BY THE COMPTROLLER GENERAL

Report To The Chairman Committee On Government Operations House Of Representatives

OF THE UNITED STATES

The Air Force Can Improve Its Maintenance Information Systems

The Air Force spends millions on aircraft maintenance information which is flawed by incomplete, inaccurate, and untimely source data. These data problems continue although they were identified years ago in numerous GAO and Air Force studies. The utility of Air Force information systems is diminished by the known data accuracy problems. Yet, the Air Force recently completed the development of a $6.6 million operating and support cost system that will rely heavily on the inaccurate source maintenance data.

GAO believes a current Air Force prototype system can improve the accurate collection and the usefulness of aircraft maintenance information. However, the Air Force needs to determine whether the automated maintenance information system is cost beneficial. In addition, a timely development decision on standard use of the system Air Force-wide is necessary to eliminate duplicate system development efforts and to prevent the acquisition of unnecessary computer equipment. The Air Force should also fully implement the information resources management concept and principles prescribed by the Paperwork Reduction Act to alleviate many of its information management problems.

GAO/GGD-83-20
JANUARY 25, 1983

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COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON D.C. 20548

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The Honorable Jack Brooks
Chairman, Committee on
Government Operations
House of Representatives

Dear Mr. Chairman:

In response to your December 16, 1980, request for broad reviews of information management activities of selected agencies to identify where information technology can benefit those agencies in terms of economy and efficiency, we reviewed selected maintenance information activities in the Department of the Air Force. This report summarizes the results of our review and suggests ways to improve Air Force maintenance information management as well as the Air Force information management program. We did not obtain official agency comments on this report. We did, however, discuss the contents of this report with program officials and their comments have been included where appropriate.

As arranged with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days from the date of the report. At that time we plan to send copies to the Director, Office of Management and Budget; the Secretary of Defense; the Secretary of the Air Force; and other interested parties. We will also make copies available to others upon request.

Sincerely yours,

Charles H. Bowsher

Comptroller General
of the United States

COMPTROLLER GENERAL'S REPORT
TO THE CHAIRMAN, COMMITTEE
ON GOVERNMENT OPERATIONS,
HOUSE OF REPRESENTATIVES

THE AIR FORCE CAN IMPROVE ITS MAINTENANCE INFORMATION SYSTEMS

D I G E S T

Current Air Force procedures for collecting data on maintenance activities are costly, paperwork intensive, and generally ineffective in providing complete, accurate, timely, and useful information to Air Force and Department of Defense (DOD) decisionmakers. As a result, managers have not always used reports from certain information systems and, when they do, they must often perform additional analysis manually. Consequently, the Air Force spends millions of dollars on data collection and reporting systems which have questionable value. (See pp. 8 to 20.)

The Maintenance Data Collection (MDC) system is the primary source of base-level maintenance data. Data on maintenance performed is recorded manually, keypunched, and processed at the base level for report output and computer storage. Since MDC data collection began in 1958, the Air Force has gone to tremendous effort and expense to record maintenance actions and process the data in numerous information systems. These systems provide information for estimating aircraft reliability and maintainability, for maintaining visibility of and managing weapon system operating and support costs, and for measuring the performance of maintenance personnel and organizations. (See pp. 1 to 6.)

GAO's review responds to a request from the Chairman, House Committee on Government Opertions, to evaluate Government information management activities to identify where information technology can benefit agencies by improving economy and efficiency.

PROBLEMS AFFECT THE USEFULNESS OF MAINTENANCE DATA

GAO found that errors are frequently made during the data recording. A substantial amount of the maintenance data is never

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collected because mechanics do not fill out the form to report their work. As a result, inaccurate data from the MDC system receives extensive distribution within the Air Force. Air Force and DOD managers are often reluctant to use MDC data or the systems that it supports because of the known inaccuracies. (See pp. 11 to 20.)

The data inaccuracy and lack of use raise questions about the need for much of the maintenance data collected. In fact, the Air Force has conducted several projects on ways to reduce the amount of data collected. The Air Force needs to revalidate its requirements for maintenance data. For that data which is needed, the Air Force needs to improve its accuracy, completeness, and timeliness to provide a better basis for decisionmaking at all levels. (See pp. 20 to 23.)

AUTOMATED MAINTENANCE SYSTEM CONCEPT CAN HELP BUT BETTER MANAGEMENT IS NEEDED

The Military Airlift Command is testing an Automated Maintenance System (AMS) prototype at Dover Air Force Base that has the potential to improve maintenance data collection. AMS provides online, real time data input, eliminating data accuracy, timeliness, and utility problems that have plagued the MDC system. Edits and other checks eliminate errors and the system's benefits to users increase the incentive to enter data. The primary objective of the AMS test is to establish the value of applying the AMS system Air Force-wide. (See pp. 24 to 30.)

While the AMS prototype improves data accuracy and completeness, management improvements must be made. Dover is not representative of most Air Force bases. The computer system supporting the AMS test has more capability than standard Air Force systems. Dover maintenance processes were more advanced than other bases before the AMS test. Therefore, extensive changes to computer programs will be required to provide AMS processes at other bases.

The Air Force did not adequately measure the costs and benefits of the AMS prototype. The Military Airlift Command used less than full

costs to justify its request for an expansion of AMS to other bases. Air Force officials used misleading benefit measures to promote expansion of the AMS system rather than rely on both measured and potential personnel savings. For example, the Air Force cited increased aircraft availability when, in fact, aircraft availability fluctuated greatly and this increase was not validated. (See pp. 31 to 39.)

Current plans by Air Force commands could result in unnecessary expenditures for stand alone (separate) AMS type computers. The AMS test was supposed to develop processes which could operate on standard base-level computers. If the prototype proves to be cost beneficial, the Air Force should develop AMS type processes which will operate on standard base-level computers. (See pp. 39 to 43.)

MAINTENANCE INFORMATION PROBLEMS ARE LONGSTANDING AND WIDESPREAD

Numerous GAO and Air Force reports have criticized the accuracy of the MDC system. However, no significant improvements have been made and managers are reluctant to rely on reports from systems which receive MDC data. GAO identified two systems which were terminated for a number of reasons, including inaccurate data supplied by the MDC system. (See pp. 16 to 18 and 44 to 50.)

The Air Force recently developed an operating and support cost management system which relies on inaccurate MDC data. The operating and support cost management information system development was in response to Office of the Secretary of Defense guidance. However, lack of involvement by that office in system design reviews and inaccurate source data could make the system nonresponsive to users' information needs. (See pp. 50 to 55.)

The Air Force wants to replace its Maintenance Cost System with the new operating and support cost system. However, the replacement is not designed to satisfy a need to measure and manage productivity. GAO supported the development of the Maintenance Cost System and believes the system should not be replaced until the operating and support cost system

can satisfy the productivity management requirement. (See pp. 55 to 59.)

THE AIR FORCE SHOULD FULLY IMPLEMENT THE INFORMATION RESOURCES MANAGEMENT CONCEPT

The Paperwork Reduction Act provides the policy and framework for managing information-related activities such as those discussed in this report. The Air Force has begun to implement the Paperwork Act by designating a senior official in July 1981. It also has established an office with objectives similar to those called for by the act and developed a proposed operating plan. These are first steps but much more needs to be done. The information-related problems discussed in this report are the type which the Air Force Information Resources Management Office should identify and work to correct.

If properly implemented, the Paperwork Act should create a framework in which the Air Force can address information-related concerns. The senior official can establish priorities for information systems development efforts and corrective actions. The priorities should include determining the need for information and ensuring that it is accurately collected in a cost-effective manner. The senior official can also ensure that compatible information systems are developed and that development efforts do not duplicate one another. (See pp. 64 to 69.)

RECOMMENDATIONS

GAO recommends a number of actions the Secretary of Defense and the Secretary of the Air Force should take to improve maintenance information activities. These actions would result in more accurate, timely, and useful information while eliminating duplicate system development efforts and preventing the acquisition of unnecessary computer equipment. (See pp. 72 and 73.)

AGENCY COMMENTS

GAO did not obtain official agency comments on this report. However, GAO did discuss the report contents with program officials and their comments were included where appropriate.

Contents

		Page
DIGEST		i
CHAPTER		
1	INTRODUCTION	1
	Maintenance data collection and use	2
	The Paperwork Reduction Act	6
	Objectives, scope, and methodology	6
2	AIR FORCE MAINTENANCE INFORMATION SYSTEMS ARE NOT RESPONSIVE TO USERS BECAUSE THEY ARE INACCURATE, INCOMPLETE, AND UNTIMELY	8
	Accurate maintenance information is essential	8
	Maintenance data is not reported or is reported inaccurately	11
	Certain Air Force maintenance information systems do not satisfy users' needs and are not used because of inaccurate MDC data	16
	The Air Force has considered eliminating MDC because of problems	20
	The Air Force must determine its maintenance information requirements and design systems to meet them	23
3	THE AUTOMATED MAINTENANCE SYSTEM CONCEPT CAN IMPROVE MAINTENANCE INFORMATION BUT MANAGEMENT PROBLEMS NEED TO BE SOLVED AND DECISIONS MADE	24
	What is AMS and how does it work?	24
	AMS improves the accuracy, timeliness, and utility of maintenance information	27
	Many management problems plague the AMS test as a basis for future Air Force decisions	31
	Timely action is needed to take advantage of interest in AMS processes and prevent unnecessary expenditures	39
	The Air Force needs to complete its AMS evaluation and prepare for the future	42

CHAPTER		Page
4	LONGSTANDING PROBLEMS AND NUMEROUS SYSTEM DEVELOPMENT EFFORTS SHOW WHY THE AIR FORCE MUST IMPROVE MANAGEMENT OF ITS MAINTENANCE INFORMATION RESOURCES	44
	Information management problems are longstanding and widespread	45
	Air Force information systems do not promote management of operating and support costs	47
	The F-16 Central Data System is adversely affected by inaccurate data, is costly, and was not fully coordinated	59
	The Air Force should fully implement the information resources management concept	64
5	CONCLUSIONS AND RECOMMENDATIONS	70
	Conclusions	70
	Recommendations to the Secretary of Defense and the Secretary of the Air Force	72

ABBREVIATIONS

ADP	Automatic Data Processing
AFB	Air Force Base
AFLC	Air Force Logistics Command
AMS	Automated Maintenance System
DOD	Department of Defense
GAO	General Accounting Office
GPS	Ground Processing System
IRM	Information Resources Management
MAC	Military Airlift Command
MADARS	Malfunction Analysis Detection and Recording System
MCS	Maintenance Cost System
MDC	Maintenance Data Collection

MMICS	Maintenance Management Information and Control System
OMB	Office of Management and Budget
OSD	Office of the Secretary of Defense
VAMOSC	Visibility and Management of Operating and Support Costs

CHAPTER 1

INTRODUCTION

The Air Force estimates that as many as 105,000 mechanics and other maintenance personnel are directly involved in maintenance documentation at the base level. Maintenance staffing accounts for one-third of the estimated $17 billion annual cost of Air Force staffing. Maintenance data collected at the base level is an important input to Air Force management information systems. These systems provide information for estimating the reliability and maintainability of aircraft, for maintaining visibility of and managing weapon system operating and support costs, and for measuring the performance of maintenance personnel and organizations.

"Equipment maintenance" describes the process used to keep equipment in condition for effective use or to return it to that condition when it fails or malfunctions. Without an effective maintenance operation, aircraft and other equipment will not function when needed.

Within the Air Force, maintenance responsibilities and functions are assigned at each level of organization from Air Force Headquarters down to and including units within the operating commands. The Deputy Chief of Staff for Logistics and Engineering at Air Force Headquarters is the senior Air Force maintenance official. The Directorate of Maintenance and Supply has the specific responsibility within the Logistics and Engineering office for supervising the entire Air Force maintenance program. The Directorate of Maintenance and Supply establishes the plans, policies, and programs for all the maintenance required on Air Force equipment.

The Air Force has a multilevel approach which places maintenance responsibility at different levels, depending on the types and complexity of work. The maintenance levels are generally structured as follows.

--Organizational level. Maintenance at this level is normally the responsibility of, and is done by, the units or organizations to which military equipment is assigned. Tasks assigned to these equipment users include inspecting, servicing, and lubricating equipment as well as adjusting, removing, and replacing parts, minor assemblies, and subassemblies. Work beyond these activities' capabilities is usually forwarded to intermediate-level activities.

--Intermediate level. Maintenance at this level is normally a user command or a base-level responsibility and is done by designated activities for direct support of user organizations. Assigned work includes calibrating,

repairing, or replacing damaged or unserviceable parts, components, or assemblies; modifying material; and providing technical assistance to user organizations.

--Depot level. Depot-level maintenance is done by designated industrial type activities. The services' depots are generally responsible for making major overhauls, modifications, and repairs to end items and components which are then returned to the supply systems. Depots also manufacture parts not otherwise available in the supply system and use their more extensive shop facilities, equipment, and higher skilled personnel to support the lower level activities.

Both organizational and intermediate level maintenance are performed at Air Force bases. These two levels of maintenance are discussed in this report.

Base-level maintenance consists of both scheduled and unscheduled work. Unscheduled work is usually identified by aircraft pilots and crew members as a result of equipment failures. Debriefing personnel on the base obtain this data from the pilots and crew and provide it to the Job Control Section which schedules the work done by the organizational or intermediate level maintenance personnel. Scheduled maintenance is usually performed when aircraft accumulate a certain number of operating hours. The Documentation Section keeps records on each aircraft and identifies when scheduled maintenance, such as an aircraft inspection, is required. The Plans and Scheduling Section schedules the work in conjunction with the Job Control Section which is responsible for dispatching appropriate specialists who perform the work.

MAINTENANCE DATA COLLECTION AND USE

Because of its importance, extensive attention to equipment maintenance is required by Air Force and Department of Defense (DOD) top management. These managers, as well as maintenance managers throughout the Air Force, depend on information to monitor the effectiveness of Air Force maintenance programs. Effectiveness measures, in part, include personnel productivity and weapon system operating and support costs. Of particular importance is the fact that maintenance data is used to determine the reliability and maintainability of weapon systems. Reliability and maintainability are key factors that influence weapon system design, weapon system effectiveness, logistics support requirements, and, ultimately, life cycle costs.

Air Force regulations and technical orders state that accurate maintenance data is essential. The maintenance data is used in the decisionmaking process. By using the data in this process, Air Force logistics, especially maintenance, receive tangible benefits. According to Technical Order 00-20-2, "The

Maintenance Data Collection System," the maintenance data collection effort's cost is returned because better logistics management decisions can be made with accurate information.

In order to support management information needs, most Air Force maintenance personnel are required to formally report the how, what, and when of the work they perform. Much effort goes into recording, processing, and presenting maintenance data. In addition, the Air Force relies heavily on many information systems to process and present essential information for managing maintenance resources.

The Maintenance Data Collection (MDC) system is the primary source of base-level maintenance data. The MDC system provides for the recording of maintenance data collected on aircraft, missiles, communication-electronic equipment, and their support equipment. The data processed by the system consists primarily of maintenance staff-hour expenditures and technical data involving maintenance tasks that are accomplished. Data on maintenance performed is documented manually on Form 349 (see exhibit on following page), collected, keypunched, and processed at the base level for report output and computer storage.

Air Force directives require that all maintenance actions involving direct labor expenditures be recorded and reported for the life of all aircraft and other equipment. Tremendous effort has been channeled into this documentation and data processing effort. Reporting data on each maintenance action performed has been required since 1958.

The MDC system imposes a significant paperwork burden and requires tremendous amounts of personnel time. In 1976 the Commission on Federal Paperwork reported that 4 million hours were required to complete the estimated 80 million forms filed annually. This amounts to about 2,000 staff years of effort. The Air Force estimates that keypunch staff time consumes 350,000 hours (175 staff years) per year and that punch cards and computer paper cost $1 million a year. Costs for additional items not reflected in these estimates include computer programmers, computer time, telecommunications, supervisory reviews of forms, and data corrections.

Before the MDC system, the means to assess reliability of aircraft simply did not exist. An important objective, therefore, was to provide this capability. An equally important objective was to provide management with a systematic method to establish and adjust staffing requirements and control workforce employment. The Air Force believed that the system of reporting maintenance work would provide it with a strong position when justifying its staffing requests to DOD and the Congress.

MAINTENANCE DATA COLLECTION RECORD

OMB NO. 21-R0227

1. JOB CONTROL NO.	2. WORK CENTER	3. I.D. NO./SERIAL NO.	4. MDS	5. SRD	6 TIME	7. PRI	8. SORTIE NO.	9. LOCATION

10. ENG. TIME	11. ENGINE I.D.	12 INST ENG TIME	13. INST. ENG. I.D.	14.	15	16	17. TIME SPC REQ	18. JOB STD.

19. FSC	20. PART NUMBER	21. SER. NO./OPER. TIME	22. TAG NO.	23. INST ITEM PART NO.	24. SERIAL NUMBER	25. OPER. TIME

ACT LINE	A TYPE MAINT	B COMP POS	C WORK UNIT CODE	D ACTION TAKEN	E WHEN DISC	F HOW MAL	G UNITS	H START HOUR	I STOP DAY	I STOP HOUR	J CREW SIZE	K CAT LAB	L CMD ACT ID	M SCN CODE	N EMPLOYEE NUMBER
1															
2															
3															
4															
5															

26. DISCREPANCY

27. CORRECTIVE ACTION

28. RECORDS ACTION

AFTO FORM 349 MAY 75 PREVIOUS EDITION IS OBSOLETE

FORM 349, "Maintenance Data Collection Record"

MDC system outputs include periodic standard format reports, flexible format reports prepared on demand, and summary data for both command and Air Force Headquarters use. The MDC system is the key system for supplying many other Air Force information systems with maintenance data. It plays a vital role in the effective and efficient use of Air Force information resources.

