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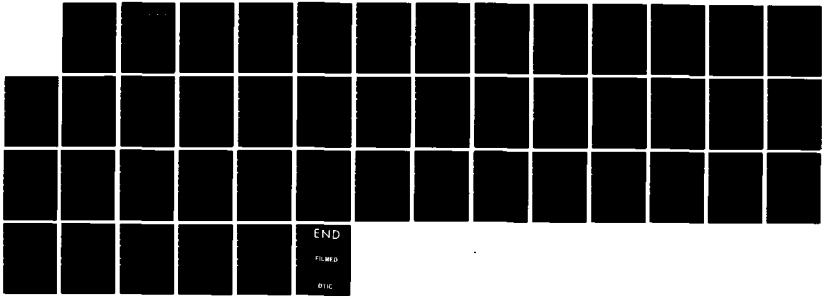

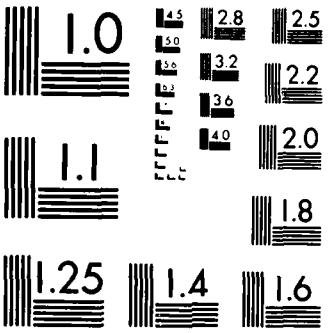

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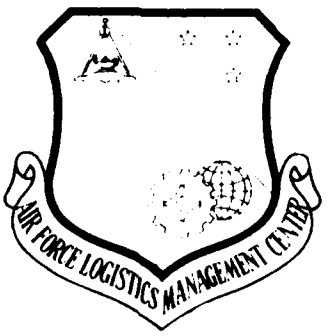

AUTOMATED MAINTENANCE SYSTEM TEST PROGRAM

INCREMENT VI "PRODUCTION SCHEDULING"

EVALUATION REPORT

BY

SMSGT LARRY J. CHAMBERS

AFLMC REPORT LM760720

OCTOBER 1984

AIR FORCE LOGISTICS MANAGEMENT CENTER
GUNTER AFS, AL. 36114

DEPARTMENT OF THE AIR FORCE
AIR FORCE LOGISTICS MANAGEMENT CENTER
GUNTER AIR FORCE STATION, AL 36114-6693

25 OCT 1984

REPLY TO ATTN OF: LGM

SUBJECT: Final Report - Automated Maintenance System (AMS) Test Program Evaluation Report - Increment VI Production Scheduling - AFLMC Project No. LM760720

TO: See Distribution List

1. The attached report documents our evaluation of the automated production scheduling processes within the Automated Maintenance System (AMS) at Dover AFB, Delaware. Maintenance management functions affected by AMS Increment VI include scheduling, tracking, and Maintenance Data Collection (MDC) for reparable parts and items requiring calibration.

2. If you have any questions concerning this report, please contact our project manager, SMSgt Larry J. Chambers, AFLMC/LGM, AUTOVON 446-4581.

DAVID M. CRIPPEN, Lt Col, USAF
Deputy Director of Maintenance

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HQ NGB/LG/LGM	(2)		
436 MAW/CC/MA/RM	(3)		
443 MAW/CC/MA/RM	(3)		
21 AF/LG	(1)		
22 AF/LG	(1)		
60 MAW/CC/MA/RM	(3)		
437 MAW/CC/MA/RM	(3)		

Attachment 1

AUTOMATED MAINTENANCE SYSTEM TEST PROGRAM

INCREMENT VI "PRODUCTION SCHEDULING"

EVALUATION REPORT

ABSTRACT

The purpose of this report is to document evaluation results of automated production scheduling processes within the Automated Maintenance System (AMS). The processes were developed and tested at Dover AFB, Delaware. Maintenance management functions affected by AMS Increment includes scheduling and tracking of reparable parts and items requiring calibration. Workcenters affected at the time of the appraisal included all Avionics Maintenance shops, the Avionics Reparable Processing Center (RPC), and the Field Maintenance Environmental Systems Shop. This report contains the evaluation methodology, findings and recommendations for future program development.

EXECUTIVE SUMMARY

The purpose of the Automated Maintenance System (AMS) Test program is to measure the effects of automating aircraft maintenance management processes in a live base environment.

The system consists of the on-board C-5 aircraft Malfunction, Analysis, Detection and Recording System (MADARS) which collects in-flight systems data, and the C-5 Ground Processing System (GPS) which is the maintenance data processor. GPS was expanded to process a wide variety of maintenance information. The expanded GPS is known as AMS or AMS/GPS. AMS was developed incrementally with six increments completed to date. Evaluation results of Increments I through V were documented in June 1981. This report covers Increment VI, "Production Scheduling." Increment VI provides a tracking system for "off-equipment" actions including test, calibration, and repair of components in the shop environment. It is intended to increase the speed and accuracy of in-shop maintenance processes by automating or eliminating a number of manual forms, computing job standards and shop backlogs, and replacing tracking boards used in the scheduling process.

