11]."

11--Aircraft Consumable Fluids. This code was used to indicate the costs of hydraulic fluid, oil, and grease used in the repair/maintenance of aircraft, engines, components, and support equipment.

12--Aircraft Consumable Fluids, Fuel. This code was used to indicate the cost of fuels used in the repair/maintenance of aircraft, engines, and support equipment.

21--Bench Stock, Aircraft Airframe. This code was used to indicate costs of the bits-and-pieces hardware, i.e.,

safety wire, seals, screws, nuts and bolts, that were used for the airframe itself.

22--Bench Stock, Aircraft Component. This code was for recording bits-and-pieces costs for aircraft sub-parts or components that are normally removed from the aircraft and taken to specialized shops for repair.

23--Bench Stock, Non-Aircraft. This code was used for recording bits-and-pieces costs for support equipment and maintenance vehicles.

24--Bench Stock, Engine. This code was used to indicate costs of the bits-and-pieces hardware, i.e., safety wire, seals, nuts and bolts, that were used in the repair of engines.

31--Parts,¹ Aircraft. This code was used to indicate costs associated with the aircraft parts, other than bench stock, that were repaired, removed, replaced, or condemned.

32--Parts,¹ Components. This code was used to indicate costs associated with parts removed, other than bench stock, repaired, and/or replaced from aircraft components not installed on the aircraft.

¹"The cost of transporting property to and from shops for repair and maintenance shall be included as a part of the cost of materials and supplies used in the repair or maintenance of such property and equipment. Transportation charges, customs and duties, etc., shall be included in the cost of repairs and maintenance operations when made by outside parties [39:10-1]."

33--Parts,¹ Non-Aircraft. This code was used to indicate costs associated with parts, other than bench stock, removed and repaired on other than aircraft or aircraft components. This included parts costs for vehicles and support equipment.

34--Parts,¹ Engine. This code was used to indicate costs associated with engine parts, other than bench stock, that were repaired, removed, replaced, or condemned.

41--Tools. This code was used to indicate costs of tools, including issued personnel tools and special jigs, dies, and templates.

42--Aircraft Support Equipment. This code category was used to indicate costs associated with, for example, the mobile electrical power generators used for starting aircraft, compressed air and hydraulic pressure equipment also used for starting engines, and stands, jacks, and ladders used by maintenance personnel.

43--Vehicular Support, General. This code was used to indicate costs associated with automobiles, trucks, and heavy maintenance-support vehicles used to support maintenance operations.

44--Test Equipment. This code was used to indicate costs of equipment used to test, inspect, and calibrate aircraft components and tools.

¹Ibid.

45--Storage Equipment. This code was used to indicate costs associated with equipment used in storing and distributing fuel, oil, and water. Included were fuel bowsers (mobile fuel disposal tanks).

51--Weapons Equipment, On-Equipment. This code was used to indicate costs associated with weapons equipment such as stores pylons.

52--Weapons. This code was used to indicate costs associated with weapons themselves.

Category 4 (Opportunity Costs)

Subcategory

11--Awaiting Parts. This code was used to indicate costs associated with labor hours lost due to parts not being available for repair.

12--Awaiting Maintenance, Maintenance Duties. This code was used to indicate costs associated with labor hours lost due to a shortage of skilled maintenance personnel, maintenance personnel being in training, maintenance personnel being on alert, and maintenance personnel flying.

13--Awaiting Maintenance, Lack of Facilities. This code was used to indicate costs associated with labor hours lost due to not having facilities. These costs stem from lack of support equipment, lack of transportation equipment, etc. It also included costs attributed to lack of technical data.

14--Awaiting Maintenance, Lack of Funds. This code was used to indicate costs associated with the uneconomical

repair of a part, component, etc. For example, if a radar set was deemed uneconomical to repair at base, it would be sent forward to depot for repair. The costs associated with the loss of the asset were recorded under this code.

15--Awaiting Maintenance, Lack of Tools. This code was used to indicate costs associated with labor hours lost when no further work can be accomplished without a particular tool.

16--Awaiting Maintenance, Cannot Duplicate Malfunction. This code was used to indicate costs associated with labor hours lost testing a piece of equipment that was deemed inoperable when, in fact, nothing was wrong with it.

17--Awaiting Maintenance, Lack of People, Overload. This code was used to indicate costs associated with aircraft, engines, support equipment not being operationally ready due to maintenance personnel working on other pieces of equipment.

18--Awaiting Maintenance, Non-Maintenance Duties. This code was used to indicate costs associated with labor hours lost due to maintenance personnel not being available due to leave, sickness, base detail, etc.

19--Awaiting Maintenance, Other.

20--Awaiting Maintenance, In Work. This code was used to indicate costs associated with a piece of equipment not being operationally ready.

21--Research and Development. This code was used to indicate costs associated with research on maintenance-related items. It included training expenses associated with new equipment.

99--Extraordinary. This code was used to indicate costs associated with costs beyond normal or expected maintenance. Specifically, this code was used with the phrase, "when an aircraft or aeronautical equipment is suspected to have been contaminated . . . [43:1-32]."