A number of other information systems are used to satisfy managers' needs for information about maintenance activities. Some of the operational information systems include the Maintenance Management Information and Control System (MMICS), the Maintenance Cost System (MCS), the Product Performance System, and the F-16 Central Data System. Systems being developed include the Automated Maintenance System (AMS) and the Visibility and Management of Operating and Support Costs (VAMOSC) system. With the exception of the AMS, most of these operational and developmental systems receive some of their input data from the MDC system.

MDC system data is intended for use on the base where it is collected. At the base-level, MDC data is used to provide feedback to managers for controlling the maintenance operation. Such base-level uses include scheduling work, identifying work accomplished, monitoring direct and indirect labor expenditures, and providing aircraft status information.

MDC data is also provided to numerous off-base organizations. The Air Force Logistics Command (AFLC) uses the data to identify aircraft reliability problems and establish improvement priorities; to monitor aircraft modifications and their effectiveness; to identify safety related problems and monitor corrective actions; and to validate parts requirements. In addition, the AFLC provides MDC data to other users. These include aircraft contractors who use the data to evaluate aircraft performance when developing new systems; the Air Force Accounting and Finance Center which uses the data to determine base-level maintenance costs; and Air Force Headquarters and major commands which use the data to establish maintenance staffing requirements.

Base maintenance managers and supervisors may also obtain information concerning the cost of maintenance. This cost information is provided by the MCS of which MDC is an input. The MCS is supposed to provide feedback in dollar terms on:

--the cost of civilian and military maintenance staff-hours;

--the cost of productive direct hours and indirect hours;

--the cost to maintain aircraft and engines; and

--the cost to maintain transient aircraft for which reimbursement will be made.

THE PAPERWORK REDUCTION ACT

Throughout both DOD and the Air Force, managers rely on information to make critical decisions about maintenance activities. Because of concerns over Federal agencies' continuing problems in managing their information activities, the Congress passed the Paperwork Reduction Act of 1980 (Public Law 96-511). The act requires that agencies manage their information as a resource--information resources management (IRM). IRM basically means managing information so that agency managers receive needed information at the right time and in the proper level of detail to permit them to efficiently and effectively carry out their responsibilities.

The act requires that agencies designate a senior official responsible for IRM and for coordinating various information-related activities such as ADP and other technology, paperwork, statistics, and records management. The act also requires that agencies periodically review their information-related activities to ensure they are performed efficiently and effectively. The Air Force has taken several steps to implement the act, including designating a senior official and establishing an office for developing implementation plans.

OBJECTIVES, SCOPE, AND METHODOLOGY

Our objectives were:

--To assess Air Force efforts in developing maintenance information and using maintenance information systems.

--To identify selected Air Force efforts to modify or improve maintenance information systems and determine whether internal coordination of these efforts is adequate and whether improvements have resulted or will result from the efforts.

--To determine whether the above efforts recognized users' needs as well as included steps to address any underlying data accuracy problems.

--To evaluate the AMS test.

--To determine how the IRM concept and procedures can be used to improve Air Force activities related to maintenance information systems.

To accomplish our objectives, we reviewed maintenance data collection efforts at the base level within the Military Airlift Command. We interviewed officials and other responsible personnel in the Office of the Secretary of Defense and the Air Force who are involved in the collection and use of maintenance data, or in the development of alternative approaches to collecting maintenance data. We analyzed documents, contracts, records, reports, regulations, and related information concerning maintenance data. We reviewed past reports by GAO and the Air Force Audit Agency on Air Force maintenance information problems. We also reviewed and evaluated selected Air Force efforts and studies of ways to improve its maintenance information systems. We conducted this effort in accordance with generally accepted Government auditing standards. We performed audit work at the following organizations during our review.

--DOD and Air Force Headquarters;

--Military Airlift Command Headquarters, Scott Air Force Base (AFB), Illinois;

--Air Force Logistics Command Headquarters, Wright-Patterson AFB, Ohio;

--Air Force Systems Command offices, including the Aeronautical Systems Division and the F-16 System Program Office, Wright-Patterson AFB, Ohio;

--Air Force Logistics Management Center, Gunter Air Force Station, Alabama;

--Data Systems Design Center, Gunter Air Force Station, Alabama;

--Oklahoma City Air Logistics Center, Tinker AFB, Oklahoma;

--Warner Robins Air Logistics Center, Robins AFB, Georgia;

--436th Military Airlift Wing, Dover AFB, Delaware;

--60th Military Airlift Wing, Travis AFB, California;

--375th Aeromedical Airlift Wing, Scott AFB, Illinois; and

--307th Air Refueling Group, Travis AFB, California.

CHAPTER 2

AIR FORCE MAINTENANCE INFORMATION SYSTEMS ARE NOT RESPONSIVE TO USERS BECAUSE THEY ARE INACCURATE, INCOMPLETE, AND UNTIMELY

For more than 20 years the Air Force has collected, processed, and disseminated inaccurate and incomplete maintenance information through its Maintenance Data Collection System. The volume of data collected and the time required to process it often make reported information more than a month old when managers receive it. Because of untimely and inaccurate data, reports from information systems are not always used by managers and, when used, often require added work. An Air Force Logistics Management Center official estimates that millions of dollars are spent on data collection and reporting systems which have questionable value. To address this problem, the Air Force needs to identify the maintenance information requirements of managers at all levels of command. Once these needs are identified, the Air Force can then begin to develop accurate, uniform, and cost-effective systems for collecting and processing maintenance information.

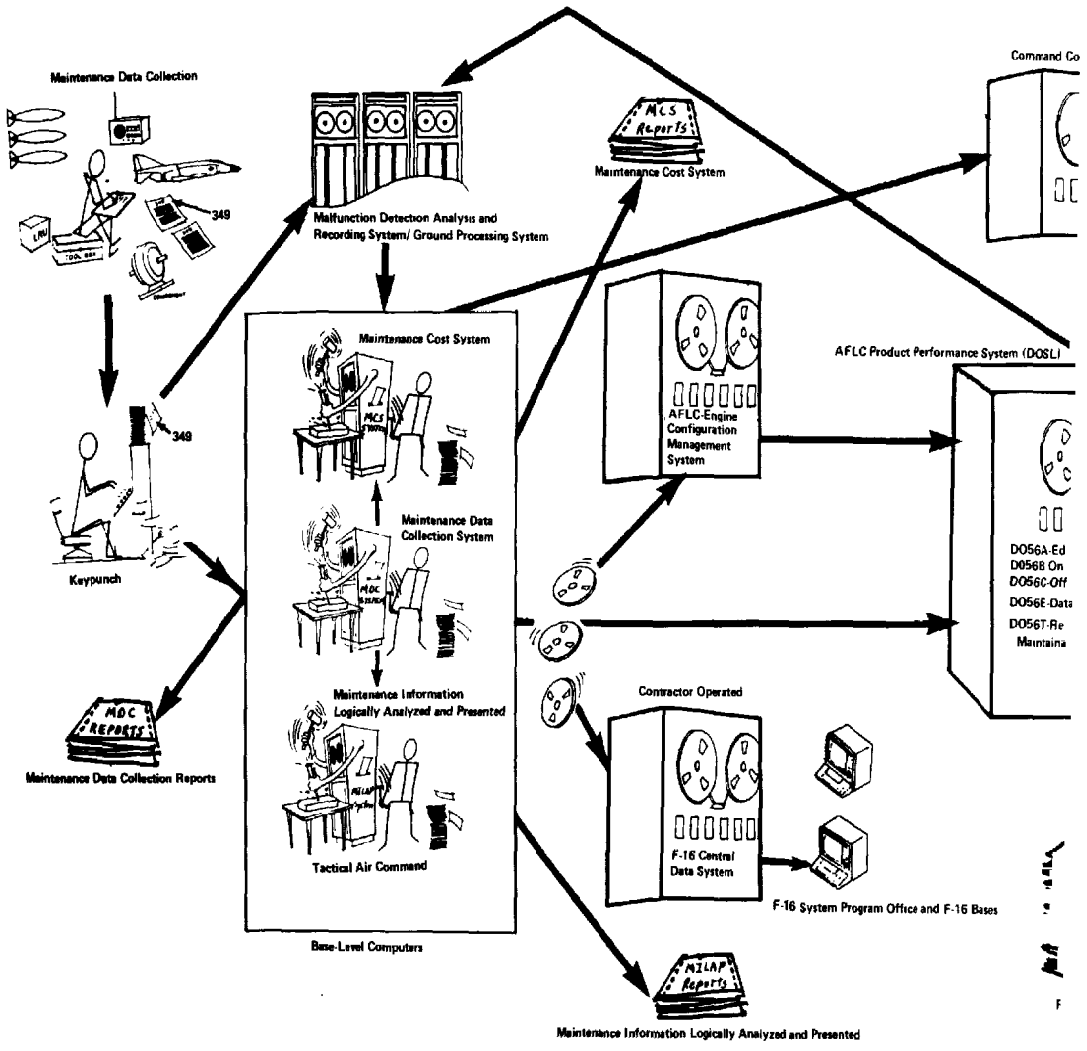
ACCURATE MAINTENANCE INFORMATION IS ESSENTIAL

The maintenance data generated and collected at the base level is supposed to support the broad and complex decision-making structure ranging from the base level to Air Force Headquarters and DOD. Air Force regulations and technical orders stress that it is essential that the data in the MDC system be accurate because of the MDC system's many uses. Air Force Technical Order 00-20-2 claims that the MDC system's cost is returned because better logistics management decisions can be made with factual information.

We analyzed the collection and flow of maintenance data. The chart on the following page depicts the widespread distribution of MDC data via numerous Air Force information systems.

Because base-level maintenance constitutes a significant portion of weapon system operating and support costs, it is an area in which data accuracy has an important impact. The validation of aircraft maintenance staffing requirements depends on MDC data. Considering the fact that aircraft maintenance staffing accounts for one-third of the total Air Force staffing resource and the cost for staffing in the Air Force budget request for fiscal year 1983 is over $17 billion, validation of staffing requirements is extremely important. Aircraft inspection intervals, intervals for depot-level maintenance, and requirements for spare parts are supported by the analysis of maintainability and reliability data acquired from the MDC system.

MAINTENANCE DATA COLLECTION (MDC) S



or contracted for a series of evaluations and studies of the MDC system. The evaluations and studies have shown that the MDC system is inaccurate and unreliable. One study suggested that use of this data seriously affects maintenance and cost analysis by Air Force and DOD managers. Results from some of these studies follow.

A statistical evaluation of the accuracy of the direct labor hour data collected by the MDC system was conducted by a contractor in 1978. The contractor found that:

--The number of maintenance actions were under reported by a factor of 2.

--The number of direct labor hours sampled by the contractor were over reported by a factor of 2.

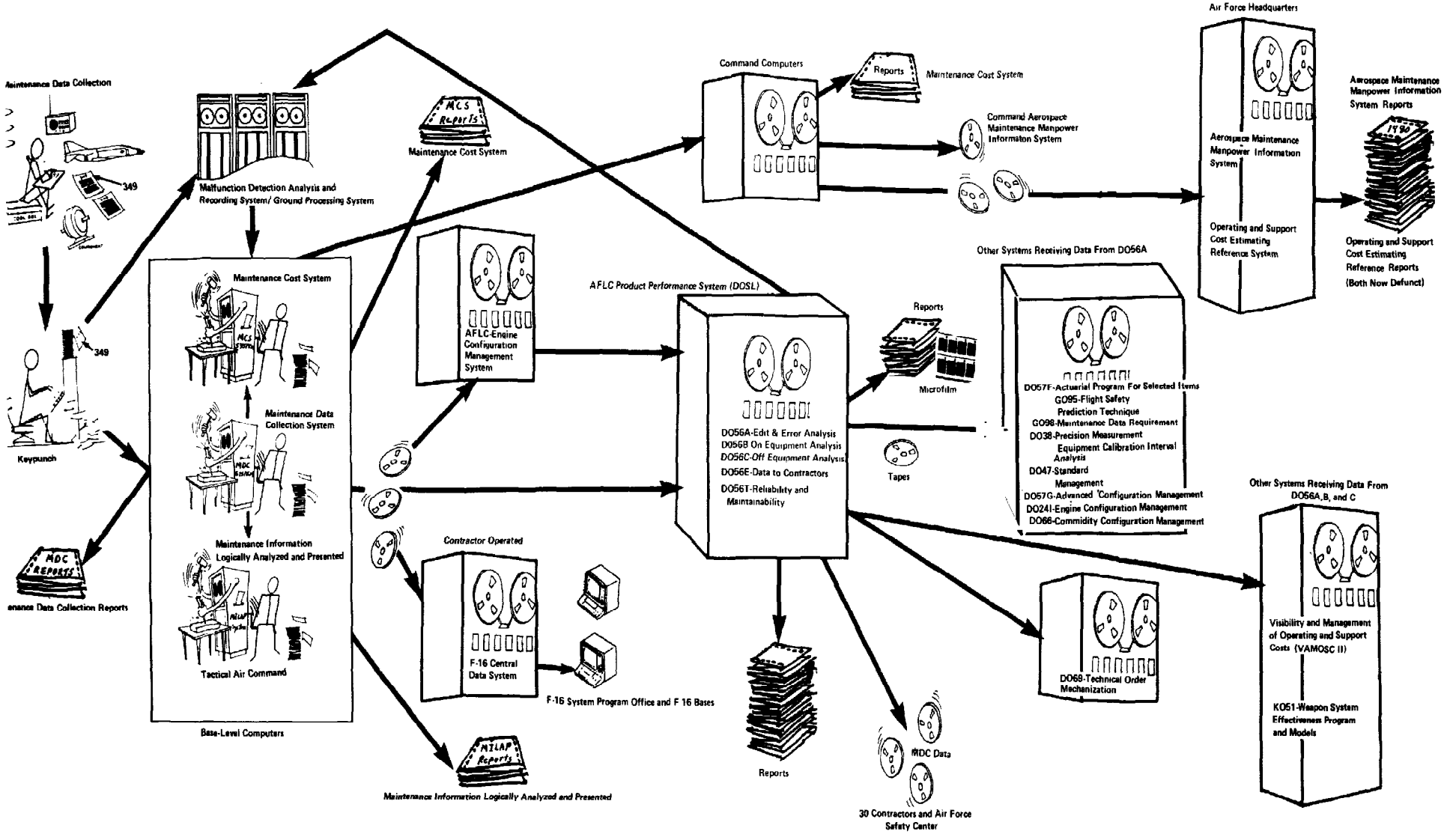
The contractor observers also found that more than half of the tasks they observed could not be matched with any reported account of work performed. The suggested causes for the matching problem were that either a number of observed maintenance tasks were never reported through the MDC system or errors in the maintenance information made matching impossible. The contractor concluded that the inaccurate data had severe ramifications for maintenance and cost analysis in the Air Force.

Personnel from the Air Force Logistics Management Center at Gunter Air Force Station, Alabama, participated in two unpublished studies related to maintenance data collection: (1) a survey of maintenance activities at MacDill AFB, Florida, and (2) an analysis of data from the Maintenance Information Logically Analyzed and Presented system that related to F-4 aircraft maintenance at MacDill AFB.

The survey of maintenance activities at MacDill AFB was conducted during the summer of 1981. The survey was narrow in scope and primarily involved discussions with maintenance personnel regarding their job responsibilities and job-related problems. The survey, however, again highlighted the problems associated with accurately recording maintenance tasks.

The analysis of Maintenance Information Logically Analyzed and Presented data involved looking at maintenance actions on F-4 aircraft assigned to MacDill AFB, a Tactical Air Command base. Maintenance Information Logically Analyzed and Presented is a Tactical Air Command system which attempts to track unscheduled aircraft maintenance to isolate and identify trends and potential reliability and maintainability problems. The system relies on data collected by the MDC system. Logistics Management Center staff sampled data from the system which was at least 6 months old. The staff assumed that 6 months should have been sufficient time for base maintenance personnel to

MAINTENANCE DATA COLLECTION (MDC) SYSTEM PARTIAL DATA FLOW



have more of an incentive to report MDC data if they were paid to collect it.

On the basis of a 1976 study prepared for the Air Force, one contractor drew the following conclusions about the MDC system.

--Maintenance personnel develop the attitude that reporting maintenance actions on the Form 349 is merely an exercise. Thus, data accuracy is questionable.

--Maintenance personnel need to transcribe long strings of alphanumeric data from a piece of equipment to the Form 349. Without proper motivation, incorrect copying of such a string of data is quite easy.

--The raw volume of the input data collected by the MDC system makes it difficult to sift out that data which might be useful.

The base-level managers also lack the incentive to push the mechanics for accurate MDC data because the data is difficult to access and use at the base level. Except for Dover AFB, base-level managers would have to manually sort Forms 349 or wait for up to a week for a computer report to obtain information from the MDC system.

The MDC system does not provide the base-level managers with information they need in the quantity, quality, format, or time that they require it. The lag between data capture and entry is too great to allow use of the information for work authorization and control and for troubleshooting aircraft problems, major needs of the base-level maintenance managers. Turnaround time on special information requests are generally excessive, resulting in the manager seeking the information he requires elsewhere. For example, during our visit to Travis AFB, one avionics technician spent several hours reviewing forms to identify failure trends. We were told that any information obtained through this process would not be very timely. However, this approach was used because MDC input was not timely. Therefore, the manual review was only helpful in identifying repeat problems.

An AFLC official stated that the problem with MDC reporting is not just confined to Air Force maintenance personnel. Some defense contractors do not always collect the maintenance data for the maintenance actions they perform. Some of the contractors receive no reports from the MDC system or the AFLC Product Performance System (DO56) which summarizes the data. Thus, there is a lack of incentive to spend the time and money to collect the maintenance data.

The conservation process, which involves the maintenance task itself, is perhaps the area where MDC data is supposed to be used most directly; the data is essential to the development of effective and efficient maintenance concepts and procedures. At the base level, for example, if MDC data were more accurate, complete, and timely, it could serve as the basis for aircraft maintenance work authorization and control. The data should be an essential input to the decision to modify and improve equipment. The data would permit the maintenance manager to determine his maintenance capability and to pinpoint limiting problems as well as facilitate the analysis of personnel requirements.