Our evaluation approach was to determine whether program objectives and postulated benefits listed in the Functional Description (FD) were realized. We also looked at supply repair cycle data to see if parts are moving through the system faster. The Air Force Human Resources Laboratory evaluated human factors.

At the time of the evaluation, the Avionics Maintenance Squadron shops were using Increment VI. Field Maintenance Squadron was operating under the manual scheduling system, with the exception of the Environmental Systems Shop. In comparing manual versus automated processes, we used Avionics Maintenance workcenters as the test group, while Field Maintenance workcenters served as the control group.

Nine of the program objectives were fully met and three were partially met. Many postulated benefits were realized to varying degrees. The most notable benefit was the savings in time required to update Precision Measurement Equipment (PME) records. Supply data showed no significant change in average repair cycle time (RCT) since Increment VI was implemented (a reduction in RCT was expected if Increment VI had improved overall repair cycle management); but average Not-Reparable-This-Station (NRTS) time showed a significant increase (again a reduction was expected). However, both "block scheduling" and the significant policy change of completing maintenance data input prior to turn-in to supply masked the potential time savings of Increment VI. Human factors assessment showed a continuous improvement in users' acceptance of the system.

Increment VI provided a real-time tracking system. However, use of the "block scheduling" method of processing reparables limited its effectiveness. Reparables, with few exceptions, were being processed in mass twice each day. Current reparable processing procedures should be reviewed by appropriate management and revised to take full advantage of the real-time capabilities of Increment VI.

Overall, AMS Increment VI has established a complete reparable processing and PME database. However, users expressed frustration over the requirement to make duplicate inputs to both the Increment VI and supply computer systems. This unnecessary redundancy could and should be eliminated through a systems interface which is planned under AMS Increment VII. This interface should be developed as soon as possible to fully use the real-time reparable/PME database within Increment VI.

TABLE OF CONTENTS

CHAPTER 1 - INTRODUCTION

1. The purpose of the Automated Maintenance System Test program is to measure the effects of automating aircraft maintenance management processes in a live base environment. AMS Increments I through V were evaluated in June 1981. This report covers Increment VI, "Production Scheduling" processes.

2. Background:

a. The C-5 aircraft has an onboard Malfunction, Analysis, Detection and Recording System (MADARS) which is processed by a Ground Processing System (GPS) at the three C-5 sites. The C-5 MADARS/GPS consists of an IBM 1130 at each C-5 base and a Central Data Bank (CDD to program objectives, postulated benefits, repair cycle system impacts, and human factors.

b. In February 1975, MAC submitted a Data Automation Requirement (DAR) recommending standard Air Force application of the C-5 GPS. In response to the MAC DAR, three Air Staff-directed conferences were held. These conferences resulted in identification of several maintenance management processes to be tested. The processes were separated into seven increments identified below:

I WORK ORDER GENERATION/CLOSE OUT

II DEBRIEFING

III PERSONNEL AVAILABILITY

IV JOB FOLLOWING

V DESIGNED OPERATIONAL CAPABILITY

VI PRODUCTION SCHEDULING

VII MAINTENANCE/SUPPLY INTERFACE

3. Scope: This evaluation was conducted to determine if AMS/GPS processes for Increment VI met the stated program objectives and postulated benefits in the functional description. The program's effects on repair cycle time were also measured and a human factors study was conducted to determine users' acceptance.

CHAPTER 2 - METHODOLOGY

1. Hypothesis: The overall hypothesis for the AMS Test Program is that the "process will improve management procedures, allowing more time for maintenance supervisors to deal with production oriented requirements."[1] The specific hypothesis for Increment VI is that "this process will save manhours by eliminating manual procedures and files, improve accuracy of repair cycle data, and reduce Due-In-From-Maintenance (DIFM) reconciliation time."[2]

2. Approach: Four areas were evaluated: program objectives, postulated benefits, effects on repair cycle time, and human factors. In comparing the manual processes to the automated processes, we used the Field Maintenance Squadron, which did not have Increment VI, as the control group, and the Avionics Maintenance Squadron, which did have Increment VI as the test group. We carefully excluded data from dissimilar procedures such as multiple-shop-processed items in FMS to insure valid results.