Category 5 (Miscellaneous Costs)

Subcategory

11--Utilities. This code was used to indicate costs associated with electrical power, water, and gas attributed to and/or allocated to maintenance facilities.

31--Administrative Supplies and Services. This code was used to indicate costs associated with office supplies and equipment directly dedicated to maintenance personnel. This included, for example, aircraft forms; filing and writing utensils needed to fill out these forms; and paper clips, paper, and pens for maintenance staff. This cost is recorded as a part of CAB's cost category, Maintenance Burden, which includes ". . . expenses specifically related to the administration of maintenance stocks and stores, the keeping of pertinent maintenance operations records . . . [39:10-1]."

D. Digit 5: Costing Systems (Definitions are in Appendix A.)

0--Cannot be Determined.

1--Direct Costing.

2--Absorption Costing. An example of a phrase which was coded as Absorption Costing was "maintenance burden shall be allocated thereto on a pro rata basis [39:10-2]."

E. Digit 6: Costing Methods (Definitions are in Appendix A.)

0--Cannot be Determined.

1--Job Order Costing. An example of a phrase which was coded as Job Order Costing was "the cost of direct labor, . . . shall be recorded on running job orders or tickets covering repairs and periodic inspection . . . [39:10-1]."

2--Process Costing.

F. Digit 7: Costing Basis (Definitions are in Appendix A.)

0--Cannot be Determined.

1--Standard Costing. An example of a phrase which was coded as Standard Costing follows: "Standard burden rates may be employed for quarterly allocations [39:10-2]."

2--Actual Costing.

G. Digit 8: Allocation Techniques.

0--Cannot be Determined/Not Applicable. The Not Applicable code was used with Cost System's Code, Direct. The Cannot be Determined code is self-explanatory.

4--Material. This code was used to indicate cost allocations based on the amount of raw materials used by a maintenance organization as compared to other maintenance organizations.

5--Activity. This code was used to indicate cost allocations based on the total services produced versus that of other organizations.

6--Aircraft Hours. This code was used to indicate cost allocations based on hours flown. An example of a phrase which was coded as Allocation Technique, Aircraft Hours, follows: ". . . on the reverse basis wherein a provision for maintenance is charged to expense and credited to a balance sheet reverse account as the aircraft is operated [Appendix H: United Airlines]."

APPENDIX C

AIR CARRIERS

Interstate:

Air Midwest
Air New England
Alaska Airlines
Allegheny Airlines
Aloha Airlines
American Airlines
Aspen Airways
Braniff International Airways
Continental Airlines
Delta Airlines
Eastern Air Lines
Frontier Airlines
Hawaiian Airlines
Hughes Airwest
Kodiak Western Alaska Airlines
Munz Northern Airlines
National Airlines
New York Airways
North Central Airlines
Northwest Orient Airlines
Ozark Airlines
Pan American World Airways
Piedmont Aviation
Southern Airways
Trans World Airlines
United Airlines
Western Airlines
Wien Air Alaska
Wright Airlines

Intrastate/Commuter:

Aerie Airlines
Aeromech
Aero Virgin Islands
Air California
Air Caribbean
Air Carolina
Air Florida
Air Gemini
Air Illinois
Air Kentucky

Air Missouri
Airmont
Air Nebraska
Air New Ulm
Air South
Air Sunshine
Air Wisconsin
Alair
Alaska Aeronautical Industries
Albany Air Services
Alector Airways
All Island Air
Altair Airlines
Amistad Airlines
Antilles Air Boats
Apollo Airways
Arkansas Airlines
Astro Airways
Bar Harbor Airlines
Brandt Air
Britt Airways
Brower Airways
Business Aircraft
California Air Commuter
California Nevada Airlines
Capitol Air Service
Cascade Airways
Catalina Airlines
Catalina-Vegas Airlines
Catskill Airways
Chalk's International Air-
line
Chaparral Airlines
Charter Air Center
Coastal Airways
Coastal Plains Commuter
Cochise Airlines
Colgan Airways
Columbia Airline
Command Airways
Commuter Airlines
Consolidated Airways
Crested Butte Air Service