The decisions required in the Air Force's acquisition process could also be supported by MDC data. Contractor performance in terms of weapon system and component maintainability and reliability is in part measured using the data. This aspect of data use has taken on increased importance with the Air Force's recent emphasis on total life cycle costs of weapon systems. MDC data is one factor used to make decisions on contractor selection, maintainability/reliability specifications and standards, quality control, and performance/cost trade-offs.

MDC data is also involved in determining aircraft safety. MDC data through the AFLC Product Performance System (D056) is an input to the Flight Safety Prediction Technique Program (G095). G095 was developed to quantitatively assess the impact of equipment malfunctions on flight safety. The basic methodology of G095 is to apply mathematical modeling techniques in the processing of aircraft equipment failure data to produce a quantifiable index of flight safety. The purpose of the safety index is to manage the capability for identifying critical safety items before they expose the aircraft and crew to a hazardous condition.

One example which illustrated the need for accurate, timely maintenance data was a major accident involving a C-141 aircraft. According to Military Airlift Command (MAC) documents, the inability to maintain accurate manual records was a direct cause of the accident. The nose landing gear collapsed on the C-141 during landing. The collapse occurred because an invalid serial number on a form went undetected and a major modification of the main landing gear was not done. This resulted in a deficient gear which caused the collapse. The resulting repairs to the C-141 took 8,000 labor hours and cost $1.15 million in materials.

MAINTENANCE DATA IS NOT REPORTED OR IS REPORTED INACCURATELY

The most often cited shortcomings of the MDC system are its inaccuracy and the resulting unreliable information the system produces. Over a period of years, the Air Force has conducted

organizational level maintenance personnel, a corresponding MDC action should be input by an intermediate-level shop. An analysis of MDC data was made for October through December 1981 for all F-16 aircraft. Data from the F-16 system indicated that 8 to 10 percent of the MDC data was never input by the shops. However, MDC data was not input by organizational level maintenance personnel for 50 percent of the maintenance actions, which should have had a corresponding input.

The inaccurate and incomplete data is not isolated to any one Air Force base, aircraft system, or command. Rather, it pervades the Air Force maintenance activities. The problems we have identified are not new ones. The weaknesses of the present MDC system have been verified in numerous studies and reports by both the Air Force and private contractors. Officials at Air Force Headquarters, the Logistics Management Center, and the Data Systems Design Center have all said that the MDC data has serious accuracy problems. These officials agreed that MDC has a major problem with incomplete and inaccurate data. One official termed MDC data "junk data." However, the MDC system has continued to operate over the years with no significant improvements.

CERTAIN AIR FORCE MAINTENANCE INFORMATION SYSTEMS DO NOT SATISFY USERS' NEEDS AND ARE NOT USED BECAUSE OF INACCURATE MDC DATA

A number of Air Force maintenance information systems have limited utility because they rely on MDC data. One system at the Air Force Headquarters level was discontinued because the data was considered inaccurate. Inaccurate, incomplete, and untimely MDC data also has prompted the development of data systems to compensate for these weaknesses and resulted in added staff effort. The Air Force needs to identify the information needs of the users and develop accurate and responsive information systems. Senior-level attention is needed to ensure that future maintenance information systems are useful and that recognized problems with existing systems are corrected.

One system, the base-level MCS, accumulates staff-hour data from the MDC system to support the Command Aerospace Maintenance Manpower Information System and cost data for aircraft maintenance organizations. The accuracy of maintenance staff-hour data contained in the MCS reports is questionable. The MCS for aircraft is constantly under attack and threat of cancellation. The MCS reports currently do not provide useful information for management purposes at the bases we visited. Managers contacted at these bases either did not receive the MCS reports or, if they did, did not use them.

At MAC Headquarters, only the Command Aerospace Maintenance Manpower Information portion of the MCS is utilized. The Air Force Headquarters-level version of the Command Manpower System,

complete the required maintenance of the aircraft and report actions taken. However, about one-half of the maintenance jobs identified as "opened" in the maintenance information system had not been closed after 6 months. For other jobs, the maintenance data provided by the system was incomplete. Although this analysis was not statistically significant because of the small sample size, it is indicative of problems associated with completely and accurately collecting and using maintenance data.

Another study of MDC accuracy was performed for the Logistics Management Center in conjunction with a Summer Faculty Research Program. According to an Air Force official, the study was limited in scope for two reasons: (1) the questionnaire, which was developed in less than 60 days, represented a rudimentary attempt to quantify certain types of data errors and (2) the study results are not entirely representative of Air Force-wide data accuracy because only two study locations were selected. However, the study report concluded that the probability exists that at least one data element on a Form 349 is wrong 99 percent of the time.

Reports we obtained from the C-5A aircraft Ground Processing System (GPS) confirmed one problem identified by both the contractor and the MDC studies. An April 1982 MDC mismatch report showed that Travis AFB had 436 part removals with no matching installation data submitted to the MDC system. Another GPS report on the total number of jobs closed by work centers also indicates that large amounts of MDC data are not being submitted. The report for January 1982 for Travis shows only 34 percent of its maintenance jobs were closed with MDC system input. In fact, one squadron at Travis closed only 1.7 percent of its jobs with MDC system input.

Incentives do not exist to provide accurate maintenance data

At the base level, the major emphasis has been on the requirement to report, rather than use, MDC data. One-hundred percent documentation of direct labor expended is required. The data recording procedures are manual, the amount of data is voluminous, and coding is complex. In the era of fourth generation computer technology, the Air Force is using first generation data input procedures. Additionally, according to an MDC System Users Work Group, accurate Form 349 data recording (and subsequent utilization and analysis) is contingent upon the availability and understanding of many technical orders and manuals. The mechanics doing the actual reporting generally are not able to use the data in their jobs and do not know how other people use the data because they receive no feedback from the MDC system. As a result, mechanics do not have an incentive to provide complete, accurate, and timely data. Air Force officials also advised us that contractors do not always collect maintenance data. An AFLC official suggested contractors might

said that the system was really a first attempt to see whether the concept of an operating and support cost system would work.

Additional effort and systems are required to compensate for inadequate systems

The Air Force currently has a number of projects underway to modify or further develop maintenance information systems to compensate for existing inaccurate and untimely systems. A discussion of some of these projects follows.

The F-16 Central Data System is one of the projects being developed by the F-16 System Program Office to provide maintenance-related information to F-16 managers. The F-16 Central Data System provides the F-16 System Program Office with a capability to track and plot reliability and maintainability statistics and trends for the F-16 aircraft and its associated avionics automatic test equipment. Reliability and maintainability are key factors influencing system design, system effectiveness, logistics support requirements, and life cycle costs.

According to a 1980 Air Force Audit Agency report, the F-16 Central Data System was necessary because the standard Air Force systems--the Product Performance System (DO56) and the Weapon System Reliability Mathematical Model (KO51) Program--were not timely, sufficiently flexible for required inquiries, or reliable during the first production and deployment year. For example, information was not available for analysis until 60 to 90 days after the maintenance action occurred. The primary input to the DO56 and KO51 systems is data from the MDC system.

In September 1977 the F-16 System Program Office at Wright-Patterson AFB started manually compiling reliability and maintainability data on operational F-16 aircraft from daily, weekly, and monthly computerized and noncomputerized sources of data. However, after F-16s were deployed to several sites, the F-16 System Program Office believed the magnitude of the manual data collection effort would become too difficult to continue and the manually collected data would not be provided in a timely fashion to manage the F-16 program. Given this situation and the interpretation that the F-16 program directive provided the authority for an automated system, F-16 System Program Office officials contracted to develop and provide a real time, [1] online [2] computer system to support its reliability and maintainability program.

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1 Real time input of data into a computer occurs as soon as maintenance work is complete. Therefore, real time retrieval allows access to up-to-date information from the computer.

2 Online data input and retrieval gives the user direct access to the automated data via a computer terminal.

Substantial problems with MDC data indicated in other maintenance information systems

Other information systems are also affected by the inaccurate MDC data they receive. One such system is the AFLC system which processes MDC data and distributes it to numerous Air Force users as well as contractors. Another such system is unique to the F-16 aircraft.

The degree of inaccurate and incomplete data provided by MDC to other systems is reflected in AFLC's Product Performance System (D056). This system processes MDC data to provide weapon system and item managers with reliability and maintainability information. It provides measures or indicators of weapon system performance such as the average number of operation hours between maintenance actions and maintenance staffing requirements by weapon subsystems.

In our opinion, weapon system performance data should be available to be used in three ways: (1) to quantify known problems, (2) to identify unknown existing problems, and (3) to predict future problems. Problem weapon system components or subsystems identified by the D056 system from the MDC data become candidates for improvement. The D056 system forms the basic framework for feedback of this data to agencies outside AFLC, such as Air Force Headquarters, Air Force Systems Command, the major operating commands, and defense contractors.

After data is edited at the base level by the MDC system, it is sent to the AFLC for processing in the D056 system. This system receives about 2.2 million input transactions a month from the MDC system. Data is input into the D056A subsystem for initial editing before further processing in the D056 system. Transactions that have invalid data codes are either dropped from the system or listed as erroneous, depending upon the invalid code. Dropped records are not corrected and reinput into the D056 system. The data from the dropped records is lost. Erroneous transactions are not corrected but are sent through the system, errors included. In looking at the causes of input errors for a number of weeks in 1981, we found that about one-half of the errors were transactions that were more than 60 days late.

The D056 system, in a sense, is an extension of the MDC system. Besides processing and passing maintenance related data to its many users, the D056 system directly provides or feeds maintenance data to 14 additional AFLC information systems through system interfaces. As of October 1981, 189 organizations were listed as recipients of D056 system reports.

Another system which is maintained for the F-16 System Program Office at Wright-Patterson AFB uses MDC data as an input to prepare management reports. When parts are removed by

being reviewed by AFLC planners. After approval of the Data Automation Requirement, the system would use the F-16 and A-10 aircraft as prototypes. The F-16 aircraft was chosen primarily because of the ongoing development of the F-16 Central Data System. Only two aircraft would be prototyped in an effort to reduce transaction volumes and development costs. Prototyping costs are estimated to be less than $100,000.

An AFLC representative acknowledged that the data access system is one of several similar ongoing developments which are attempting to address problems with the use of current Air Force maintenance information systems. The similar development efforts include the Product Performance Feedback System, the F-16 Central Data System, the Automated Maintenance System, and MMICS enhancements.

While the Product Performance Feedback System and the Maintenance and Operational Data Access System developments are attempting to address the issues of accuracy and timeliness of maintenance information, neither deals with the problem of inadequate source data collection techniques.

THE AIR FORCE HAS CONSIDERED ELIMINATING MDC BECAUSE OF PROBLEMS

Since the MDC system became operational in 1958, both the Air Force and contractors have conducted numerous studies dealing with problems in the system. Several of the studies and efforts have been directed at reducing or eliminating maintenance data collection. Yet, attempts continue to modify and improve the MDC system and those systems it feeds. This raises questions about whether the Air Force needs the amount of MDC data it presently receives.

According to an Air Force report, during the 1960's management began to question the documentation concepts being used. The questions, "What maintenance should be documented?" and "How should our work be reported?" were asked often at various levels of management. In response to these questions, in 1969 and 1970, the Strategic Air Command and AFLC conducted a test of a limited reporting concept. The concept led to a loss of part of the component failure information considered essential by AFLC. As a result, the concept was not implemented, and 100-percent reporting of maintenance actions continued to be required.

The reporting requirements of maintenance were evaluated in 1973. A team repesenting Air Force Headquarters and major commands categorized data elements and studied the various uses of maintenance information during Project Rivet Rally. The response to the often asked question, "What do you need?" was "Everything I have now plus * * *." No significant changes were made to the reporting system as a result of the study.

the Aircraft Maintenance Manpower Information System, was discontinued in October 1981 because inaccurate MDC source data made it unusable without extensive manual work. A review by the office of primary responsibility for the Headquarters Manpower System found the system report contained numerous errors which made the reports unusable.

We analyzed a November 19, 1980, request by senior Air Force Headquarters officials for online access to the Aircraft Maintenance Manpower Information System via a computer terminal. While officials responsible for maintaining the system said they would provide the staffing information for selected aircraft, they provided information from the database only after performing manual analyses. According to an Air Force Headquarters official, the analyses were done manually because data errors from inaccurate MDC system source data are so extensive. The office of primary responsibility also manually analyzed the information before using it.

The Product Performance System (D056) processes data from the MDC system to satisfy system and item managers' needs for reliability and maintainability information. In general, we found that the effectiveness of the D056 system is adversely affected by inaccurate, incomplete, and untimely MDC data.

Comments from selected system report users confirmed that D056 information is inaccurate and not available on a timely basis. However, for most of these users, the D056 information is used because it is the only available source of reliability and maintainability information in the Air Force.

A system we identified as unused by its primary report recipients in OSD because of questionable accuracy was the Operating and Support Cost Estimating Reference system. This system was developed by the Air Force in response to a DOD management objective which required the military services to provide accurate information concerning the costs of operating and supporting existing weapon systems. The Estimating Reference System was a management information system which made extensive use of the data collected by 14 other Air Force data systems, including the MDC system.

To provide the required cost estimates by weapon system, the Estimating Reference System performed allocations of many of the composite cost elements available. It accomplished this by using various cost allocation algorithms, several of which allocated aggregate costs to weapon systems based in part on the ratio of the direct labor hours expended in support of each weapon system.

Because of the inaccurate maintenance staff-hour data and the way the costs were redistributed, the intended DOD users we contacted indicated that they did not believe the information was valid and consequently did not use it. Air Force officials

The recommendations in the contractor's report and the assessment in the paperwork reduction report caused concern within the Air Force. Both the Director of Manpower and Organization and the Deputy Assistant Secretary for Logistics expressed doubts about eliminating MDC reporting without a substitute system. They were concerned because support general activities account for a substantial percentage of the time mechanics spend on aircraft maintenance. Because of Air Force officials' concern about the modification project, the 1977 Program Management Directive was cancelled.

In May 1978, the Deputy Assistant Secretary for Logistics and the Deputy for Productivity Management suggested using engineered labor time standards as a way for documenting base-level maintenance and thereby reduce recordkeeping and increase productivity. [4] An agreement was reached in July 1978 to pursue the use of engineered job standards as a way to reduce maintenance recordkeeping. The Directorate of Manpower and Organization and the Director of Maintenance and Supply agreed to jointly pursue the development of job standards for the highly repetitive or high staff-hour level tasks in the support general area as a substitute for detailed data reported by individual maintenance technicians. The F-4E was selected as the test aircraft for the project.

In September 1979 the 4th Tactical Fighter Wing began testing the standards method of reporting support general maintenance actions. If the measurement of the F-4E job standards proved cost-effective and provided the desired results, the measurement of other aircraft was to be included.

As of July 1982, each command within the Air Force had developed or was developing job standards for its major aircraft types. Twelve different types of aircraft, including the F-4E, are now covered by job standards.

As the support general job standards are developed, the Form 349 will no longer be used to report support general maintenance actions. Instead, a less complicated form will be used. Air Force officials estimate that, as of July 1982, MDC paperwork has decreased by 30 percent and support general paperwork has decreased by 60 percent. These reductions are a result of the support general job standards program. However, the Air Force does not have documented figures to support the reductions.

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[4] Engineered labor time standards are developed using work sampling and time study methods. Standard times are charged for maintenance tasks performed. This eliminates the need for a mechanic to record the hours spent performing a task.

At the Oklahoma City Air Logistics Center, the Engineering and Reliability Branch, Directorate of Materiel Management, uses maintenance information provided by the D056 system. Two years' worth of information are prepared to support Product Improvement Working Groups. These groups use the information to assess the need for, and effectiveness of, aircraft modifications. In order to analyze an avionics modification of the B-52 bomber, the Engineering Division is manually collecting maintenance data on the B-52, by aircraft number, before, during, and after the modification. This manual tracking is needed because D056 information is inadequate. In addition, engineers at the Air Logistics Center said D056 information is primarily used to document what they already know.

Efforts are underway to improve the utility of AFLC's D056 system. These efforts are in the form of (1) increased feedback from D056 system users on their problems and concerns regarding D056 system information, (2) increased communication between the D056 system users, and (3) two new information systems under development to enhance maintenance data collection. A discussion of the two proposed new systems, the Product Performance Feedback System and the Maintenance and Operational Data Access System, follows.

A Product Performance Feedback System project was initiated by a January 1979 Air Force Headquarters directive. The feedback system project is in a very early stage of development. Its ultimate objective is to provide a convenient, usable source of design-related operating and support information using uniform methods and definitions throughout the equipment life cycle. The information will be used by the Air Force and contractors to analyze existing performance when designing new aircraft and other equipment. In addition, the system may help Air Force managers monitor Reliability Improvement Warranty programs. At the time of our review, the feedback project development effort had not yet been funded; consequently, an economic analysis and functional description have not been prepared.

As a part of the feedback system development effort, the project office intends to look at a number of maintenance information systems in operation and under development. Included are both the F-16 Central Data System and MAC's Automated Maintenance System.

The Maintenance and Operational Data Access System is a proposed online data system for retrieving maintenance and operational information for weapon systems. The proposed system would provide terminals for retrieving information. The data access system would draw data from the Product Performance System (D056) and one other system. A project directive had not been prepared for the data access system project. At the time of our review, a Data Automation Requirement for the system was

CHAPTER 3

THE AUTOMATED MAINTENANCE SYSTEM CONCEPT CAN IMPROVE MAINTENANCE INFORMATION BUT MANAGEMENT PROBLEMS NEED TO BE SOLVED AND DECISIONS MADE

The Automated Maintenance System (AMS) is a test program at Dover AFB. The program is designed to evaluate the automation of selected maintenance information and control processes and establish the value of the concept Air Force-wide. AMS provides the capabilities for online, real time data input and retrieval. These capabilities help eliminate accuracy problems and improve maintenance managers' access to vital information which can improve decisionmaking. AMS eliminates much of the paperwork processed by mechanics and their supervisors, thereby freeing them to perform vital maintenance work. The reduced paperwork in turn eliminates the need for assigning staff to administrative work such as keypunching and recordkeeping.