3. Methodology:

a. The program objectives, as stated in the Functional Description (FD), were evaluated to determine if they had been fully met, partially met, or not met. Each objective was broken into key elements whenever possible. The presence or absence of these elements determined findings. The evaluation was conducted through direct observation of system use, stopwatch tests, and comparison of data samples from maintenance and supply computer products and input source documents.

b. The postulated benefits assessment was conducted to determine if each benefit was realized and the value of the benefit. Evaluation processes included direct observation of system use, stopwatch studies, user interviews, and quantitative analysis of supply and maintenance data.

c. Supply repair cycle data was analyzed to determine if the system had impacted Repair Cycle Time (RCT) and/or Not-Reparable-This-Station (NRTS) processing time. This data was collected from Dover AFB supply computer tapes. The test hypotheses were:

(1) Average Repair Cycle Days - Increased efficiency in parts processing should be reflected in a reduction of RCT.

(2) Average NRTS/Condemned Days - Increased efficiency in parts processing should be reflected in a reduction of NRTS/Condemned time.

d. Human Factors were assessed by the Air Force Human Resources Laboratory through questionnaires and personal interviews. The areas measured were training required, implementation difficulty, process usability, and user acceptance.

CHAPTER 3 - EVALUATION RESULTS

This chapter contains analyses and findings related to program objectives, postulated benefits, repair cycle system impacts, and human factors.

SECTION ONE - PROGRAM OBJECTIVES EVALUATION

OBJECTIVE 1: Provide schedulers with a single, integrated data base to store all DIFM and Precision Measurement Equipment (PME) asset status information.

This objective was broken into four elements: (1) single database, (2) integrated database, (3) complete DIFM status, and (4) complete PME status.

ANALYSIS:

(1) Single data base - TO 00-20-3 requirements for DIFM information was contained within the AMS/GPS single data base as was PME asset information. AFM 67-1 data requirements were not contained in a single database but are maintained separately in the Supply computer. This necessitated updating of supply data through manually generated forms which often contained information redundant to AMS/GPS information.

(2) Integrated data base - The term "Integrated" as applied in the FD refers to the system's ability to crossfeed information to eliminate redundant inputs. From the maintenance standpoint, the data base is fully integrated with the exception that AFTO Form 350 and AFTO Form 349 data is not crossfed.

(3) DIFM status information - Complete DIFM status was available in AMS/GPS.

(4) PME asset information - The Master ID Listing was fully automated and "real-time" under Increment VI. Calibration due dates were automatically updated by MDC inputs, eliminating the use of the AF Form 1530 in updating the Master ID Listing.

FINDING: PARTIALLY MET. The ability to crossfeed AFTO Forms 349 and 350 data, and the ability to crossfeed data between maintenance and supply information systems were the limiting factors.

OBJECTIVE 2: Provide on-line inquiry capability to permit monitoring of individual assets status and location.

ANALYSIS: Asset status and location (including ETJC) was available on-line. However, the capability was limited to listing all parts in a particular workcenter or individual parts by AFTO Form 350 tag number. The system could not be used to find the AFTO Form 350 when a part's paperwork was lost or unreadable. The system could not be used to determine the status and location of a grouping of parts such as by national stock number, manufacturer's part number, or by work unit code. Further, users had to "page through" an entire shop report to locate an individual part if the tag number was unknown. A program to locate parts and status by national stock number, manufacturers

part number, and/or work unit code was needed to allow individual asset monitoring.

FINDING: FULLY MET. The objective was partially met at the time of the evaluation. Following the evaluation, AMS/GPS programmers have added the capabilities to terminate the shop report and to locate parts by a variety of categories.

OBJECTIVE 3: Provide asset inventory control through automated records creation when an asset enters the repair/calibration cycle.

This objective was broken into two elements: (1) Asset inventory control, and (2) Automated records creation for assets undergoing repair/calibration.

ANALYSIS:

(1) Asset Inventory Control - Comparisons of actual asset status and location versus recorded status and location revealed no discrepancies. A high degree of asset control was readily apparent.

(2) Automated records creation - All assets entering shops with Increment VI capability were processed through RPC using automated records.

FINDING: FULLY MET. Data contained in Increment VI programs meets and exceeds the T.O. 00-20-3 production control requirements.

OBJECTIVE 4: Provide an inquiry system for obtaining summary labor hour backlog data for off-equipment work (Automated AF Form 2443) and PME assets awaiting repair/calibration.

ANALYSIS: The system automatically computed and displayed current shop backlog data in under ten seconds in the Avionics RPC which had Increment VI. In the FMS RPC, which did not have Increment VI, the scheduler required more than a half hour to complete backlog calculations and fill out the AF Form 2443. The automated AF Form 2443 was easier to read and understand, and contained the same information as the manual form. Also, the automated AF Form 2443 contained real-time information while the manual form represented "snap-shot" information.

FINDING: FULLY MET. A direct manhour savings of more than a half hour each workday was realized as a result of this program.

OBJECTIVE 5: Provide a suspense system to monitor estimated times of job completions (ETJCs).

ANALYSIS: This objective was broken into two elements: (1) ETJC suspense system and (2) ETJC monitoring.