Crown International Airlines	Omni Airlines
Cumberland Airlines	Palmas Air
Davis Airlines	Pearson Aircraft
Dorado Wings	Pennsylvania Commuter Air- lines
Dovair-Baltimore Airways	Perkiomen Airways
Downeast Airlines	Phillips Airlines
Eagle Commuter Airlines	Pilgrim Airlines
Eastern Caribbean Airways	Pioneer Airways
Empire Airlines	Polar Airways
Eureka Aero Industries	Priority Air Transport
Execuair Airlines	Provincetown-Boston Air- line
Executive Airlines	PSA Pacific Southwest Airlines
Federal Carriers	Puerto Rico Int'l Airlines
Florida Airlines	Resort Commuter Airlines
GCS Airlines	Rio Airways
Golden West Airlines	Rocky Mountain Airways
Grand Canyon Airlines	Ross Aviation
Great Plains Airlines	Roswell Airlines
Gull Air	Royale Airlines
Harbor Airlines	Royal Hawaiian Airways
Hensley Flying Service	Rutland Airways
Imperial Airlines	San Juan Airlines
Island Pacific Air	Scenic Airlines
Key Airlines	Scheduled Skyways
Lake Central Aviation	Seaco Airlines
Lake Havasu Air Service	Seaplane Shuttle Transport
Lawrence Aviation	Semo Aviation
Los Angeles Helicopter Airlines	Shawnee Airlines
Mackey International Airlines	Sierra Pacific Airlines
Mall Airways	Skystream Airlines
Marco Island Airways	Skyway Aviation
Merrimack Airways	Sky West Aviation
Mesaba Aviation	South Central Air Trans- port
Metro Airlines	Southeastern Commuter Airlines
Metroflight Airlines	Southeast Skyways
Metroplex Helicopter Airways	Southwest Airlines
Midstate Airlines	Star Aviation
Midwest Aviation	Sterling Air Service
Mississippi Valley Airways	Stol Air
Monmouth Airlines	Suburban Airlines
Montauk Caribbean Airways	Sun Aire Lines
Mountain West Airlines	Sun Airlines
Munz Northern Airlines	Sun Basin Airlines
Naples Airlines	Swift Aire Lines
Nelson Airlines	Trans American Airways
Nevada Airlines	Trans Commuter Airline
New England Airlines	
Newport Aero	
Nor-Cal Aviation	
Oahu & Kauai Airlines	
Ocean Reef Airways	

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AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB OHIO SCHO--ETC F/G 15/5
AIRCRAFT MAINTENANCE COST ELEMENTS.(U)

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Trans Mo Airlines
Trans Mountain Air
Trans Regional Airlines
Trans Western Airlines
Valley Airpark
Valley Air Service
Vero Monmouth Airlines
Vieques Air Link
Virgin Air
Weiss Aviation
Wheeler Flying Service
Wings Airways
Winnepesaukee Aviation
Yosemite Airlines
Zia Airlines

APPENDIX D

MILITARY MAINTENANCE COST ACCOUNTING LITERATURE

AFM 66-1	<u>Maintenance Management</u>
AFM 177-380	<u>USAF Standard Base Level Maintenance Cost System (B3500)</u>
TM 38-750	<u>The Army Maintenance Management System (TAMMS)</u>
OPNAVINST 4790.2A	<u>The Naval Aviation Maintenance Program (NAMP), Volumes III and IV</u>
TO 00-20-1	<u>Preventive Maintenance Program General Requirements and Procedures</u>
TO 00-20-2	<u>The Maintenance Data Collection System</u>
TO 00-20-2-2	<u>On-Equipment Maintenance Documentation for Aircraft; Air-Launched Missiles; Ground-Launched Missiles, Except ICBMS; Drones; and Related Training Equipment</u>
TO 00-20-2-3	<u>"On-Equipment" Maintenance Documentation for Advanced System (ACMS) Aircraft, Air-Launched Missiles, Their MTSS and Peculiar AGE (G5, G141, F/RF-4, F/RF/FB-111, and AGM-69)</u>
TO 00-20-2-4	<u>Maintenance Documentation for In-Shop Engine Maintenance</u>
TO 00-20-2-7	<u>On-Equipment Maintenance Documentation for AGE and Trainers</u>
TO 00-20-2-10	<u>Off-Equipment Maintenance Documentation for Shop Work, Conventional Munitions, and Precision Measuring Equipment</u>
TO 00-20-3	<u>Maintenance Processing of Repairable Property and the Repair Cycle Asset Control System</u>
TO 00-20-4	<u>Configuration Management Systems</u>

TO 00-20-5 Aircraft, Drone, and Air-Launched Mis-
 sile Inspections, Flight Reports, and
 Supporting Maintenance Documents

TO 00-20-7 Inspection System, Documentation, and
 Status Reporting for AGE and Training
 Equipment (Excluding Intercontinental
 Ballistic Missiles)

TO 00-20-10-2 Reporting Operating Time for Selected
 Items

TO 00-20-10-4 Base Level Mechanized Time Compliance
 Technical Order Reporting System

TO 00-20B-5 Vehicle and Base Support Equipment
 Inspection and Records Administration

TO 00-20K-1 Inspection and Control of USAF Shelf-
 Life Equipment

STANDARD FORM NO. 64

APPENDIX E

MAINTENANCE WORK ORDER REQUESTS

MAINTENANCE DATA COLLECTION RECORD													OMB NO. 21-80227														
1. JOB CONTROL NO.		2. WORK CENTER		3. I.D. NO./SERIAL NO.		4. MDS		5. EO/CL		6. TIME		7. PRI		8. SORTIE NO.		9. LOCATION											
10. ENG. TIME		11. ENGINE I.D.		12. INST. ENG. I.D.		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 PART NO.				24. SERIAL NUMBER				25. OPER. TIME			
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z		
TYPE MAINT	COMP POS	WORK UNIT CODE	ACTION TAKEN	WHEN DISC	HOW MAL	UNITS	START HOUR	STOP DAY	STOP HOUR	CREW SIZE	CMD ACT ID	SCH CODE	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