Although AMS processes provide improvements, the Air Force has yet to fully measure them. Air Force managers were provided misleading and incomplete information on the benefits and costs of AMS. We therefore believe that the Air Force needs to further identify the system's costs and benefits. Because of reported AMS benefits, there are several proposals to expand its application within the Air Force. Such proposals call for stand alone computer systems. To prevent the proliferation of stand alone systems, the Air Force needs to justify and develop AMS capabilities which are compatible with its standard base-level computer systems. This will prevent the acquisition of unnecessary computer hardware to support AMS expansion efforts.

WHAT IS AMS AND HOW DOES IT WORK?

For many years the Air Force has attempted to increase the use of automation in its maintenance management activities. Currently, the standard automated Air Force maintenance information system at the base level is the Maintenance Management Information and Control System (MMICS). MMICS is an online computerized system used to track and control maintenance resources at more than 100 Air Force bases worldwide. Work on MMICS began in 1966 and implementation of the system began in 1974.

Although five increments of MMICS were designed, only three have been implemented. Increments four and five would have provided online following and close out of maintenance work. But, as presently designed, MMICS generally does not receive MDC data input. An Air Force Headquarters official stated that computer hardware limitations prevented the implementation of these increments. However, an official at the Air Force Logistics Management Center said that the Air Force was not willing to

In June 1976, the Air Force awarded a contract to study the MDC system and to determine whether sampling techniques could be used to collect staff-hour data rather than collect all data. The study report was titled "Project Realms: Recommendations to Enhance the Air Logistics Maintenance System."

After completing the 2-month study, the contractor found that the MDC system had four basic problems:

(1) the system did not provide accurate information,

(2) the data collection cost was too high,

(3) the data documentation was excessive, and

(4) the volume of the data collected made it difficult to sort out desired information.

The contractor recommended the application of statistical sampling techniques and the use of trained observers to gather staff-hour expenditure data. The benefits of the proposed sampling included (1) collection of accurate staff-hour data, (2) reduction of documentation on Forms 349, (3) reduction of keypunching, and (4) reduction in the amount of MDC computer processing time.

When the study was presented to Air Force officials in March 1977, questions were raised about the technical aspects and cost-effectiveness of sampling and the need for a test to prove or disprove the recommendations. Then, on July 14, 1977, the Air Force published a Program Management Directive tasking the Air Force Logistics Management Center with the responsibility of designing and testing a modified MDC system as outlined in the study report.

In addition to the MDC system modification project, an Air Force evaluation team studied the paperwork impact of the various proposed ways to reduce MDC data collection. The resulting report on paperwork reduction within the MDC system was issued in August 1977 by an Air Force Headquarters office. This report assessed the impact and alternatives for the following proposals:

--the elimination of MDC in all offshore commands and

--the elimination of all support general [3] documentation in the MDC system.

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[3] These are highly repetitive tasks, such as ground handling, refueling, washing, and preflight and post flight inspections.

Increment	Process
IV	Job following and suspense
	Inspections following
	Ground equipment following
	Maintenance preplanning (job standards)
V	Monitoring designed aircraft capability
VI	Production control and component scheduling
	Precision measurement equipment scheduling
VII	Interface with supply system
	Automated inventory of available parts
	Automated control of cannibalization
	Automated cross reference of part number and stock number

At the time of our review, increments I through V of the AMS test were operating at Dover AFB.

Because of the GPS computer capability, it was possible to expand the existing terminal network at Dover AFB by adding 30 terminals and 20 printers for increments I through V. Dover AFB was selected over other MAC locations because it had only the C-5A aircraft, thus allowing the use of a single maintenance tracking system. Altus and Travis AFBs, which also have GPS capabilities, were not chosen because they have C-141s in addition to the C-5A. Maintenance actions on the C-141 aircraft are tracked by MMICS. Therefore, Altus and Travis AFBs have dual maintenance tracking systems--GPS and MMICS. Another reason for selecting Dover was that a single aircraft maintenance system location would allow the use of existing equipment, thereby minimizing the cost of the test.

AMS automates many previously manual maintenance record-keeping activities. For example, instead of the Job Control Section calling a shop when work needs to be done, job controllers type the work instructions into the terminal. These instructions are then transmitted to the terminal in the maintenance shop which will perform the work. For scheduled

Studies of the MDC system continue and costs of these studies mount. A 1979 Air Force Audit Agency report showed that studies performed in connection with the MDC modification project cost more than $1 million. Even though numerous MDC studies have been completed, MDC accuracy problems continue to plague Air Force decisionmakers.

THE AIR FORCE MUST DETERMINE ITS MAINTENANCE INFORMATION REQUIREMENTS AND DESIGN SYSTEMS TO MEET THEM

On one hand Air Force regulations emphasize the need for complete and accurate maintenance information. On the other hand, Air Force studies and projects have attempted to reduce the amount of data collected, and inaccurate and untimely maintenance information abounds throughout the Air Force. These apparent contradictions create doubt about whether the Air Force has adequately determined its maintenance information requirements.

Millions of dollars are spent on collecting, processing, and disseminating maintenance information. The process is paperwork intensive and prevents more productive work from being accomplished.

The problems of inaccurate, incomplete, and untimely maintenance information have been reported within the Air Force for many years and in several studies. These problems persist unabated.

In order to correct the problems in its maintenance information processes, we believe two key steps are needed. First, the Air Force needs to identify its maintenance information requirements at all levels of management and operations and the level of information timeliness, accuracy, and detail that is needed. Second, the Air Force must design cost-effective information collection processes and systems which will meet these maintenance information requirements.

had. This helps the mechanics diagnose current problems and prevents them from having to continually remove a component which then checks out as operable. The mechanics can look for other causes for the problem. For example, a failure involving an onboard computer system might be caused by a wiring harness and not the computer which would check out as operable when taken into a shop.

According to Air Force officials, inaccuracy in MDC data is virtually eliminated with AMS because of extensive data and logic checks. Further, improvements to MDC data collection at Dover are substantial. The chart on the following page shows these improvements by comparing Dover's MDC data input in January 1982 and in May 1980 (during early stages of AMS implementation) with Travis AFB's input.

As the chart indicates, a substantial amount of MDC data is not reported at Travis AFB. For the month of January 1982, only 34 percent of the 10,516 maintenance actions received MDC system input. As a result, the Air Force does not know the kind of malfunction, the corrective action, or how long the work took for 6,939 (66 percent) maintenance actions. However, supervisors told us that they make sure that their mechanics record a full day's labor hours. In accounting for these hours, productive time is charged to the 34 percent of the reported maintenance actions, making the labor hours reported on these actions inaccurate.

AMS allows managers at Dover to identify individuals who do not input MDC data. With this information, the manager can take corrective action. Further, as the benefits of the system are realized, mechanics and their managers have more incentive to ensure that MDC data is input.

In addition to these benefits, Dover AFB managers have identified and reported numerous others. A few of the benefits included in the users' evaluation report follow.

--The personnel availability subsystem and the shop job overscheduling protection programs identify those mechanics available for work and work already assigned to a shop. This prevents the Job Control and the Plans and Scheduling sections from overscheduling work in a particular shop or assigning mechanics who are not available for the day. This also reduces the time required for internal coordination of work.

reduce its budget authorization for maintenance staff to pay for the system cost in accordance with an Air Force interpretation of legal reguirements.

The AMS test system, as implemented at Dover AFB, includes more automated processes than MMICS, although many are the same. One advantage AMS has over MMICS is that AMS provides for real time input, editing, and retrieval of MDC data. The AMS system is based on enhancements to the computer system obtained with the C-5A aircraft in the early 1970s. This system was referred to as the Malfunction, Analysis, Detection, and Recording System (MADARS)/Ground Processing System (GPS). MADARS provides a unique capability to monitor the C-5A aircraft in flight and record component and part malfunctions as well as other flight data. The onboard MADARS tape is removed and processed by the GPS after the aircraft lands. The GPS portion of the system provides the basic computer hardware around which the AMS test program is built.

The GPS system consists of base-level computers at Altus, Dover, and Travis AFBs (bases where the C-5A aircraft are stationed) which are linked via communications lines to a central data bank at Tinker AFB. The base-level computers are used to process and transmit data from the MADARS tape to the central data bank. In addition, the computers enable base-level users to develop and run certain local programs which are unique to their needs. There is also a network of terminals and printers at the three bases, at the C-5A manufacturer, at MAC Headquarters, at the San Antonio Air Logistics Center which manages the C-5A program, and at Tinker AFB which manages the MADARS/GPS system itself.

Because of the unique capabilities provided by the GPS system and enhancements made by the Air Force after the system was acquired in 1975, MAC submitted a proposal recommending adoption of the system Air Force-wide. In response, three Air Force Headquarters directed conferences were held in 1976. The conferences identified several processes to be tested and established a basic development plan. The 21 processes (not all listed) were separated into the following seven AMS test increments.

Increment	Process
I	Automated work order generation and online close out
II	Automated aircraft debriefing
III	Personnel availability and forecasting

--The specialist dispatchers, mechanics, and shops no longer prepare Forms 349 on an average of 11,783 jobs per month since the data is keyed directly into the terminal. This saves about 49 staff-hours per month.

--The organization and intermediate level work centers no longer have to pick up Forms 349 from the Job Control Section. This saves an estimated 5 minutes per trip to Job Control each day for each shop that dispatches mechanics to work on the aircraft. The shops were spending an estimated 3.25 staff-hours per day picking up Forms 349.

--The Debriefing Section no longer prepares Form 349 packages for the work centers, reducing the workload by an average of 25 minutes for each of 162 debriefs per month.

--Forms 349 that are generated list the tools required to perform tasks, if special tools or test equipment have been identified and maintained by the users. Additional benefits allow identification of equipment required to provide offshore support and ensure all equipment is shipped.

--Forms 349 are no longer sorted before keypunching. This was requiring 4 hours daily.

--Forms 349 are no longer manually reviewed when completed. This frees supervisors from an estimated 3 hours per shop per day.

--The Inspection Dock Supervisor has a single document which outlines all maintenance requirements.

--Online availability of the average time to complete a task enables the Job Control Section to realistically estimate when a job will be completed and when an aircraft will be ready to fly.

--All programs are designed to meet users' needs and are modified to the satisfaction of the individual user. Any program problems are investigated and corrected immediately. The system is designed to help maintenance personnel operate in a more efficient and real time environment.

The above list of benefits provided by AMS users at Dover is by no means complete. However, it is indicative of the general user satisfaction with the system.

maintenance, the system provides a list of all actions required to complete aircraft inspections. Instead of completing Forms 349, the form is shown on the terminal screen and a mechanic directly inputs MDC data on the maintenance action performed into the system at the terminal. The system also tracks the status of open work, identifies maintenance specialists' availability, and estimates when the work will be completed. Keypunching of cards is reduced since data is input directly into the system terminals. These and other AMS maintenance processes produce numerous benefits. These benefits are discussed in the following section.

AMS IMPROVES THE ACCURACY, TIMELINESS, AND UTILITY OF MAINTENANCE INFORMATION

Maintenance management tracking processes are time-consuming and paperwork intensive. As a result, errors and delays occur, and maintenance personnel have little incentive to provide information. In combination, these problems result in information systems which do not provide managers with the timely information they need to make decisions. The information which is provided is often not relied on because of its widely recognized inaccuracy. The AMS test project at Dover AFB demonstrates how these problems can be corrected with state of the art technology.

As discussed in chapter 2, key elements of the Air Force's maintenance information system are MDC data and the associated data processing systems. Problems in the MDC system begin at the base level with mechanics providing code intensive detailed information on what they are doing. MDC data requirements in the AMS system are no less detailed or code intensive. However, Dover provides more MDC data than any other base and the data is more accurate. Why does this happen?

Filling out Forms 349 and keypunching and processing MDC data at most bases takes time--time in which data is not available to managers. The dynamics of a base environment and the need to have aircraft ready to fly does not allow maintenance managers the luxury of waiting for time-consuming processes to produce outdated information. As a result, MDC data is not used for day-to-day management. At most bases, mechanics see only the work of filling out the form, not the corresponding benefits. The lack of any perceived benefits to a base contributes to missing and inaccurate data.

The MDC data improvements at Dover are not an accident. They are directly attributable to the design of the AMS system and management's recognition of its utility. Once input into a terminal, MDC data is available for base-level, MAC, and AFLC users. More importantly, flight line and shop mechanics can, and are encouraged to use MDC historical information to identify maintenance problems a particular aircraft or component has

Because of the limitations, the plan noted that other test locations may be needed. At the time of our review, the unique GPS capabilities and the fact that the system operates on computer hardware which is not compatible with computers at most Air Force bases were posing problems for Air Force managers trying to make decisions on the future of AMS capabilities.

The Air Force Logistics Management Center is responsible for evaluating the AMS test. The purpose of the Center's evaluation is to verify the operational and technical feasibility of the AMS processes and, for feasible processes, determine Air Force-wide applicability and potential benefits. In its evaluation report on Increments I through V of the AMS Test Program, the Air Force Logistics Management Center noted that the originally recognized limitations hindered its evaluation. The Center reported that AMS processes are totally dependent on GPS because of the database management system used for AMS/GPS. This system does not run on the computers used at other Air Force bases. As a result, major programming changes would be needed to make the existing AMS computer programs work on most Air Force computers.

In addition to the computer program problems, AMS processes are dependent on many GPS computer programs. According to the Logistics Management Center report, the separation of AMS from GPS processes would also require major computer programming changes. The Center report added that certain GPS processes are superior to MMICS processes and may have potential Air Force-wide benefits.

We were told that it was not possible for the Logistics Management Center staff to establish good baseline measures because certain AMS processes were already partially implemented with GPS. The interdependability of AMS and GPS resulted in a lack of good data on computer resources needed to support AMS processes.

Since baseline measurements were not available at Dover AFB, the Logistics Management Center devised another approach to test the postulated benefits of AMS. The AMS Data Project Plan listed the following as some of the possible benefits.

--Work order generation and closeout processes will save staff-hours, reduce elapsed time, and improve MDC accuracy.

--The job following and suspense system will save staff-hours for Job Control, Plans and Scheduling, and workcenter personnel and improve the accuracy of job completion estimates.

--The job standard subsystem will save staff-hours for the Job Control and the Plans and Scheduling sections in scheduling work orders and will save staff-hours for

Maintenance Actions Closed

And Percent Closed With MDC Data Input

Maintenance Squadron	Dover AFB January 1982 Number of actions closed	Dover AFB January 1982 Percent closed with MDC	Dover AFB May 1980 Number of actions closed	Dover AFB May 1980 Percent closed with MDC	Travis AFB January 1982 Number of actions closed	Travis AFB January 1982 Percent closed with MDC
Organizational Maintenance Squadron	5,722	99.4	Not available		4,173	1.7
Field Maintenance Squadron	7,172	93.5	6,698	65.5	3,668	52.3
Avionics Maintenance Squadron	2,781	98.2	4,234	92.2	2,675	59.3
Total	15,675	96.5	10,932	a/75.8	10,516	34.0

a/This average does not include the Organizational Maintenance Squadron.

projected saving of 9 years of effort and the actual staff reductions at Dover, the total staff which could be eliminated or reallocated to other tasks is 22. As noted earlier, other staff savings are also possible.

We found that the Air Force is reluctant to comment on, or justify AMS on the basis of personnel savings. The Deputy Chief of Staff for Logistics and Engineering stated in a May 1982 memorandum that "* * * we wanted to avoid having to promise to 'give up' large numbers (2000-3000) of manpower authorizations to pay for a maintenance data system * * *." Our discussion with an Air Force Logistics Management Center official who is familiar with AMS indicated MAC will not give up staff authorizations until AMS is fully evaluated. Instead, Air Force officials are relying on other measures to portray the AMS system benefits, although these benefits are misleading.

Misleading benefits are used to promote AMS

MAC is planning an expansion of AMS which is based on benefits which were not validated by the Logistics Management Center and are misleading to senior Air Force officials. These misleading benefits are a key part of the justification for expanding AMS.

During our initial visit to Dover AFB, we were told that one of the most significant benefits of AMS is a 7-percent increase in the full mission capable rate since November 1979. [1] This increase was supposed to be the equivalent of providing the Air Force with more than three additional C-5A aircraft. A table showing the full mission capable rates at Dover AFB follows.

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[1] Full mission capable is a status code meaning that the system or equipment has in working condition all systems which are needed to perform all its primary missions.

MANY MANAGEMENT PROBLEMS PLAGUE THE AMS TEST AS A BASIS FOR FUTURE AIR FORCE DECISIONS

Although the AMS test has proved to be a successful application of automation from an operational standpoint, our study indicates weaknesses in the management of the test program. The AMS test evolved from the C-5A GPS which does not represent maintenance tracking capabilities at most Air Force bases. Baseline measures of maintenance staff performance were not made at Dover AFB. The Air Force therefore had to select other bases for comparing the time required to perform administrative tasks. Although substantial savings in administrative work by both mechanics and administrative personnel results from AMS, the Air Force has not relied on these benefits to promote AMS expansion. Instead, certain misleading information was used. In addition, the Air Force did not identify the estimated full costs associated with AMS. MAC documents submitted to senior Air Force officials did not include the full cost of an expansion proposal. While an AMS type of system can provide the Air Force with benefits, managers need to have an accurate picture of both the full costs and benefits when they make decisions on future AMS applications.

Dover AFB may not be a good test for AMS

As noted earlier in this chapter, Dover AFB was selected for the AMS test because of its existing GPS hardware and capabilities and because Dover is a single aircraft maintenance location. These advantages make Dover less representative of other Air Force bases. Consequently, the Dover advantages raise questions of whether the Air Force has a valid basis for accomplishing the AMS test objective to estimate the value of Air Force-wide implementation of AMS processes. The Air Force recognized these limitations in the AMS project plan, which stated the following.