MAINTENANCE REQUEST TM 11-5820				* See reverse of file encls for codes and additional data	PAGE NO. 1	NO. OF PAGES 1	REPORTS CONTROL SYMBOL OCT 19 1947 1131
SECTION I		<input checked="" type="checkbox"/> MAINT REQUEST		<input type="checkbox"/> MWO	<input type="checkbox"/> FIR	5	
CONTROL NUMBER 079809	10. ORGANIZATION 1ST BN 66TH INF 21ST INF DIV	8. LOCATION APO NY 09372		6. UNIT IDEN CODE WAZCAF			
2. SERIAL NUMBER 1643	3. NOUN NOMENCLATURE TRANSMITTER	4. LINE NUMBER	5. MODEL T195/GRC19	6. FEDERAL STOCK NUMBER 5820-503-3428			
7. STRAC <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	8. UTILIZATION CODE <input checked="" type="checkbox"/> A	9. SELECTED ITEM <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO R		10. HOURS	11. MILES	12. ROUNDS	13. STARTS
14. FAILURE DETECTED DURING (Select one - use if X)				15. FIRST INDICATION OF TROUBLE (Select one use if X)			
<input type="checkbox"/> SCHEDULED MAINTENANCE <input type="checkbox"/> TEST <input type="checkbox"/> STORAGE <input type="checkbox"/> FLIGHT <input type="checkbox"/> HANDLING <input checked="" type="checkbox"/> NORMAL OPERATION <input type="checkbox"/> INSPECTION <input type="checkbox"/> OTHER				<input checked="" type="checkbox"/> INOPERATIVE <input type="checkbox"/> OVERHEATING <input type="checkbox"/> OUT OF ADJUSTMENT <input type="checkbox"/> NOISY <input type="checkbox"/> LOW PERFORMANCE <input type="checkbox"/> OTHER			
16. DESCRIBE DEFICIENCIES OR SYMPTOMS ON THE BASIS OF COMPLETE CHECKOUT AND DIAGNOSTIC PROCEDURE IN EQUIPMENT TM (Do not prescribe repairs) T195 WILL NOT CHANNEL WHEN THE HAND SELECTOR SWITCH IS TURNED TO ANY PRESET FREQUENCIES. CHECKED TUBES V-101, V-102, AND V-103. IN ACCORDANCE WITH THE PROCEDURES IN TM 11-5820-295-20 <i>Maj. G. Wenzinger</i>							
FSN OF END ITEM				FSN: 5820-030-0155			
17a. REPAIR ORGANIZATION/ACTIVITY HQ & MAINT SPT CO 21ST MAINT BN		4. UNIT IDEN CODE WCK BTO		18. TYPE ORGANIZATION/ACTIVITY ACCOMPLISHING WORK (Select one use if X)		19. AMS ACT. CODE	
A. LOCATION APO NY 09372				<input checked="" type="checkbox"/> TOE <input type="checkbox"/> TO <input type="checkbox"/> CONTRACTOR		FSN OF ITEM REPAIRED	
20a. FAILURE CODE F	20b. CB CODE T	20c. COMPONENT/PART NOUN, SERVICE OR MWO NO. 195/GRC-19	20d. MFR. CODE	20e. MANHOURS* 2	20f. FEDERAL STOCK NUMBER	20g. PARTS COST	20h. QUANTITY
C	T	195/GRC-19		1.8	5820-503-3428		1
A	450	B 1102		2	6105-696-5606		1
G	T	195/GRC-19		2			
				20i. TOTAL MANHOURS 2.0	20j. TOTAL MANHOURS COST	20k. TOTAL PARTS COST	
21. DELAY (Select one - use if X)							22. DATA TRANSCRIBED TO LOG BOOK
<input checked="" type="checkbox"/> PARTS <input type="checkbox"/> MANPOWER <input type="checkbox"/> FACILITIES <input type="checkbox"/> FUNDS <input type="checkbox"/> TOOLS							<input type="checkbox"/>
23. SUBMITTED BY F. POOL	24. RECEIVED BY P. LUTZ	25. WORK STARTED BY A. WOODS	26. INSPECTED BY M. KNOTT	27. ACCEPTED BY F. POOL	28. DISPOSITION (Select one - use if X)		
JULIAN DATE 9136	JULIAN DATE 9136	JULIAN DATE 9137	JULIAN DATE 9138	JULIAN DATE 9139	<input checked="" type="checkbox"/> TO USER <input type="checkbox"/> SALVAGED <input type="checkbox"/> EVACUATED <input type="checkbox"/> TO STOCK <input type="checkbox"/> CANNIBALIZATION		
SECTION III - EQUIPMENT IMPROVEMENT RECOMMENDATION							
29. NORMAL RECOMMENDATION (Select one - use if X)		31. RECOMMENDATION (Select one - use if X)		32a. ORGANIZATION/ACTIVITY		4. UNIT IDEN CODE	
<input type="checkbox"/> YES <input type="checkbox"/> URGENT <input type="checkbox"/> ROUTINE		<input type="checkbox"/> EMERGENCY <input type="checkbox"/> IMPROVE DESIGN <input type="checkbox"/> REVISE PROCEDURE <input type="checkbox"/> MODIFY <input type="checkbox"/> OTHER: Specify		b. LOCATION		6. SUBMITTED BY	
33. FEDERAL STOCK NUMBER		34. NOUN NOMENCLATURE		35. OPINION OR REMARKS. DESCRIBE CONDITIONS UNDER WHICH FAILURE OCCURRED. ATTACH PHOTOS OR SKETCHES, IF AVAILABLE			
"ILLUSTRATES COMPLETED DA FORM 2407 FOR WORK ACCOMPLISHED BY SUPPORT MAINTENANCE ON A COMPONENT OF AN END ITEM BELONGING TO A SUPPORTED UNIT".							

MAINTENANCE ACTION FORM
OPNAV FORM 4790/40 (10-69) S/N: 0107-770-4400

1. JOB CONTROL NUMBER				2. TYPE EQUIP.		3. S/N/SEQ NO		4. ACTION ORG.		5. BOM CENTER		6. MAINT LEVEL			7. ACT-ON DATE		
ORG.	DATE	SEN	SAF	AAEA 151681		TOY		110		<input checked="" type="checkbox"/> 1 DFG <input type="checkbox"/> 2 INT <input type="checkbox"/> 3 DEP			1033				
8. WORK UNIT CODE				9. WHEN DISCD		10. TYPE MAINT.		11. ACTION TAKEN		12. MAL		13. ITEMS PROC.		14. MAN. HOURS		15. EMT	
29313				D		F		C		127		1 4 0		2 0			

20. REMOVED ITEM				21. INSTALLED ITEM			
1. MFGN		2. SERIAL NUMBER		1. MFGN		2. SERIAL NO.	
3. PART NUMBER				4. TIME/CYCLES			
5. PART NUMBER				6. TIME/CYCLES			

B. DISCREPANCY				C. CORRECTIVE ACTION			
A 10				ADJUSTED THROTTLE QUADRANT, THROTTLE CONTROLS CHECK OK			
THROTTLE BINDING							

D. ENTRIES REQUIRED				SIGNATURE				E. CORRECTED BY		F. INSPECTED BY		G. SUPERVISOR	
CONFIGURATION		<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO						J. ALLEN ADJ3		B. BAKER ADJ1		C. COOK ADJL	
LOG		<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO											
ACCESS RECORD		<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO											

30. REPAIR CYCLE DATA						31. FAILED MATERIAL							
DATE		DATE		ACT TRN		MAL		QTY		MFGN		PART NUMBER/REF. SYMBOL	
1. REMOVED		5. TO AMP											
2. RECEIVED MATL CONTROL		6. OFF AMP											
3. WORK STARTED		7. TO AMP											
4. COMPLETED		8. OFF AMP											
R/S <input type="checkbox"/>		B COND <input type="checkbox"/>		R/S <input type="checkbox"/>									
H. PCN		PRIORITY		DATE DUE									
				IN		OUT							

J. ACCUMULATED HOURS				K. ACQUIRED MATERIAL																	
NAME/SHEET		DATE		MAN-HOURS		EMT		REQ. NO.		MFGN		PART NUMBER		QTY		PRI		DATE/TIME		AMP	
AHLEN		1033		2.0		2.0															
FINE		1033		2.0																	
TOTAL				4.0		2.0															

SINGLE-COPY MAF. Example of a maintenance action on a transient aircraft by N.A.S. Operations Maintenance Division (OMD). A duplicate of this document marked "do not process" must be initiated to return with the aircraft to the home station. (paragraph 3041)

APPENDIX F

DEPARTMENT OF THE AIR FORCE
AIR FORCE INSTITUTE OF TECHNOLOGY (AU)
WRIGHT-PATTERSON AIR FORCE BASE, OHIO 45433



28 April 1977

X Airline Company
Comptroller
Address

Dear Sir

For our master's thesis at the Air Force Institute of Technology's School of Systems and Logistics, we are proposing to identify the optimum basic cost elements and cost accounting techniques which could be used to determine the costs of performing maintenance on Air Force aircraft. To accomplish this, we will compare and contrast currently-used Air Force cost elements and techniques to those cost elements and techniques used by the airline industry.

Therefore, would you please send us a copy of your policies and directives which outline the procedures you use to record the total costs of performing maintenance on your aircraft. We are particularly interested in maintenance cost recording guidelines used for internal use as well as for that required by the Civil Aeronautics Board.

Sincerely

Deryl S. McCarty
DERYL S. McCARTY, Captain, USAF
Graduate Student
School of Systems and Logistics

1 Atch
Return Envelope

Ronald L. Moore
RONALD L. MOORE, Captain, USAF
Graduate Student
School of Systems and Logistics



APPENDIX G

AIR CARRIERS WHICH REPLIED

Interstate:

Aloha Airlines*
American Airlines*
Delta Airlines
Eastern Air Lines*
Frontier Airlines*
Hawaiian Airlines*
Hughes Airwest*
Piedmont Aviation
Trans World Airlines
United Airlines*
Western Airlines*

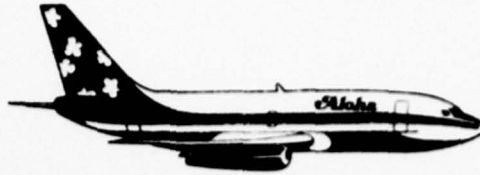
Intrastate/Commuter:

Air Kentucky
Catalina-Vegas Airlines
Mackey International Airlines
Metroplex Helicopter Airways
Mountain West Airlines
Pioneer Airways
Provincetown-Boston Airline
Star Aviation
Suburban Airlines
Trans American Airways

*Cost data recorded.