--It is impossible to separate and isolate AMS capabilities from those of the C-5A GPS. GPS software exists for many AMS processes and, with slight modification, other GPS processes can accomplish the AMS capability. Thus, it may not be possible to attribute all benefits or savings to AMS.

--Differences between procedures and policies at Dover and those at other maintenance organizations are, in some cases, significant. These differences exist primarily because of unique GPS capabilities. Thus, there may not be a direct correlation between the usefulness of automation at Dover and its usefulness at other organizations.

--The tactical air forces operate under a different maintenance organization structure.

Another benefit cited in AMS justifications is the percentage of maintenance actions which require parts--a 12-percent decrease. The GPS system tracks work which requires parts. According to Air Force officials, the AMS system helps mechanics to better diagnose aircraft failures. When there is a failure after a recent part replacement, the part is not automatically replaced. Instead, the mechanic looks for other causes of the problem. At other Air Force bases, the mechanic cannot readily obtain information on the previous maintenance actions taken because the data is not compiled in a timely way.

Although the number of maintenance actions requiring parts decreased at Dover, neither the Logistics Management Center nor Dover officials were able to quantify the benefits of the decrease. Dover officials did not measure benefits by using data from the supply system. Although they attempted to produce measureable supply benefits, they were unable to do so.

In justifying a proposed expansion of AMS processes to Altus and Travis AFBs, MAC stated that the full mission capable rate for the C-5A aircraft would increase 5 percent. A similar improvement was estimated in a proposal to include the C-141 aircraft in the system. Further, the Deputy Chief of Staff for Logistics and Engineering also cited increased full mission capable rates and decreased parts usage as the benefits to be used in justifying AMS.

While we recognize that AMS may have benefits, such as greater aircraft availability because of improved work scheduling, the measures used by the Air Force did not demonstrate them. The Air Force needs to continue its AMS evaluation to further demonstrate the system's benefits.

AMS costs were not tracked and were misrepresented

The AMS test program serves as a prototype for estimating the value of its processes. In addition to limitations in the way the Air Force has proceeded in documenting AMS benefits, we also found weaknesses in its cost documentation. AMS managers have not provided senior Air Force officials with the total system requirements in terms of costs or system computer hardware.

We attempted to obtain AMS project costs from Air Force Headquarters, the Data Systems Design Center, MAC Headquarters, the Tinker Data Services Center, and Dover AFB. None of the officials we contacted at these locations was able to provide the total cost of the AMS project or AMS operating costs.

We analyzed the data provided us at the various locations to develop some idea of the annual operating cost of AMS as implemented at Dover AFB. The following chart breaks out various AMS operating costs. Certain GPS processes are included in

specialists in determining tool and equipment requirements.

--Production scheduling will save staff-hours by eliminating procedures and files.

The Logistics Management Center collected data from bases in the Air Training Command, Strategic Air Command, and the Tactical Air Command on the time required to perform various maintenance management tasks comparable to those automated in the AMS test. By comparing the collected data with data for the Dover processes, the center staff estimated the potential benefits from Air Force-wide implementation of AMS processes. The Logistics Management Center evaluation report stated that "The results of this test indicate that we may assume that current Air Force procedures require more hours per day than the AMS test procedures * * *." Savings of more than 18,000 staff-hours per year, or about 9 staff years, were estimated.

The Air Force has avoided emphasizing AMS staff savings

The Air Force Logistics Management Center's evaluation report on increments I through V of the AMS test contained estimated personnel savings resulting from fewer manual processes. The estimated savings, however, are not all inclusive. Further, the Air Force is reluctant to rely on the estimated personnel savings when it promotes AMS benefits.

The Logistics Management Center estimated savings in the time required to perform six specific maintenance tasks at Dover AFB as compared with other bases. The savings equate to 9 years of maintenance staff effort. In addition to the time saved in maintenance processes, we identified areas where staff are no longer required. Dover now uses five fewer keypunch staff and eight fewer staff members in its Documentation Section. These staff reductions resulted from the entry of MDC data by terminal instead of by keypunch and the automated tracking of aircraft records. Dover officials also advised us that some of the work now performed by staff in the Production Analysis Section, a unit which prepares reports on maintenance activities, can be reduced. For example, the AMS computer can produce reports on such subjects as high failure components and high staff-hour consuming work unit codes.

Although the Logistics Management Center evaluation of increments I through V was completed in June 1981, an August 1981 economic analysis of possible Air Force-wide implementation of AMS indicated that only seven positions could be eliminated if AMS processes were implemented at an extra large base and only five positions at a large base, such as Dover. We believe this substantially understates the benefits for possible personnel savings. Based on the Logistics Management Center's

"* * * inclusion of C-141 aircraft data in GPS would permit realization of numerous benefits * * * with relatively small additional expenditures. Approximately 10 scopes and six printers would be needed at Travis, and six scopes and four printers would be needed at Altus. Applications software from the existing GPS/AMS would require minor modifications."

Approval for the expansion was granted on September 18, 1981, by the Director of Maintenance and Supply.

In addition to the required terminals and printers for the C-141 expansion, we identified other cost elements. The minor software modifications will require four additional programmers and support personnel at a cost of more than $100,000 per year. The estimated cost of ADP hardware and disk storage space to support the expansion is about $440,000. These costs do not include communications lines and possible other cost elements.

For some time, we have urged Government agencies to develop computer cost accounting systems so that management can

--assess the full cost of requests for computer services, including the resources required to operate information systems as well as design them;

--evaluate the relative worth of current and proposed applications on the basis of their total cost and their benefit to the organization's missions and programs;

--determine the allocation of support needed to meet new and existing program needs; and

--foster cost consciousness among data processing users.

We issued guidelines for accounting for ADP costs in our 1978 Federal Government Accounting Pamphlet Number 4. Office of Management and Budget Circular No. A-121, issued on September 16, 1980, requires that all data processing facilities that exceed $3 million per year comply with our guidelines. Our guidelines state that cost centers should be established to accumulate the operating costs incurred for computer processing and software maintenance. Within each cost center, costs should be aggregated by area of management responsibility and work function. Accumulated costs should also be assigned to the offices benefiting from them. Costs for data processing should normally be reported--whether reimbursed or not--to the users who receive the benefits as well as to the managers responsible for operations and for budgeting for the expenses.

There are three general objectives in accounting for ADP costs. One is to arrive at the total cost of processing data with computers and other related resources. Second, for control

DOVER AIR FORCE BASE
FULL MISSION CAPABLE RATES
1979 to 1982

	1979	1980	1981	1982
January	51.9	45.4	46.3	46.2
February	42.2	46.6	50.7	42.6
March	47.9	42.5	48.4	49.8
April	42.4	45.9	49.6	
May	42.7	46.4	51.4	
June	46.5	47.3	51.2	
July	47.3	42.7	45.8	
August	43.2	43.4	47.4	
September	46.8	45.2	53.2	
October	43.3	53.6	47.1	
November	54.9	44.5	51.5	
December	49.5	46.9	48.1	
Average	46.6	45.9	49.2	

As the table indicates, full mission capable rates fluctuate widely. The basis for the cited benefit of a 7-percent increase was the April through June period for 1979, 1980, and 1981. The 1981 rates for April, May, and June are 7.2, 8.7, and 4.7 percent higher, respectively, than the 1979 rates, or an average of 6.8 percent higher. However, during some other months in 1981, the full mission capable rate was lower than 1979.

A Logistics Management Center staff member who worked on the AMS evaluation stated that it would be difficult to attribute the full mission capable rate increase at Dover to AMS. He said that the full mission capable rate increase was not validated by the Logistics Management Center evaluators, but was included in the Center's report as a statement by MAC officials. He said that too many factors affect full mission capable rates to attribute an increase to AMS. One DOD official stated that, to be significant, a full mission capable rate increase of 20 percent would have to be achieved.

intended to coincide with the Phase IV base-level data automation program.

Phase IV is a hardware and software conversion project which will culminate in the purchase of replacement hardware for the current base-level computer systems with a single system at most bases. The overall objective of the Phase IV program is to provide cost-effective, responsive, and reliable computer support for a variety of base-level administrative and operating functions. It is intended to provide a safe transition of current applications software as well as responsive computer support for up to 20 years (1983 to 2002). The specific objectives of the program follow.

--Replace current computer systems with new software compatible computer systems from a single manufacturer's product line.

--Consolidate the replacement computer systems within a single data processing facility, where feasible, and under a single manager.

--Provide for modular, add on growth to the replacement computer systems to support future workload growth.

Phase IV is intended to satisfy most base-level computer requirements, including MMICS. Contractors are now converting software, such as that supporting MMICS, to run on hardware proposed by the two vendors competing for the Phase IV contract. A vendor selection is scheduled for February 1983. All Phase IV computers should be installed and operational by July 1985.

Because of the Phase IV conversion process, Air Force commands, through preliminary discussions and plans, are proposing stand alone computers for AMS/GPS maintenance type processes. As noted earlier, the AMS system is run on computer hardware and related computer programs which are not compatible with equipment proposed by the potential Phase IV vendors. Until the Phase IV vendor is known, it will be difficult to begin either adding selected AMS processes to MMICS or reprogramming selected AMS/GPS processes to run on Phase IV compatible hardware. If, as many Air Force officials have indicated, AMS processes are to be included as standard base maintenance practices, current efforts in various commands should be delayed until the Phase IV vendor is known and compatible AMS processes can be developed. A discussion of some command plans for AMS processes follows. It may be desirable for the Air Force to redirect these efforts and funds to projects which would provide Phase IV compatible processes.

The MAC is in the process of expanding the AMS system to Altus and Travis AFBs. This is a natural progression since the C-5A aircraft on these bases use the GPS system rather than

these costs since the Air Force did not have any breakdown of computer resources needed to support AMS processes only.

ESTIMATED ANNUAL OPERATING COSTS OF AMS AT DOVER AFB

Tinker AFB	
Central processing unit and other hardware	$ 852,445
Disk storage	14,545
Personnel	473,131
Dover AFB	
Terminals	112,275
Communications lines	78,000
Total annual costs	$1,530,396

It is unlikely that all cost categories are reflected in this chart. We did not find any basis on which we could estimate total AMS project development costs, and the Air Force did not have any estimates of these costs.

The nature of the AMS Test Program should have dictated that system costs be identified and tracked. The Data Project Plan for AMS states that the project is limited to a level of effort necessary to validate the individual processes, to estimate the cost-effectiveness of the processes in the test environment, and to determine those actions necessary to ascertain the technical and economic feasibility of providing the capabilities worldwide. The plan also required that each program participant prepare a monthly personnel and travel cost report. This was not done.

The overall lack of management of AMS costs was indicated in most offices we visited. Each office advised us that others were responsible for data on certain resources. No single office controlled or was responsible for the total program. The costs of computer, communications, and programmer resources were paid for by AFLC. Local communications and terminal costs were paid by MAC. Along with the interdependence of AMS and GPS processes, this lack of data and costs will make it difficult for the Air Force to develop good estimates of AMS computer hardware and dollar costs for possible expansion of the processes.

The recent MAC plan to expand AMS processes to its C-141 aircraft highlights the problem of not making managers aware of the cost of their decisions. In September 1981, MAC Headquarters wrote to the Air Force Headquarters office in charge of maintenance and supply, requesting approval for the C-141 expansion effort. The letter stated:

hardware. If the proposed B-1B resources could be diverted to developing a Phase IV compatible system, substantial savings could eventually be realized.

Other AMS prototype efforts are also being considered. The Strategic Air Command requested a prototype to support B-52 aircraft at Ellsworth AFB, and the Air Training Command wants a T-37/38 prototype at Laughlin AFB. Both commands indicated an interest in obtaining stand alone hardware support. As an option, interim support at Tinker Data Services Center is also being considered. Estimated hardware costs at Tinker are about $500,000 a year. These prototypes, as now proposed, would not accomplish Phase IV compatibility.

In 1980 the Deputy Assistant Secretary for Logistics recommended developing standard AMS capabilities that would be compatible with Phase IV. An attachment to the memorandum noted that AMS concepts are not new or unique. Existing base-level hardware could not support AMS type teleprocessing requirements. By comparison, Phase IV could provide the teleprocessing capability needed for AMS. The proposed strategy called for early functional definition, design, development, and implementation of AMS processes on Phase IV hardware.

Some officials are now concerned that Phase IV compatible AMS processes could not be designed until all existing base-level computers are replaced (replacement should be completed by 1985). We were advised by an official of the Standard Systems Division that it may be feasible to begin design once a Phase IV vendor is selected. However, adequate resources would be needed. Tentative resource requirements for AMS systems which are not compatible with Phase IV, if redirected, could provide the funding needed to begin developing a Phase IV compatible system. Steps to modify MMICS or reprogram existing AMS/GPS processes could lead to an AMS type system available to all Air Force users once the Phase IV hardware conversion is complete in 1985.

THE AIR FORCE NEEDS TO COMPLETE ITS AMS EVALUATION AND PREPARE FOR THE FUTURE

The AMS test system at Dover AFB improves the completeness, accuracy, timeliness, and utility of maintenance information. As such, it can improve maintenance management and decision-making and therefore demonstrates a good application of technology. For the AMS test to be successful as a precursor of future systems, however, management must be improved.

We believe the Air Force must first identify realistic measures of the test system's costs and benefits for the first five increments which have been implemented. Future AMS increments should be measured by establishing good baseline data so that costs and benefits can be measured.

purposes, management needs cost information on specific operations. This involves aggregating costs by area of management responsibility and by work functions. A third objective is to know the costs incurred in processing data for each user application and in keeping software for that application up-to-date and operational.

Accounting for and reporting of costs at organizational levels which coincide with assignment of management responsibility is a fundamental step in making individuals conscious of and responsible for the costs incurred within their areas of control. All direct, indirect, and overhead costs should be accumulated at the lowest possible level.

While in its inception, the AMS project was not subject to the OMB requirement that data processing facilities comply with our guidelines. The nature of the project, however, would dictate that the Air Force measure project costs. The Air Force has not done this. Further, Air Force managers appear to minimize the costs of AMS expansion projects as was done for the C-141 effort. Future AMS actions will require substantial resources. The Air Force should fully identify the costs of the AMS test system to estimate the costs of further expansion efforts.

TIMELY ACTION IS NEEDED TO TAKE ADVANTAGE OF INTEREST IN AMS PROCESSES AND PREVENT UNNECESSARY EXPENDITURES

Automated maintenance concepts have existed in the Air Force for many years. MMICS, as originally tested, included two additional increments which had AMS type processes. However, these increments were not implemented. In 1969 the Air Force began studying the best way to automate base-level logistics needs. One study, entitled, "System to Automate Logistics at Base Level," included many functions which serve as a basis for the AMS test. Although the Dover test of AMS processes is not complete, MAC and other commands are interested in, and planning for, implementing the processes at other bases. Because of this interest, unless the Air Force acts to develop software to implement AMS processes on its standard base-level computers, unnecessary stand alone computers may be acquired for AMS processes.

The AMS test program was designed to validate the AMS processes in a test environment and estimate the economic feasibility of providing AMS capabilities worldwide. The plan stated that it did not provide for worldwide implementation, but would provide the preliminary analysis that may ultimately lead to data automation requirements for incorporating individual processes or groups of processes into the standard Air Force maintenance management system. The plan also stated that it is

CHAPTER 4

LONGSTANDING PROBLEMS AND NUMEROUS SYSTEM DEVELOPMENT EFFORTS SHOW WHY THE AIR FORCE MUST IMPROVE MANAGEMENT OF ITS MAINTENANCE INFORMATION RESOURCES

In chapters 2 and 3, we show the problems with MDC data accuracy, timeliness, and utility and one Air Force effort to correct these problems. In this chapter, we will show that MDC system problems have existed for many years and that other Air Force information systems have similar problems. We also show that the Air Force has system development projects which would attempt to compensate for, rather than correct, inaccurate and incomplete MDC data collection. One such project which will use MDC data is a DOD-directed system to help the Air Force and DOD better manage operating and support costs. The Air Force needs to take steps to improve its maintenance data collection efforts before developing systems to use this data.

In addition to explaining why the Air Force needs to better manage its AMS development, this chapter also explains why the Air Force needs to better manage and coordinate other system development efforts. One such system is quite similar to AMS, although it has fewer capabilities. Both system developments are proceeding concurrently with little coordination.

The problems discussed in this report can be corrected by improved management, coordination, and decisionmaking. However, a mechanism is needed to prevent the continuation of a structure which allowed the problems to develop. The information resources management concept promoted by the Paperwork Reduction Act of 1980 would provide such a mechanism.

Concerns and problems similar to those discussed in this report prompted the Congress to pass the Paperwork Reduction Act of 1980. The act fosters the concept of information resources management (IRM), focusing on centralizing and integrating the management of information-related activities. Information is critical to Air Force management and decisionmaking. It supports program management thoughout the Air Force. It is also vital in planning for other Air Force resources, such as staff and equipment. Thus, it is important that the Air Force manage this vital information resource. If the Paperwork Reduction Act is properly implemented, the management framework created could address many of the information-related problems which now prevail in the Air Force.

MMICS. C-141 aircraft are also stationed at those bases, and MAC plans to include those aircraft in the AMS/GPS to eliminate the need for duplicate maintenance management systems. As noted earlier, we identified C-141 expansion costs of $540,000 annually.

While these expansions of AMS processes are, in our opinion, logical progressions, MAC also has long-range plans to implement AMS/GPS processes at four other C-141 bases and eventually at three C-130 bases. The time frame for these expansions could coincide with a Phase IV compatible AMS if work is begun soon after the Phase IV vendor is selected.

A MAC-projected automation requirement also proposes to replace the base-level computer which supports the GPS system at Altus, Dover, and Travis AFBs. The estimated cost of the equipment is $2.5 million. The MAC proposal is much more than a replacement of this small computer; it is a substantial upgrade of the onbase computer capabilities.