APPENDIX H

Aloha
Your airline in Hawaii



AIR CARRIER LETTER REPLIES

May 12, 1977

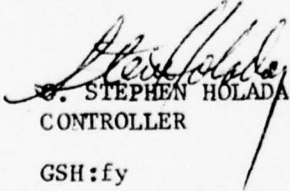
Capt. Ronald L. Moore and
Deryl S. McCarty, 77B
School of Systems and Logistics
Department of the Air Force
Air Force Institute of Technology (AU)
Wright-Patterson Air Force Base, Ohio 45433

Dear Sirs:

In reply to your letter of April 28, 1977 concerning aircraft maintenance costs, I will explain our simple procedure rather than send you our policies.

We record all costs of maintenance on our aircraft by assigning a work order for each task performed in the Maintenance Department. All parts leaving inventory are charged against a work order, and all Maintenance Department labor is either unallocated (meals, vacation, sick leave, etc.) or charged to a work order. Therefore, all costs of maintenance are summarized by work order. The work order number allows us to monitor costs by particular aircraft number or engine number.

If you have any further questions, please contact me.


STEPHEN HOLADAY, CPA
CONTROLLER

GSH:fy

American Airlines

May 18, 1977

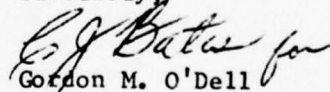
Deryl S. McCarty, Captain, USAF
Graduate Student
School of Systems and Logistics

Ronald L. Moore, Captain, USAF
Graduate Student
School of Systems and Logistics

Dear Captains McCarty and Moore:

At your request, we are enclosing copies of the CAB Uniform System of Accounts and Reports and American Airlines' Expense Distribution Manual pertaining to the recording of the total American Airlines' aircraft maintenance costs.

Sincerely,



Gordon M. O'Dell
Controller-Maintenance and
Engineering

enc.

May 24, 1977

Captains D. S. McCarty and R. L. Moore 77B
Department of the Air Force
Air Force Institute of Technology/LSGR
Wright-Patterson Air Force Base, Ohio 45433

Gentlemen:

In accordance with the request contained in your letter of April 28, 1977, we have prepared the two attached exhibits concerning Eastern's policies and procedures in recording total costs of performing aircraft maintenance.

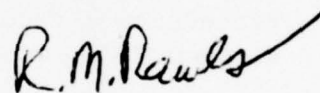
Over the years, Eastern has developed a highly complex series of interfacing computer systems serving the overall needs of the company rather than individual functions such as maintenance costs. Consequently, each individual function becomes an accumulation of by-products from several systems. Original inputs are designed to lock-in the maximum practical limit of information. To provide complete documentation of all these systems would involve an excessive amount of detail for your purposes. On the other hand, the attached exhibits provide the general outlines of our systems together with specifics on key documents in the maintenance area.

Exhibit I, "Some Determinants of Maintenance Cost," was prepared as a kind of "thought starter" in the process of identifying the truly important factors impacting maintenance costs. It identifies various factors under three major categories, viz., technical, operations (aircraft movements), and management. Although these categories are somewhat arbitrary, they do provide some value as an organizing device.

Exhibit II is a much more detailed piece describing Eastern's policies, procedures, and techniques for the actual determination of total aircraft maintenance costs. It covers the scheduling of maintenance activities, regulatory accounting and reporting, accounting codes (cost centers, locations, aircraft types, job numbers, employee numbers), material systems, and labor systems. Each of the foregoing is described briefly to provide you with a good idea of the "flow" of information through our various interfacing systems.

Please feel free to contact me if you have questions concerning this material and if you need additional information.

Sincerely,



R. M. Rawls

Attachments

8 Atchs

1. Exhibit I, "Some Determinants of Maintenance Cost"
2. Exhibit II, Eastern's Policies, Procedures, and Techniques for the Actual Determination of Total Aircraft Maintenance Costs
3. Schedule I, Aircraft Operating Expenses
4. Schedule II, Development of an Income Statement Code
5. Schedule III, Master Code Table No. 4--Aircraft Type
6. Schedule IV, Job Number Coding System
7. Schedule V, Material Management Systems, Purchasing and Material Services
8. Schedule VI, Time-Card-Hourly Employees

FRONTIER AIRLINES, INC.
6250 SMITH ROAD
DENVER, COLORADO • 80207



May 5, 1977

AFIT/LSGR
Capts. McCarty/Moore 77B
Wright-Patterson AFB, Ohio 45433

Re: Your letter April 28, 1977

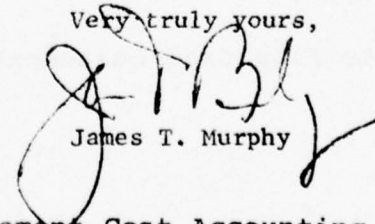
Gentlemen:

At Frontier Airlines, all costs are collected and recorded through the Management Cost Accounting system and I am enclosing a brief explanation of the system together with listings of organization and account numbers used.