Currently the GPS base-level computers serve as remote terminals for the MADARS/GPS/AMS system, transmitting and receiving data from the central data bank at the Tinker Data Services Center. The MAC plan is to replace the computers with a system having enhanced teleprocessing and stand alone processing capabilities. The proposed system would allow base-level processing of an estimated 115 AMS/GPS computer programs. The timing of the planned replacement generally coincides with plans for the Phase IV replacement at MAC bases. Therefore, in lieu of obtaining stand alone computers, Phase IV compatible systems should be considered, and, if technically feasible, serve as a Phase IV compatible AMS test.

The Deputy Chief of Staff for Logistics and Engineering stated that an AMS derivative is being encouraged for new weapon systems. One such system which includes tentative AMS/GPS plans is the B-1B bomber. In February 1982, a working group convened to develop a plan for designing and implementing a GPS for the B-1B. The results of a fact finding program and the working group prompted a conclusion that the most practical approach for satisfying the B-1B requirement would be adapting the current MAC system. The B-1B logistics liaison recommended that the Aeronautical Systems Division assign an office of primary responsibility to acquire the GPS. The Systems Division is also responsible for weapon systems procurement.

The proposed configuration for the B-1B system calls for a separate computer to serve as the central data bank and support equipment at operating bases. The tentative cost estimate for one base is $2.3 million. Software rental would cost more than $180,000 annually. In addition, an estimated staff of 38 could be required. Eventually, at two of the planned B-1B bases, deployment of additional aircraft would require a doubling of

man-hour data. However, the effect of any overstatement can be easily shown. For example:

--If the C-141 man-hour per flight hour factor is overstated 5 percent, manpower would be overstated by 348 authorizations which cost about $3 million annually.

--If the factor is overstated 20 percent, 1,393 authorizations costing about $13 million annually would not be needed.

"Some factors used in the C-5A equations were also derived from questionable man-hour data. As a result, the C-5A manpower requirements may also be overstated.

"2/ The ratio of maintenance hours used to support actual flight hours."

During this audit we found that, if staff-hour per flight hour data from the MDC system had been used, staffing requirements for the C-5A would have been overstated. Information obtained from the Air Force Headquarters Manpower and Organization Directorate showed that, by using MDC data, 100 maintenance staff-hours per flying hour would be needed to support the C-5A. However, a sophisticated staffing model was used instead of the historical MDC data. The model developed a maintenance staff-hour per flight hour of 40.5 hours to maintain the C-5A (60 percent less than the estimate which was based on MDC data). The 40.5 hour figure was used to develop the fiscal year 1984 Air Force budget for C-5A maintenance.

Some of our other reports have also cited problems in Air Force information systems. Some examples follow.

--In 1981 (PLRD-82-12, November 30, 1981), we found that the data produced by information systems used to make computations of supply requirements needed extensive manual adjustments before it could be used. At one Air Logistics Center, we found that 30 of 65 sample items we reviewed resulted in overstated requirements of $2.5 million and understatements of $260,000. These problems also resulted in $1.3 million in unnecessary procurement actions.

--A 1980 report (LCD-80-30, February 7, 1980) on ground support equipment discussed problems the Air Force found with its data retrieval systems. The systems were not used extensively because of incorrect, outdated, and incomplete information and because they were difficult to use. The report also said decisions which are supposed to be based on the data systems are difficult if not impossible to make.

Because of the success of the AMS processes at Dover AFB, there are several command initiatives to apply them to other aircraft and at other locations. With good measures of the test system costs and benefits, such applications could be better evaluated by senior-level officials. However, we believe that Air Force resources can be better spent on developing AMS type processes which can be applied at all Air Force bases using the Phase IV computer. Therefore, the Air Force should redirect its resources to a project which would develop a Phase IV compatible system.

History of operating and support cost management

The decision to purchase a new weapon system commits the Air Force and DOD to operate and support the system over its lifetime. These operating and support costs have, in some cases, reached a level in recent years that exceeds the original purchase price of the aircraft.

In October 1975, a DOD memorandum to all military departments described the need to identify operating and support costs by weapon system. This memorandum included Management by Objective 9-2 which provided guidance to achieve support cost visibility and described the characteristics of a management information system that is required to give DOD a long-term historical operating and support cost perspective. In addition, DOD issued Directives 5000.28, "Design to Cost," and 5000.39, "Acquisition and Management of Integrated Logistics Support for Systems and Equipment." Both directives indicated a need to consider operating and support costs during the weapon system development process.

In response to the requirements of the Management by Objective 9-2 and its predecessor, Management by Objective 12-3, various related Air Force efforts were established to increase the visibility and management of operating and support costs. Among these efforts was the development of the Operating and Support Cost Estimating Reference System to display operating and support costs to the Aircraft Mission, Design Series [3] level.

This system provided costs in accordance with a cost element structure promulgated by the OSD Cost Analysis Improvement Group. Because this was the first system developed by the Air Force to meet the DOD management initiatives, it was unofficially designated the Visibility and Management of Operating and Support Costs System (VAMOSC I).

In addition to the Operating and Support Cost Estimating Reference System, the Air Force developed a system to display maintenance costs to the Type Model Series (a designator similar to mission design series of aircraft) for ground communication, electronic, and meteorological equipment.

A third system developed in response to Management by Objective 9-2 was the Component Support Cost System. This system was actually an enhancement to an existing system which identified aircraft components that accounted for a high degree of logistics support costs.

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[3] Mission, Design Series - For example, for a B-52D aircraft, the mission is bomber or "B", the design is "52" and the series is "D".

INFORMATION MANAGEMENT PROBLEMS ARE LONGSTANDING AND WIDESPREAD

As discussed in chapter 2, problems in maintenance data collection, accuracy, and utility have existed for many years. In earlier reports, we have identified these weaknesses. Problems with MDC system accuracy also adversely affect other data systems. More importantly, the inaccurate data can affect Air Force management decisions, such as determining maintenance staffing requirements. Our reports have also identified accuracy problems with other Air Force information systems. These problems also affect decisionmaking and resource determinations.

In 1975 we reported [1] that MDC data was inaccurate, unreliable, and did not facilitate in controlling productivity. At McClellan AFB, California, one activity reported that mechanics and supervisors did productive maintenance tasks 119 percent of the time during the 6 months ended March 1974. Although one official said this was because overtime was not included in available hours, others said reported maintenance hours were inflated. We determined that, if overtime were the only factor, for a 1-month period every mechanic would have had to work at least 9.2 hours each day of the month, including weekends; one holiday; plus whatever time was required for lunch, coffeebreaks, leave, training, and other nonproductive activities. We stated that this was unlikely and recommended establishing controls over reported data.

In 1977 we reported in another productivity study [2] on inaccurate MDC data. We pointed out that several factors in the MAC's staffing equations were based on inaccurate and overstated labor hours in the MDC system. We judged that the impact of this problem could be substantial, as the following excerpt from our report indicated.

> "The man-hour per flight hour factor 2/ used in the C-141 manpower equation was derived from the reported man-hour data. After consolidating the reported labor hour data, Air Force officials review and evaluate it. They make adjustments to eliminate obvious errors, but agree that all errors could not be eliminated. * * * we did not.determine the extent of overstatement in either the adjusted or raw

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[1] "Productivity of Military Below-Depot Maintenance--Repairs Less Complex than Provided at Depots--Can Be Improved" (LCD-75-422, July 29, 1975).

[2] "Determining Requirements for Aircraft Maintenance Personnel Could be Improved--Peacetime and Wartime" (LCD-77-421, May 20, 1977).

estimating reference system output could become more and more inaccurate. According to an Air Force report, the lack of provisions for tracking source system changes could affect comparability of output from one year to the next.

We discussed the estimating reference system with one of the primary report recipients in OSD and found that the reports were not used because the recipient believed the output distorted aircraft maintenance costs. One OSD official said the system was of no use and never could be unless the input data could be improved. In the fall of 1981 the estimating reference system reports were terminated. The system's weaknesses eliminated it from consideration as a part of the Air Force VAMOSC II project.

Inaccurate input data and limited OSD involvement during development may affect the utility of VAMOSC II

Although one key factor which impaired the utility of the Operating and Support Cost Estimating Reference System was inaccurate MDC data, the Air Force has spent more than 5 years developing VAMOSC II, a system which will rely on data from the MDC system and other inaccurate source data systems. In addition, although OSD initiatives prompted the VAMOSC II effort, OSD representatives did not participate in VAMOSC II reviews designed to ensure that the system will meet users' needs. While there were informal OSD contacts with VAMOSC II officials, OSD did not establish a formal steering committee to oversee the military services' efforts until December 1981, 6 years after Management by Objective 9-2 prompted the services' development efforts. We found that OSD and Air Force officials disagree as to who the ultimate users of VAMOSC II reports will be. These problems in the VAMOSC II effort indicate the information management weaknesses within the Air Force. In addition, the problems indicate that OSD has not really determined its information requirements for managing operating and support costs.

The VAMOSC II system, subsystems, and feeder systems are shown on the chart on the next page. We examined the inputs to each subsystem of VAMOSC II and attempted to identify those systems receiving MDC data. Once we identified the systems, we then determined what efforts, if any, were made by the management officials to evaluate the accuracy of the information provided by these systems, and what adverse impact any inaccuracies would have on VAMOSC II reports. We found no efforts to correct inaccurate data received from the feeder systems.

The first VAMOSC II subsystem--Weapons System Support Cost--has a total of six feeder systems, one of which is AFLC's Product Performance System (DO56) which provides MDC data. According to documents we reviewed and a discussion we held with

--A 1977 report (LCD-78-403, November 23, 1977) on Air Force Air Logistics Centers pointed out that personnel involved with the cost reporting system said the data was meaningless because of inaccurate data input, among other problems.

--A 1977 report (LCD-77-202, June 7, 1977) stated that the Air Force did not have basic information to make repair versus replace decisions. One system which had been used was terminated because it was ineffective.

--In a 1977 report (LCD-77-429, October 17, 1977) we noted that the Air Force advised us that, because of reporting system errors, the F-15's reliability was understated.

These reports; our findings regarding the present status of the accuracy, completeness, and timeliness of MDC data; and the problems in managing operating and support costs and developing the F-16 Central Data System (discussed in the following sections) all are indicative of the significant, long-term nature of weaknesses in Air Force information management practices.

AIR FORCE INFORMATION SYSTEMS DO NOT PROMOTE MANAGEMENT OF OPERATING AND SUPPORT COSTS

In fiscal years 1974 and 1975 DOD issued management by objective statements covering the management of operating and support costs of aircraft and other equipment. In response to the DOD initiatives, the Air Force has developed information systems to measure operating and support costs. A key element of such costs is maintenance staffing. The MDC system is a source relied on to identify the maintenance staffing used to support aircraft and other equipment. As a result, cost allocation systems are designed to use MDC input. However, inaccurate MDC data input adversely affected the utility of one now terminated operating and support cost system and may affect a replacement system. In addition, because of limited OSD involvement in the replacement system development, its information needs may not be satisfied.

Furthermore, the new Air Force operating and support cost system (VAMOSC II, which we will discuss in detail in this chapter) is designed to replace a system which measures aircraft maintenance staff productivity. Managing the productivity of mechanics is one method which can be used to manage the associated costs. However, the operating and support cost system will not contain all the elements of information needed for productivity management.

We believe the involvement of users at all levels is needed to develop an adequate operating and support cost system. For the Air Force systems to succeed, plans must be made to improve the accuracy of the information systems upon which the cost measurements are based.

the Weapons System Support Cost System project manager, no studies or evaluations were made of the accuracy of the feeder systems. The efforts that dealt with accuracy concentrated on the accuracy of the algorithms used to allocate costs to various weapon systems. Feeder system accuracy was addressed only by a review of prior audit reports on the feeder systems.

We asked the manager of the Weapons System Support Cost System to rank the six feeder systems in the order of impact they would have on the subsystem reports if they were inaccurate. The ranking indicated that the Product Performance System (DO56), which would provide inaccurate MDC data, is third in order of its potential impact on the accuracy of the Weapons System Support Cost System reports. Additional Air Force plans for assessing the accuracy of Weapons System Support Cost reports include testing for the "reasonableness" of the information by comparing it with other related information.

The second VAMOSC II subsystem is the Communications-Electronics System which has 11 feeder systems. The initiatives to identify accuracy problems in this subsystem focused on methods to test feeder system accuracy. We asked the subsystem officials to rank the potential impact inaccurate feeder system data could have on the accuracy of Communications-Electronics reports. The AFLC Product Performance System (DO56), which provides MDC data, was ranked second in terms of the potential adverse impact inaccurate input data would have on report accuracy. The first feeder system, in terms of the potential impact of inaccurate data, was the Equipment Item Requirements Computation System File (DO39). In 1980 the Air Force Audit Agency criticized the accuracy of input to DO39. Because of this, VAMOSC II program officials sent extracts of DO39 data to three Air Logistics Centers for evaluation. The centers' responses indicated that 34 percent of the data was in error. Analysis of information in the Communications-Electronics System users manual indicates that this DO39 data will be used in 10 of 25 cost categories reported by the system.

The third VAMOSC II subsystem is the Component Support Cost System. The concept of the Component Support Cost System was criticized because of data inaccuracy. The Director of Logistics Systems at the Data Systems Design Center said that the system was similar to the existing Maintenance Cost System and that MCS has drawn criticism because it lacks accurate and reliable source data. As a result, an MCS for missiles was delayed and the MCS for communications and electronics equipment was cancelled. For these and other reasons, the Director stated that the Design Center did not believe the proposed system was feasible from either a systems design or functional suitability point of view. Notwithstanding this criticism, the VAMOSC II system has been designed to use this inaccurate maintenance data.

On May 4, 1979, the Air Force issued a Data Project Directive with the objective of consolidating the Operating and Support Cost Estimating Reference System, the Communications-Electronics-Meteorological Cost System, and the Component Support Cost System. The responsibility for accomplishing this task was assigned to AFLC. The effort to consolidate these systems was designated VAMOSC II. The cost to develop and operate the consolidated system through fiscal year 1989 is over $6.6 million, according to Air Force estimates.

The Operating and Support Cost Estimating Reference System did not satisfy user needs

Over the years, the Air Force has built many systems which rely, at least in part, on data from the inaccurate MDC system. The Operating and Support Cost Estimating Reference was one such system. According to Air Force officials, the system was originally designed to "pull together" costs and prove that it could be done without a massive system development effort. The system responded to the 1974 Management by Objective 12-3 which was superseded by the 1975 Management by Objective 9-2. The system satisfied one of the requirements of Management by Objective 9-2. In addition to inaccurate source data, two other factors prompted the eventual replacement of the estimating reference system. First, untested algorithms were used to allocate and estimate operating and support costs. Second, the changes in source data systems which could affect input to the estimating reference system were not tracked and reflected in the reference system itself. In total, the weaknesses in the reference system project are an example of why better management of Air Force information resources is needed.

The Operating and Support Cost Estimating Reference System made extensive use of 14 Air Force data collection systems. In order to estimate costs by weapon system, the reference system used more than 100 allocation algorithms. Several of these allocate aggregate costs to weapon systems partially on the basis of the ratio of direct labor hours expended in support of each weapon system. The source for this labor hour data was the MDC system. An Air Force official advised us that the Air Force never determined the validity of the allocation algorithms. Even if it had, the reference system reports would have been flawed by inaccurate data from source data systems. Chapter 2 of this report clearly demonstrates that the MDC system would supply inaccurate and incomplete input data.

In addition, to remain up-to-date, the estimating reference system would have to be modified to reflect source system changes. For example, if there was a change in 1 of the 14 source system's calculations which affected the output, such as a change from weekly to biweekly reporting, the allocation algorithms in the estimating reference system should also have been changed. However, the system operation contained no provisions to do this. As a result, as time passed, the

accounting system we do not believe this to be a significant problem."

A Design Problem Report submitted by an Air Force Systems Command organization stated:

> "The primary source of information for component related costs is the DO56 Maintenance Data Collection System. Since DO56 data is widely perceived as inaccurate and untimely, the resulting CSCS [Component Suport Cost System] system may have limited value and usefulness."

In the disposition of the Air Force Systems Command Design Problem Report, VAMOSC II documents showed:

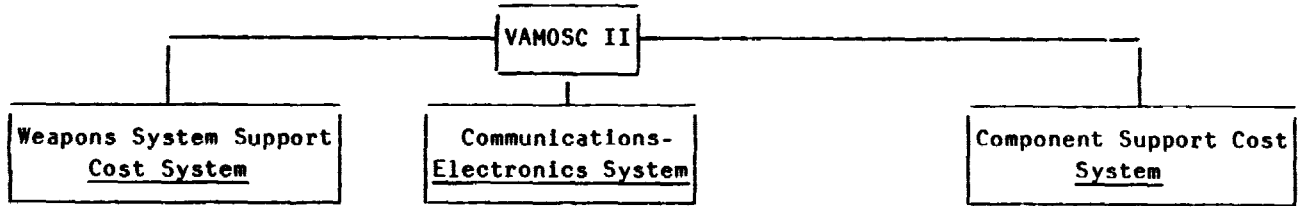
> "The DO56 inherent accuracy problems are acknowledged. It is the 'best show in town.' Until it can be corrected by appropriate authority-(i.e., AF/LEYM) [Air Force Headquarters Maintenance Policy Division] it will be used with the constraints defined where possible."

According to the manager of the Component Support Cost System, the three DO56 subsystems which input into the system have the greatest impact on accuracy of Component Support Cost reports. Thus, of the 17 feeder systems, the 3 DO56 subsystems would be most important to the Component Support Cost System's accuracy.

Our discussions with potential VAMOSC II users produced mixed reactions about the effect the inaccurate data would have on the system's utility. One user believes that, once the system is completed, it will provide an incentive to initiate actions to correct problems in feeder system accuracy. Others stated that the MDC input is the "shaky limb" in the entire VAMOSC II effort. One OSD official believes that "data credibility" is the biggest problem and that VAMOSC II reports will not be used unless this issue is resolved. Although feeder system data is inaccurate, some officials believe that VAMOSC II outputs will allow the identification of trends. One official said he would not want to do any trending because of the low percentage of MDC input. Another official said that the same data problems which caused the demise of the Operating and Support Cost Estimating Reference System are also a weak link in VAMOSC II.

Another factor which may limit the utility of VAMOSC II reports to OSD users is the lack of OSD's involvement in VAMOSC II's development. Although OSD guidance was responsible for the initiation of the VAMOSC II effort, OSD did not participate in critical elements of the development effort. No OSD representatives were sent to any of the system requirements or design reviews, although they were invited to attend. The purpose

VAMOSC II System Description



Subsystems	Weapons System Support Cost System	Communications-Electronics System	Component Support Cost System
Feeder systems, files and reports	H036C-VAMOSC-AF (depot level) H069R-Accounting and budget distribution system G033B-Aerospace vehicle inventory status/ utilization report D022A-Central fuels management system D056-Product performance system E300Z-Advanced personnel data system	D056A-Product performance system D039-Equipment item requirements system D041-Recoverable consumption item requirements H036B-Depot maintenance industrial fund accounting/production report 0013-Packaging and transportation data maintenance H069R-Accounting and budget distribution system F006-Command civil engineer and military housing costs C003K-Engineering/installation management system E300Z-Advanced personnel data system D160-Weapons system support cost system G033E-C-E status and inventory reporting system	D002A-Standard base supply system D024A-Propulsion unit data collection status reporting D033-AFLC retail stock control and distribution D056A-Product performance system (edit and error analysis) D056B-Product performance system (on equipment analysis) D056C-Product performance system (off equipment analysis) D071-Stock number user directory D143B/F-History accumulation subsystem	G072D-Contractual depot maintenance production and cost system G004L-Job order production master system H036B-DMIF cost accounting production report 0013-Packaging and transportation data maintenance H069R-Accounting and budget distribution system G033B-Aerospace vehicle inventory status/ utilization D220-AFLC provisioning system D046-Base account screening exercise G019F-MISTR contract schedule and repair

At the base level, the intended use of maintenance production data is to provide information feedback to managers and supervisors for controlling the maintenance operation. The MCS provides information on the following categories of costs:

--the cost of civilian and military staff-hours,

--the cost of productive direct and indirect hours, and

--the cost to maintain aircraft and engines.

During our visits to Dover and Travis AFBs, we found that MCS reports were either not received or not used by maintenance managers. We also identified efforts to terminate the MCS notwithstanding our recommendation that all staff hours be tracked as a basis for productivity improvement efforts. [5] Although VAMOSC II will satisfy some MCS type requirements, questions as to the need for added information before terminating MCS still exist.

The MCS was developed to satisfy an OSD requirement to furnish the cost, in terms of dollars, of all resources in performing maintenance on Air Force equipment. The MCS accumulates selected data elements from existing data collection systems and major air commands, quantifies these data in terms of cost, and provides reports on maintenance cost to each level of management. Data sources include:

--the MDC system,

--the Exception Time Accounting System,

--the Standard Base Supply System,

--the Base Level General Accounting and Finance System,

--the Civilian Payroll System,

--the Aerospace Vehicle Status Reporting System, and

--Major Air Commands.

The base-level Accounting and Finance Office combines the above data and produces monthly cost reports. The MCS reports provide the chief of maintenance and his staff with cost data for analysis, isolation, and control of the cost of resources consumed in the maintenance operation. The reports are expense oriented, meaning that they cover the use and consumption of resources, rather than the assignment of resources or obligation of funds. Monthly MCS reports are also electronically transmitted to the major commands.

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[5] See footnote 4 on previous page.

The Component Support Cost System has a total of 17 feeder systems, including AFLC's DO56 system which provides MDC data. The Component Support Cost System project officer sent eight major commands support general staff-hour data from DO56 for their review and verification. Four of the eight commands responded that the data was inaccurate. One response from Headquarters, Air Force Systems Command, stated the following:

> "The support general totals reported to you are not completely accurate. Hickam's total assigned labor manhours for October 81 was 28,668 with 19,974 direct labor produced. The total support general listed on your Atch 2 for Hickam is 34,783 or 26,089 more hours than were available for non-direct labor."

This response shows that the time available for nondirect labor, such as support general, was 8,694 hours (28,668 total hours less 19,974 direct hours). The 34,783 reported support general hours exceeded the 8,694 available hours for such work by 26,089 hours.

In addition to this survey by the Component Support Cost System project officer, the accuracy of DO56 information was specifically addressed by Air Force personnel during the development of VAMOSC II in the form of Design Problem Reports. These reports are used to officially comment on new information systems and to identify problems with their design.

The Military Airlift Command stated the following in its Design Problem Report.

> "Many items of information come from existing systems (i.e., maintenance data collection (MDC), Maintenance Cost System (MCS), and Maintenance Management Information and Control System (MMICS) which provide data of unspecified reliability; despite this, we are building an expensive system on top. The master plan schedule revised 1 Dec 78 stated one objective was to identify and validate information provided by source systems, i.e., operating and support cost estimating reference (OSCER), communications-electronics-meteorological (CEM) cost system, and MCS. The documentation does not indicate this was accomplished."

In response to this Design Problem Report, the VAMOSC II documents showed the following:

> "We are currently in process of verifying and validating the algorithms associated with VAMOSC II. We recognize that some of the data systems are not 100% accurate. Where possible, the limitations of the input data systems will be explained. However, since VAMOSC II is designed as a cost estimating system not a cost

MAC Headquarters used staff-hour data derived from the Command Aerospace Maintenance Manpower Information System.

A 1979 analysis of MCS at MAC Headquarters pointed out numerous weaknesses in MCS.

--Base-level MCS monitors indicated that MCS reports are of little or no value and should be eliminated.

--The accuracy of staff-hour data in the MCS reports is questionable--over 1.5 million staff-hours of adjustments to the April through June 1979 data were required.

--The financial data in MCS reports is not compatible with programming and budgeting requirements. Therefore, the reports are useless to financial managers.

A 1976 Air Force Audit Agency report also noted MCS problems. The report stated that the development of functional requirements and the system design for MCS were not based on established Air Force maintenance management needs.

Attempts were made to eliminate MCS in 1977. This effort was based in part on the results of a 1977 user survey showing limited MCS uses. These limited uses did not justify the cost of the system. The Air Force Secretariat, however, did not approve the request to eliminate MCS.

The current justification for eliminating MCS is that VAMOSC II would satisfy most MCS requirements as well as eliminate its high cost--an estimated $1.4 million per year. However, we found that the Air Force Accounting and Finance Center used data obtained from the system to develop labor costs which will be used in VAMOSC II calculations. According to a VAMOSC II draft users manual, these labor rates will be adjusted annually using inflation indices prepared by OSD. Therefore, data derived from the often criticized MCS will provide a baseline for VAMOSC II. Further, officials from the Air Force Comptroller's Office said that VAMOSC II data will be used to develop cost factors. Again, the source for much of this data is the MDC system.

The MCS provides both base-level and command-level reports. As currently planned, VAMOSC II will not report data in the format of direct, indirect, and overhead costs. The last two categories will be merged into an "other" category. This would reduce the visibility of maintenance costs not used in direct support of aircraft maintenance--the "indirect" category. An analysis of VAMOSC II notes that this breakout could be provided but that users have not expressed interest in this data. Since the indirect labor figure indicates unused available labor, it is a key in measuring productivity. The lack of MCS use and continuing MDC inaccuracy leads us to

of the system requirements review was to identify the information requirements of the VAMOSC II system users.

In December 1981, a triservice steering committee to oversee the VAMOSC development efforts of all three military services was established by OSD. The memorandum establishing the committee stated:

> "We believe the time has come to reexamine the directions being taken by the various VAMOSC systems. It is important that the Services continue to refine and improve these systems and that, to the extent possible, comparable data be produced by all Service systems."

This committee was established 2-1/2 years after the Air Force VAMOSC II effort began and 6 years after OSD issued its Management by Objective guidance.

Our discussions with Air Force and OSD officials provided conflicting views as to the purpose of the VAMOSC II system. Air Force officials stated that, although they may use VAMOSC II products, the system is primarily designed for OSD purposes. An OSD official presented just the opposite view. He believes the major users of VAMOSC II will be in the Air Force.

The VAMOSC II development effort was completed in June 1982. Since OSD did not participate in its design, VAMOSC II products may not satisfy OSD needs. More importantly, however, the accuracy of the feeder systems may be the deciding factor in how well VAMOSC II reports satisfy users' needs.

The need for productivity measurement, a key indicator in support cost management, may not be satisfied by VAMOSC II

We have issued several reports indicating the need for the measurement of maintenance staff productivity. Improving productivity is a way to control staffing costs. In response to our 1975 report, [4] DOD endorsed the Air Force's effort to develop a base-level maintenance cost system from which staff productivity may be determined. Although MCS was originally designed as a part of VAMOSC, there are now attempts to replace the MCS with VAMOSC II. However, as presently designed, VAMOSC II will not present information on maintenance staffing in the format needed to manage productivity. Further, the Air Force has not corrected another basic deficiency noted in our earlier report--inaccurate MDC data.

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[4] "Productivity of Military Below-Depot Maintenance--Repairs Less Complex Than Provided at Depots--Can Be Improved" (LCD-75-422, July 29, 1975).

The F-16 System Program Office initially managed the F-16 weapon system configuration, reliability, and maintainability programs by manually compiling logs from a variety of computerized and noncomputerized daily, weekly, and monthly data sources. In August 1979, the Office contracted to develop an automated system to provide the critical data on a real time basis through a remote access capability. Since the initial contract was approved, an expanded and more capable system has evolved. This system is referred to as the F-16 Central Data System.

According to F-16 System Program Office officials, the authority for initiating development of the F-16 Central Data System stems from a Program Management Directive which stated that the F-16 System Program Office should

> "Develop in conjunction with AFLC, TAC [Tactical Air Command] and AFTEC [Air Force Test and Evaluation Center] an operational reliability prediction/tracking plan that will be implemented during early stages of operational experience. This plan will be designed to provide a focused investigation of initial F-16 O&M [operational and maintenance] performance, identify deficiencies, and initiate any required corrective actions in design, technical data, manning, support equipment, software, training, etc. Additionally this plan will be a management tool to track Reliability and Maintainability (R&M) performance."

The System Program Office's interpretation of this directive was that it provided authority for an automated data system to support the reliability and maintainability program.

In November 1979, the F-16 System Program Office negotiated a sole source, fixed price basic ordering agreement. Since the contract was negotiated, the F-16 System Program Office has placed eight major orders against the contract for a total cost of about $13.7 million. This cost has been used to develop and support four basic functions or subsystems: (1) a Reliability and Maintainability subsystem for aircraft; (2) a Reliability and Maintainability subsystem for F-16 Avionics Intermediate Shops; (3) a Configuration Accounting/Status subsystem; and (4) an Automated Briefing and Data Analysis subsystem. As well as expanding the functional capabilities of the F-16 Central Data System, a more recent order also involves expanding the F-16 data system to include overseas installations.

The Reliability and Maintainability subsystems provide a capability to track and plot statistics and trends for the F-16 aircraft. In addition, the Avionics Intermediate Shops are able to input some data into the system using computer terminals located in the shops. Currently, the Reliability and Maintainability subsystem for aircraft collects and stores data for

According to Air Force regulations, MCS is designed to enable maintenance managers to identify and concentrate management attention on high cost areas. The system also allows major commands and Air Force Headquarters to evaluate the dollar impact of their decisions.

In our 1975 report we stated that the key to productivity improvements is an effective information system which gives management the information needed to identify and correct problem areas. A decrease in staff-hours used for each unit of desired output is an accepted indicator of productivity improvement. An information system must have controls over data accuracy and must track both productive and nonproductive staff-hours.

At the time of our 1975 report, the MDC system was the primary source of productivity information. We noted several weaknesses in the system. The system tracked only staff-hours actually charged to maintenance. Therefore, managers did not know how 50 percent of available staff-hours were used. MDC data was inaccurate and was used to plan and schedule work rather than to control productivity.

In response to our report, DOD endorsed the Air Force's development and test of a base-level accounting system which would identify both direct and indirect staff-hours and relate costs to weapon systems and subsystems. This system is now known as MCS. We agreed that the Air Force system could help improve base-level maintenance by making productivity more visible to Air Force management. We stated that accurate information on how mechanics spend their time and effective use of labor standards would provide the tools for evaluating and improving productivity. As indicated in chapter 2, MDC data accuracy has not yet been substantially improved.

At the base level, MCS produces reports on maintenance costs by type of aircraft maintained. Staffing costs are broken out into direct, indirect, and overhead categories. Both labor hours and associated labor costs are shown. Data, such as maintenance staffing reports, are produced at the command level by the Command Aerospace Maintenance Manpower Information System. The input data to this system is obtained from the base-level MCS.

At the three MAC bases we visited, we found that maintenance managers did not use the MCS reports. At Travis AFB, MAC maintenance managers did not even receive the reports. The Budget Office of the Strategic Air Command contingent at Travis used the MCS report only to prepare a report to its command headquarters. This report to command headquarters was eliminated as of October 1981. At Dover AFB, MAC maintenance officials received summary information from the MCS but said that it was not very useful for their purposes.

10 percent of identified maintenance actions, and line mechanics did not input about 50 percent of the required data. The previously mentioned Air Force audit report also found MDC problems affecting the F-16 data. The following excerpt illustrates this point.

> "The actual performance for 94 WUCs [Work Unit Codes] randomly sampled was misstated because over 26 percent of the maintenance actions were not reported in the MDC system (maintenance actions of 59 of the 94 WUCs were understated between 9 and 163 percent). AFTO [Air Force Technical Order] Forms 349 were either not properly filled out by maintenance technicians or were not key punched into the MDC system. However, had adequate edit routines been established to identify (1) off-equipment maintenance actions without a corresponding reported on-equipment action, (2) reported replacement actions without a reported removal action, and (3) reported troubleshooting actions without a reported repair or with no defect action, these problems could have been identified. For example, these edit routines would have disclosed an additional 422 maintenance actions not previously reported on the 94 randomly selected WUCs reviewed. (These 422 unreported maintenance actions represented 26.8% of the total maintenance actions for the 94 WUCs). To illustrate the impact this has on F-16 R&M [Reliability and Maintainability] reporting, when the rate (26.8%) of unreported maintenance actions on sampled components is applied to all F-16 components (a) the F-16 mean time between maintenance action reported for January 1980 of 1.43 hours would be reduced to 1.05 hours, significantly less than the 1.62 mean time between maintenance action predicted for January 1980, and (b) maintenance manhours per flying hour for January 1980 of 36.9 hours could increase to 50.4 hours, significantly more than the predicted 27 maintenance manhours per flying hour."

As this quotation indicates, the inaccurate and incomplete MDC data has a substantial impact on the accuracy of F-16 reliability and maintainability information.

The capabilities of the F-16 Central Data System are similar to AMS processes. However, AMS provides much more extensive capability, including the input of accurate MDC data. The following chart compares the two systems.

reaffirm our 1975 concerns over efforts to measure and manage productivity.

An OSD official advised us that lack of MCS use really reflects a lack of concern over managing operating and support costs. This official said that there is a need to raise the cost consciousness of base-level managers. While base-level managers are concerned over supply costs for which they are charged, maintenance personnel costs, which are more than the supply costs, are considered to be a "given" according to one OSD official. An Air Force official stated that the low level of productivity indicated by MCS is the real reason for efforts to abandon the system. Although this may be true, the inaccuracy of MDC data would lead to questionable analyses of productivity if the analyses are based solely on MCS data. However, information from VAMOSC II is also likely to be inaccurate and unusable by decisionmakers until MDC and other feeder systems are improved.

THE F-16 CENTRAL DATA SYSTEM IS ADVERSELY AFFECTED BY INACCURATE DATA, IS COSTLY, AND WAS NOT FULLY COORDINATED

Timely, accurate, complete, and consistent maintenance information is important during the production and deployment phase of a new aircraft to determine the impact of changes in configuration and mission requirements on aircraft reliability and maintainability. During this phase, tests and analyses begin on production aircraft to determine if established reliability and maintainability goals, standards, and thresholds will be realized. Because of untimely and inaccurate maintenance data in standard Air Force systems, the Air Force developed a data collection and processing system to support the F-16 aircraft during its early operational period. The system is costly, is not run on standard Air Force computers, uses inaccurate MDC data, and its capabilities are similar to, although less extensive and sophisticated than, AMS. However, the system does provide managers with better information than standard Air Force data systems. As a result, managers have better information on which to base multimillion dollar aircraft acquisition decisions. The need to develop the F-16 data system is another example of why the Air Force needs to better manage its information resources.

The Air Force Systems Command, through its System Program Office at Wright-Patterson AFB, is responsible for procurement of the F-16 aircraft. In a 1980 report, the Air Force Audit Agency reported that various reliability and maintainability data systems did not provide consistent, accurate, and complete data. The report said that the primary input to these systems is data from the MDC system. The audit report also stated that standard Air Force systems were not timely, sufficiently flexible for required inquiries, or reliable during the first production and deployment year.

THE AIR FORCE SHOULD FULLY IMPLEMENT THE INFORMATION RESOURCES MANAGEMENT CONCEPT

The issues discussed in this report demonstrate the need for the Air Force to improve the management of its information resources. Air Force managers do not receive timely, accurate, and complete maintenance information to support the decision-making process. Air Force information systems development efforts suffer from many management weaknesses. These are the kinds of problems the information resources management concept, as embodied in the Paperwork Reduction Act of 1980, is designed to correct.