Maintenance labor costs and costs of material drawn from stores are identified and collected through a job numbering system used on time cards and Material Requisitions which breaks costs down by type of aircraft and work and converts them to proper coding for Management Cost Accounts and CAB requirements via computer tables. Copies of this material are also enclosed.

These systems permit cost identification and control through organizational responsibility and by maintenance element. CAB accounting is contained in the "Uniform System of Accounts and Reports for Certificated Air Carriers" available through the Superintendent of Documents, Government Printing Office, Washington, D.C.

Very truly yours,



James T. Murphy

BCR:bp
Enclosures

- 4 Atchs
1. Management Cost Accounting System
 2. Job Code Manual
 3. Explanation of Job Numbers
 4. Management Cost Accounts: Numerical Listing



May 9, 1977

Capt. Deryl S. McCarty
Capt. Ronald L. Moore
Air Force Institute of Technology
Wright-Patterson Air Force Base
Ohio 45433

Gentlemen:

I am happy to respond to your request for information regarding our company's policies and procedures for maintenance costs. We follow the CAB's Uniform System of Accounts and Reports for both internal and reporting purposes. The attached paragraph is a summary of our significant accounting policies that relate to property and equipment, as published in one of our annual reports.

I hope this will assist you in your study.

Sincerely,

Edward S. Nielsen
Controller

ESN:mk

Enc.

1 Atch
Notes to Financial Statements



International Headquarters
San Francisco International Airport
San Francisco, California 94128
Telephone: (415) 573-4000

May 11, 1977

Dept. of the Air Force
Air Force Inst. of Technology (AU)
Wright-Patterson Air Force Base, Ohio 45433
Attn: Deryl S. McCarty, Ronald L. Moore

Dear Sirs:

The following is in response to your request of April 28, 1977, for Maintenance accounting details.

Enclosed is a spare copy of the CAB regulations relating to financial and statistical reporting. Included therein are the requirements for accounting for maintenance costs. Generally speaking, these regulations provide for considerable detail by aircraft type. A copy of a recent set of our CAB Form 41 reports is enclosed to help you see what is reported. In every instance that I am aware of, these accounting and reporting requirements are not compatible with the methods best suited to maintenance operations. The most common method of inputting maintenance costs is through a work order or job order system.

Our system has two compatible but different methods of tracking these costs. One is referred to as "down line" and requires time cards and stores issues cards. The other is a Maintenance Data Collection System (MDCS) installed in our PHX maintenance base. This system allows maintenance personnel to indicate through various terminals what they are doing. This is facilitated by the use of their ID badges which are encoded and can be inserted in the terminals to minimize input activity and increase accuracy. This enables the system to track time and attendance for pay purposes and to track time spent on specific projects for distribution purposes. Materials can also be issued from PHX stores through the MDCS system.

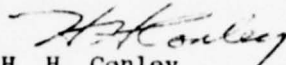
Enclosed are some samples of the lists of eligible component Overhaul, Open Work Orders, Open Shop Orders and Standard Job Numbers that are in our MDCS computer to edit the input-interact with the mechanic to help him put the right amount of acceptable detail. Also enclosed is a reduced size copy of the chart mounted above the terminals in the shops to facilitate the reporting of selected details,

some copies of time and attendance reports, and material relating to our "down line" manual system for "field or line" maintenance.

I trust this will give you some general ideas and should help keep you busy for some time. Good luck!

Sincerely,

HUGHES AIR CORP. dba
HUGHES AIRWEST


H. H. Conley
Director-General Accounting

HHC:eh

enclosures

6 Atchs

1. Letter, subject: New Time Cards and Instruction
2. Letter concerning Downline Job Number
3. Report, Report of Financial and Operating Statistics for Certificated Air Carriers
4. Report, Daily Time and Attendance Report
5. Report, System Data File--Open Work Orders
6. Report, System Data File--Standard Job Numbers



May 24, 1977

Deryl S. McCarty and Ronald L. Moore
Captains, USAF
Department of the Air Force
Air Force Institute of Technology (AU)
Wright-Patterson Air Force Base, Ohio 45433

Gentlemen:

Unfortunately, we do not have a readily available comprehensive manual outlining our cost collection systems at our Maintenance Operations Center. To develop and accumulate such a document that would be understandable to someone unfamiliar with the operations at the Center would take manpower that we do not have available at this time.

In essence, however, our system is a job cost system where costs are accumulated by engine or tail number. Component parts have their own numbering system. Obviously, there are some cost items that must be allocated and we do this through various statistical means -- the basic allocation being direct labor charged.

The CAB requires quarterly and twelve-months-to-date reporting by aircraft type. The costs required to be reported are:

Direct Labor - (separated between Airframe, Engine, Other)
Direct Material - (separated between Airframe, Engine, Other)

Purchased Services:

- Associated
 companies - (separated between Airframe, Engine, Other)
- Other
 companies - (separated between Airframe, Engine, Other)

May 24, 1977

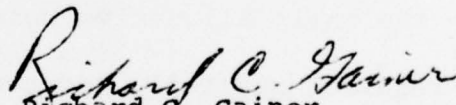
Airworthiness Reserve Provisions - (separated between Airframe,
Engine, Other)
Airworthiness Reserve Credits - (separated between Airframe,
Engine, Other)
Amortization of Overhauls - (separated between Airframe,
Engine, Other)

The last three items are used by those carriers on the reserve basis wherein a provision for maintenance is charged to expense and credited to a balance sheet reserve account as the aircraft are operated. The actual cost of the overhaul, when it takes place, is then charged to the reserve. This methodology prevents distortive highs and lows in the expense reporting. United is on a progressive maintenance system and its maintenance costs relatively follow the operation. United has a waiver from the CAB on the use of the reserve system of accounting for maintenance.

The CAB also requires that all maintenance burden (overhead) be allocated between flight and ground maintenance.

I hope this information fits your needs, and I am sorry we could not be of more assistance.

Sincerely,


Richard C. Gainer
Director of
Financial Accounting

RCG:MP



Western Airlines

June 1, 1977

DEPARTMENT OF THE AIR FORCE
Air Force Institute of Technology (AU)
Wright Patterson Air Force Base, Ohio 45433

Attention: Deryl S. McCarty, Captain, USAF
Graduate Student
School of Systems and Logistics

Ronald L. Moore, Captain, USAF
Graduate Student
School of Systems and Logistics

Gentlemen:

This letter is in response to your request regarding information about Western's procedure for recording Direct Maintenance costs.

I have enclosed a copy of Western's Chart of Accounts pertaining to maintenance, along with appropriate sections of the CAB Manual.

Western maintains permanent work order numbers for each airframe, engine and APU unit in its fleet. These numbers are shown on pages D-3 thru D-14 of the Chart of Accounts. All direct material, outside service and labor costs are charged directly to the work order when the specific airframe or engine number is known. When it is not known, costs are charged to the general repair and other miscellaneous account work order numbers shown on pages C-1 thru C-6.

In 1975, Western discontinued its policy of accruing for airframe and engine major overhauls. Instead, all overhaul costs are now allowed to flow through and are booked when incurred.

When an engine comes in-house for general repair, as opposed to major overhaul, a special reclass accounting entry is made transferring the associated costs to the general repair accounts mentioned above. This is necessary because the specific engine work order numbers are designated as overhaul accounts. Conversely, when an airframe is in-house for major overhaul, a special overhaul account is created to effect a reclass of the associated costs because the specific tail-numbers are designated as repair accounts.

DEPARTMENT OF THE AIR FORCE
Air Force Institute of Technology (AU)
Wright Patterson Air Force Base, Ohio 45433

June 1, 1977
Page - 2 -

Attention: Deryl S. McCarty, Captain, USAF
Ronald L. Moore, Captain, USAF

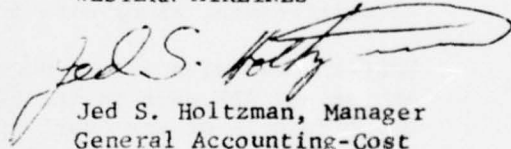
Special balance sheet work order accounts (D-1 thru D-2) are used to accumulate costs associated with insurance claims, engineering authorizations, expense and capital projects, fabrication of kits from inventory and jobs for outsiders. These work orders are normally cleared to the appropriate expense or capital accounts each month.

Although maintenance costs are accumulated by each airframe, engine and APU unit according to labor, material and outside service, Western does not use a standard cost system. Maintenance costs are generally evaluated and analyzed in summary by type of equipment using month-to-month, year-to-year and actual-to-budget comparisons. Detailed cost records are not kept for time controlled component parts.

If you should require further information, please write or give me a call at (213) 646-5333.

Sincerely,

WESTERN AIRLINES



Jed S. Holtzman, Manager
General Accounting-Cost

JSH:rca

enclosure

2 Atchs

1. Data Input Manual
2. Sections 7 and 11, CAB Uniform System of Accounts and Reports for Certificated Air Carriers

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BIOGRAPHICAL SKETCHES

Captain Deryl S. McCarty is an Aircraft Maintenance Officer who has had maintenance assignments at detachment level in ADC, at the squadron level in MAC and PACAF, at numbered Air Force levels in MAC, at MAJCOM level in MAC, and at HQ USAF level (AFISC). Captain McCarty has a BA in Political Science from the University of Washington and is a Certified Professional Logistician. He is being assigned to the 62 MAWg at McChord AFB, Washington.

Captain Ronald L. Moore is also an Aircraft Maintenance Officer who has had maintenance assignments at the squadron level in MAC, group level in TAC, wing level in PACAF, and has served on the faculty of the Squadron Officer School (AU). Captain Moore has a BS in Education from Washington State University and an MS in Counseling and Guidance from Troy State University. He is a Certified Professional Logistician who is being assigned as a Logistics Staff Officer at Tinker ALC (AFLC) in the AFLC-sponsored Career Broadening Program.