The Air Force has started to implement the Paperwork Reduction Act; however, progress has been slow. Much needs to be done if the Air Force is to correct the weaknesses we have identified. We believe that a properly placed and organized IRM program should be able to identify information-related problems similar to those we discuss and should bring about corrective actions. This can be done by using information systems reviews required by the Paperwork Act to identify problems and by ensuring that the proper skills are applied to systems development efforts as called for in the IRM concept. In addition, visibility of information problems by the senior information management official may ensure that timely decisions are made. Such decisions would include placing priorities on and coordinating information systems development efforts.

The Congress has had a continuing interest in the management of information and associated information policy, especially Federal information and ADP management. The collection, use, and dissemination of information; acquisition of ADP and other information technology; and development of information-related standards have been of particular concern to the Congress. The Congress also has encouraged more effective policies to limit information disclosures, preserve personal privacy, reduce paperwork burden, and improve information management in Federal programs.

These congressional concerns about how the Federal departments and agencies manage their information resources culminated in the passage of the Paperwork Reduction Act of 1980. The act requires uniform and consistent information policies and practices and strengthens and centralizes certain Federal information management activities. Both the act and the IRM concept focus on centralizing and integrating the management of information-related activities.

IRM is a relatively new and evolving concept. As such, there is no universally accepted definition. Consequently, we have developed a working definition and refinements of certain aspects of the concept. To us, IRM basically means managing information so that agency personnel (particularly managers and other decisionmakers) are provided needed information at the

about 700 work unit codes, 28 major aircraft systems, the overall aircraft, and several other reliability and maintainability categories.

The Configuration Accounting/Status subsystem provides a capability to track and report the current configuration by aircraft number and model for all deployed F-16 aircraft. Data is accumulated and stored in the subsystem for about 50 aircraft components. The data that is tracked and reported against these items includes:

--configuration item identification number,

--part number,

--serial number,

--nomenclature,

--vendor or supplier,

--aircraft number,

--location by base code,

--activity (removal or installation), and

--activity date.

Currently, the F-16 Central Data System is operating on computer equipment which is being provided as part of the contract requirements. Also, about 75 terminals are linked via telephone lines to the F-16 Central Data System. The terminals are located at several locations, including Hill AFB, MacDill AFB, Nellis AFB, the F-16 System Program Office, and the F-16 prime contractor. Terminals for overseas locations will be purchased.

The F-16 Central Data System integrates the operational data it receives for the F-16 aircraft and its components. Currently F-16 data is sent from F-16 bases to the contractor via a tape-to-tape transmission device on a daily basis. After receiving the data, the contractor verifies the data and enters it into the F-16 integrated tactical data base. Immediately after this data has been entered into the F-16 data base, the System Program Office can access the data base via several queries. The queries provide the System Program Office personnel with timely reports containing F-16 information that is based on the transmitted data's currency.

The F-16 Central Data System suffers from unreliability of its MDC source data. As discussed in chapter 2, the system receives MDC input. An Air Force analysis done during October through December 1981 showed that shops were not reporting 8 to

On March 7, 1981, the Assistant Vice Chief of Staff of the Air Force established the Office of Information Resources Management as the focal point for Air Force-wide planning and for matters relating to the implementation of the Paperwork Act. The office is a multifunctional Air Force Headquarters planning group backed by a steering group comprised of Deputy Chiefs of Staff and directorate level managers. Included are full-time representatives from Computer Resources; Command, Control and Telecommunications; Administration; and Cost and Management Analysis. Additionally, each functional discipline within Air Force Headquarters has primary and alternate ad hoc representatives for IRM.

The objectives of the IRM office are to:

--improve the accessibility, consistency, timeliness, and accuracy of information support for the user;

--reduce unnecessary duplication of information collection requirements;

--reduce the time, effort, and financial burden to collect, maintain, use, and disseminate information;

--ensure that Air Force information systems do not unnecessarily overlap each other or duplicate systems of other Federal agencies;

--foster data/information sharing and compatibility among Air Force and Federal information systems;

--improve the productivity of Air Force personnel by efficiently procuring and effectively using ADP, telecommunication, and office automation equipment;

--coordinate the diverse but related information management policies and programs in areas such as information requirements management, forms management, documentation management, information collection, publications management, privacy, and major automated information systems;

--improve the accountability for the resources used to manage information; and

--ensure information policies are consistent with changing needs of the Air Force.

The Air Force IRM office has a 2-year charter and must develop an IRM operating plan by March 1983. A draft plan has been sent to the commands for comment. This plan includes the overall philosophy, concepts of management, objectives, and definitions for applying the IRM discipline to Air Force activities.

COMPARISON OF
OPERATIONAL CAPABILITIES

Capability	F-16 Central Data System	AMS
Aircraft and ground equipment job following	Yes	Yes
Engine and aircraft configuration tracking	Yes	Yes
Aircraft and engine reliability by work unit code and part number	Yes	Yes
Deployment capability	Planned	Planned
Real time MDC input and output	No (note a)	Yes
Automated work order generation and closeout	No	Yes
Aircraft debriefing	No	Yes
Online work monitoring for Job Control Section	No	Yes
Online personnel availability	No	Yes
Automated maintenance/supply interface for ordering and inquiry	No	Planned

a/The Avionics Intermediate Shop has real time MDC data input.

The F-16 System Program Office officials had not coordinated the Central Data System development effort with officials responsible for AMS. We also found that the Data System was not coordinated with AFLC, as called for in the Program Management Directive. AFLC officials advised us that they do not know whether they will have adequate funds to retain the Central Data System once the F-16 becomes fully operational in late 1984 or 1985 and program management responsibility is transferred from the Air Force Systems Command to AFLC. However, the Systems Command is continuing to expand the Central Data System and has plans to obtain a competitive bid for continued support of the system. The Systems Command also plans to make a lease versus purchase decision on the support equipment used by the Central Data System. This decision may be premature in light of the funding question.

first produced in 1959, systems like those used in the Defense Support Program (DSP) are 1965 technology, and even our latest missile detection system, PAVE PAWS, has seven year-old computer technology. Admittedly, there are programs to upgrade some of this equipment, but these programs are not structured to fully exploit advances in technology.

* * * * *

"The strong criticism of Air Force ADP management and previous recommendations by several agencies dictate the establishment of an organization on the Air Staff with a clearly defined responsibility for all ADP systems. I recommend a high-level action group be chartered to determine the organizational placement of that leadership focus. * * *"

Our review shows that senior Air Force managers need to make many decisions about maintenance information and how it is processed. How can the Paperwork Reduction Act help? The Paperwork Act requires that agencies evaluate their information-related activities. A study, focused on the broad spectrum of maintenance information could have identified the continuing problems of maintenance accuracy and raised the issues to an appropriate level where decisions could be made. The study could have covered such issues as who needs the information, how it is used, and whether existing systems satisfy the users' needs in the most effective and efficient manner possible. Although the Air Force has studied the MDC and related systems, the studies have generally been narrow in scope and have not depicted the widespread adverse impact of inaccurate maintenance data on Air Force management. More importantly, corrective actions have not been taken and the problems persist.

The Air Force has established an IRM organization with objectives which appear to be consistent with the Paperwork Act as well as the concerns addressed in this report. Effective implementation of the act and the IRM concept by this organization could help to solve some of these problems. An effective IRM program could allow the Air Force to establish realistic goals and priorities. These priorities could include providing for the collection of accurate and reliable information before building new systems to use inaccurate data. For example, the Air Force will spend an estimated $6.6 million to develop and operate the VAMOSC II system through fiscal year 1989. Yet VAMOSC II will suffer from one of the key weaknesses which caused prior operating and support cost systems to fail--inaccurate input data.

right times and in the proper level of detail to permit them to efficiently and effectively carry out their responsibilities. The Paperwork Reduction Act of 1980 lists five functional areas--paperwork, statistics, records management, privacy, and information technology. In many cases, persons responsible for these areas have applied their skills independently of each other and are located in different organizational components. The IRM concept involves centralizing these skills and integrating them at the proper times and in the proper mix so that information is

--obtained or created in the most efficient and economical manner;

--provided to agency personnel at the right time and in proper levels of detail for use in carrying out their responsibilities;

--maintained, stored, and retrieved in the most efficient and economical manner; and

--disposed of when no longer needed.

The Paperwork Reduction Act contemplates drawing together, under a designated senior official, support but not operational components of the five IRM areas. Further, the act recognizes that an IRM organization should be flexible and tailored to the needs of the organization.

Centralized management of information resources allows agencies to collectively apply the skills identified above to each "system" of information created or collected by an agency. As used in this report, a system of information is specific information obtained and used to achieve a particular goal or objective as well as the tools, processes, and personnel employed in conjunction with the information.

The act also requires that agencies establish a review mechanism to periodically review agency information activities. This mechanism is to ensure that information-related activities are performed in an effective and efficient manner and that they conform to applicable policies and regulations.

IRM organization in the Air Force

On July 28, 1981, the Secretary of the Air Force designated the Assistant Secretary for Financial Management as the senior official responsible for implementation of the Paperwork Reduction Act. The Air Force's reasoning for this selection was that several portions of the act were already assigned to the Assistant Secretary.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

The Air Force spends millions of dollars to collect, process, and disseminate maintenance data. Its primary mechanism for collecting data on work performed by mechanics is the MDC system--a system which attempts to document every maintenance action. As a result, the system is paperwork intensive and burdensome on mechanics, requiring an estimated 4 million hours to complete 80 million forms annually. The volume of data collected and the time required to process it often makes MDC information more than a month old when received by managers.

Data reported by mechanics to the MDC system is code intensive, requiring the use of numerous technical manuals and orders. The data can be used to diagnose aircraft component failures and trends. However, mechanics do not receive feedback from the system. Inquiry responses from the base computer are not timely enough to help mechanics and managers make maintenance decisions. As a result, managers often turn to time-consuming manual data collection procedures. These problems with the MDC system eliminate any incentives for maintenance managers or mechanics to provide complete, accurate, or timely maintenance data to the MDC system.

Over the MDC system's 20-year history, numerous Air Force studies have shown it to have significant accuracy problems--problems which still exist today. The MDC system reports this inaccurate data to many other Air Force information systems and the Air Force has built new systems which rely on MDC data. Because of timeliness and accuracy problems, managers often do not rely on information in systems which are based on MDC data. When they do, the data is used only to document known maintenance problems. Extra effort is also required because managers cannot rely on the data systems designed for the decisions they must make.

The Air Force has studied eliminating maintenance data collection and substituting sampling methods or job standards. This was done in the area of support general maintenance. The inaccuracy and resulting inability of existing systems to meet managers needs and attempts to eliminate the collection of maintenance data raise questions about whether the Air Force has adequately identified its maintenance information requirements.

One test system--the Automated Maintenance System--has the potential for improving the accuracy, timeliness, and utility of MDC system data. By using computer terminals to collect MDC data and providing extensive edits of the data, accuracy is improved and the completeness of data collection is increased

Officials in the IRM office advised us that the operating plan would not address specific areas of IRM such as maintenance information systems. As of February 1982, the IRM office was identifying the individuals and issues involved in implementing the Paperwork Act.

Effective application of IRM concept could improve Air Force maintenance information activities

To ensure that maintenance information contributes to the Air Force's goals and objectives, it is vital that the information be managed as a resource, as called for by the Paperwork Reduction Act. This requires the participation of management throughout the Air Force, including senior-level managers. Over the years, problems with maintenance information have persisted. There have been proposals to eliminate or modify the way in which the information is collected and questions as to the need for the information. Numerous studies of selected information problems have been conducted. Notwithstanding these concerns and problems, key decisions on how to improve the MDC system have not been made and the problems persist.

Current automation efforts could improve the accuracy and utility of maintenance information. Here again, however, the lack of high level coordination and decisionmaking may result in the acquisition of unnecessary hardware. Effective implementation of the Paperwork Reduction Act can provide a framework for solving some of these problems.

A 1981 letter by the Commander in Chief of the Strategic Air Command to the Chief of Staff of the Air Force recognized the need for senior-level attention to manage ADP. The same kind of attention is also needed for other information processes and technology. Following are a few excerpts from that letter.

> "The key to overcoming our current problems is the establishment of a high-level focal point on the Air Staff [Air Force Headquarters offices] responsible, in a policy sense, for all ADP systems. At one time, the Air Force was a leader in the use of computer technology. To regain that position, we must reduce the excessive oversight of other federal offices. In our view, this can only be accomplished by taking steps to show that we take constructive criticism seriously.
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> * * * * *
>
> "When SAC [Strategic Air Command] assumed management of the surveillance and warning sensor sites on 1 Oct 79, many of the 58 computers involved in this critical mission were found to have failed to capitalize on technological progress. For example, the Ballistic Missile Early Warning System (BMEWS) computers were

replaced with VAMOSC II until the issues of accuracy, productivity measurement, and system requirements are addressed by both Air Force and OSD officials.

AMS is based on concepts developed more than 10 years ago. However, its lack of availability at most Air Force bases and drawbacks in existing maintenance data systems led to the development of systems such as the F-16 Central Data System which does not have as much capability as AMS. The Air Force Logistics Command has not decided whether it will fund the system when management responsibility for the F-16 aircraft is transferred to AFLC in late 1984 or 1985. As a result, the Central Data System has an uncertain future. Yet the Air Force Systems Command is planning system enhancement, soliciting competitive bids for system support, and planning to make a lease versus purchase decision on certain equipment which supports the system. We believe the Air Force Systems Command's decisions may be premature.

These kinds of issues prompted the Congress to pass the Paperwork Reduction Act of 1980. The Paperwork Act promotes the concept that information should be managed as a resource. The act also requires agencies to establish organizations to manage their information resources and to report to a senior-level agency official. Agencies are required to review their information activities to ensure that they are performed efficiently and effectively.

We believe that, if properly implemented, the Paperwork Act will create a framework in which the Air Force can address information-related concerns. The studies required by the act could identify the information problems. With a complete picture of information systems and problems, the senior official can establish priorities for work which should be undertaken. This work should include determining what information is needed and ensuring that it is accurately collected in a cost-effective manner. The senior official can also ensure that compatible information systems are developed and that development efforts do not duplicate one another. Although the Air Force has established an IRM office, appointed a senior official, and drafted an operating plan, much more needs to be done to fully implement provisions of the Paperwork Act.

RECOMMENDATIONS TO THE SECRETARY OF DEFENSE AND THE SECRETARY OF THE AIR FORCE

We recommend that the Secretary of Defense reassess the requirements for an operating and support cost system and work with the Air Force to develop a system that will meet these requirements. To improve maintenance information activities, we also recommend that the Secretary of the Air Force:

--Determine maintenance information requirements for the different levels of command throughout the Air Force.

Senior-level attention and decisions on the AMS effort are also needed. For example, the success of the AMS effort could be jeopardized by underestimating AMS costs and portraying benefits which are highly suspect. In addition, decisions on developing an AMS capability to take advantage of the Phase IV computer system are soon needed. Individual command development efforts must also be controlled to prevent the acquisition of unnecessary computer systems. For example, the senior IRM official could have directed the F-16 System Program Office's attention to the AMS project. Without this attention, the System Program Office has contracted for the F-16 Central Data System which does not have nearly the capability of AMS but is costly and has an uncertain future. An AMS type system would have provided F-16 managers with better information for decisionmaking. In any event, earlier action to improve standard Air Force maintenance information systems could have reduced the need for a system such as the F-16 Central Data System.

substantially. We believe mechanics are more willing to report complete and accurate maintenance data because the system can provide them with information which helps them perform their work.

Because the AMS is an online system, it provides managers with timely information for decisionmaking. The availability of timely and accurate maintenance information at the base level results in improved decisionmaking and, as a result, improved performance of the maintenance organization.

Although personnel savings resulting from the AMS system could be substantial, the Air Force is reluctant to measure the savings and rely on them to promote the system. The Air Force does not want to give up staff authorizations until AMS is fully evaluated. Instead, misleading information on full mission capable rates and unmeasured supply savings has been used to promote the system. In addition, the Air Force has not identified all of the system's costs and has provided only partial costs to managers who had to make decisions about the future of AMS. We believe the Air Force needs to measure both the costs and benefits of the AMS system.

Dover AFB was selected as the AMS test location because of the level of automation already available there and because only the C-5 aircraft is based there. These advantages have turned into drawbacks because computer hardware for the AMS test is not compatible with other Air Force computers. Recognizing the benefits of an AMS type of system, numerous Air Force activities are proposing the acquisition of stand alone computers on which to operate AMS type systems. We believe the Air Force needs to begin developing AMS capabilities which will be compatible with the new base-level Phase IV computer system to prevent the proliferation of stand alone maintenance computer systems. We also believe that work proposed to develop stand alone systems could be better focused on the timely development of compatible capabilities.

Inaccurate maintenance and other data systems will be used in a new operating and support cost system--VAMOSC II. We previously reported on the lack of accurate data for managing operating and support costs and productivity. Although the Air Force developed a productivity measurement and costing system, some managers do not use it and proposals exist to abolish the system. However, questions exist about whether the new VAMOSC II system can satisfy the same measurement requirements. Further, questions exist as to who will use VAMOSC II and the impact inaccurate maintenance data will have on its use. Because of these problems, we believe our prior recommendations about the need for good productivity measurement information are still valid. We also believe that the VAMOSC II system may not be used, like its predecessors, until accurate input data is provided. Therefore, we do not believe the MCS system should be

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--Develop uniform and cost-effective systems for collecting and processing accurate maintenance information needed to meet identified requirements.

--Identify the full costs and benefits of the Automated Maintenance System prototype and, if justified, develop automated maintenance information capabilities which would be compatible with standard Air Force base-level computer systems. This action would eliminate the need for stand alone maintenance computer systems beyond Altus, Dover, and Travis AFBs.

--Defer terminating the Maintenance Cost System until issues concerning data accuracy, productivity management, and VAMOSC II system requirements are resolved.

--Determine whether a Phase IV compatible automated maintenance information system may eliminate the need for the F-16 Central Data System. This issue should be considered when deciding on future Central Data System support, expansion plans, and lease versus purchase of equipment.

--Apply information resources management approaches to managing future information system development efforts.

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