(1) ETJC suspense system - Avionics RPC schedulers demonstrated that ETJCs were present in the system, but in many cases, no ETJC had been established for individual items in the in-work (INW) category. No overdue ETJCs were noted during the visit, but in follow-up checks from our AMS/GPS terminal at Gunter AFS, we found many overdue ETJCs. The system does not

force an ETJC input nor does it automatically notify RPC or the shop when an ETJC goes overdue.

(2) ETJC monitoring - The system provided the means to monitor ETJCs, although the program used for this purpose was not very convenient since the user had to go through the entire shop report to find an individual ETJC. Avionics RPC schedulers said that individual ETJCs were checked twice daily except for certain critical items that were checked hourly.

FINDING: PARTIALLY MET. At the time of the evaluation, the program lacked the capability to notify schedulers that an ETJC was overdue. AMS/GPS programmers have since added a program to quickly display a list of next due ETJCs for all shops, but the system still has no automatic ETJC due/overdue notification program.

OBJECTIVE 6: Provide automatic update of PME records from MDC close-out data entered in the system.

ANALYSIS: The PME scheduler demonstrated automatic update of PME data through MDC close-out along with a programmatically updated Master ID Listing. The scheduler said that before Increment VI was implemented, it took her two full weeks out of each month to update this listing. This does not include the time spent by the owning workcenters in keeping their listings up to date. Workcenters periodically receive notification of items coming due calibration in the near future. This feature has virtually eliminated items overdue calibration.

FINDING: FULLY MET. In our opinion, this is the most outstanding system feature for Increment VI.

OBJECTIVE 7: Provide accurate asset status data to enhance the Mission Capability System (MICAP) verification process.

This objective was broken into two elements: (1) Accurate asset status data, and (2) Enhancement of MICAP verification.

ANALYSIS:

(1) Accuracy of asset status data was verified by comparing actual status and location of parts with the information shown in the AMS/GPS computer. No discrepancies were noted.

(2) Enhancement of MICAP verification - MICAP verifiers stated that their primary method of checking parts status and location was to call RPC. The computer was used only as a last resort. They indicated they would use the computer only if they were able to call up assets by NSN, part number, or WUC.

FINDING: FULL MET. This objective was not met at the time of our visit. AMS/GPS programmers have since added a program to call up parts status and location by NSN in a variety of categories.

OBJECTIVE 8: Provide job average for component repair/calibration.

Subprocess C - Ordering repair parts.

Activities		Average Time
1 AMS	Fill in AF 2413	3 min 30 sec
1 FMS	Fill in AF 2413	3 min 30 sec
2 AMS	Input AFTO 350 status change (AWP)	1 min 52 sec
2 FMS	Annotate AFTO 350 part 1 (AWP status)	08 sec
3 AMS	Attach doc. to part and send to AWP	30 sec
3 FMS	Attach doc. to part and store in AWP area	30 sec
Total Process Time - AMS (Inc VI Shops)		5 min 52 sec
Total Process Time - FMS (Non-Inc VI Shops)		4 min 08 sec

Subprocess D - Close out of NRTS action in the shop.

Activities		Average Time
1 AMS	No Action Required	00 sec
1 FMS	Annotate Shop Log	42 sec
2 AMS	Complete DD 1577-2 unserviceable (2 cy)	2 min 02 sec
2 FMS	Complete DD 1577-2 unserviceable (2 cy)	2 min 02 sec
3 AMS	Input AFTO 349 Data	2 min 57 sec
3 FMS	Input AFTO 349 Data	2 min 57 sec
4 AMS	RPC notified by 9129 program	00 sec
4 FMS	Notify RPC when work completed	1 min 00 sec
5 AMS	Complete Automated AFTO 350	10 sec
5 FMS	Complete AFTO Form 350	44 sec
6 AMS	Attach documentation to part for RPC processing	35 sec
6 FMS	Attach documentation to part for RPC processing	35 sec

SHOP PROCESSING

Subprocess B - Processing parts for repair in the shop.

Activities		Average Time
1 AMS	Enter AFTO Form 350 data in computer (9128 screen) Printout AFTO Form 350, attach to part for RPC proc.	4 min 18 sec
1 FMS	Fill out AFTO Form 350 tag, attach to part for RPC proc	2 min 13 sec
2 AMS	No action required	00 sec
2 FMS	Annotate shop reparable log (part to RPC for proc)	42 sec
3 AMS	No action required	00 sec
3 FMS	Annotate shop reparable log (part rec'd from RPC)	42 sec
4 AMS	Enter AFTO 349 data	3 min 00 sec
4 FMS	Enter AFTO 349 data	3 min 00 sec
5 AMS	RPC notified by 9129 program report	00 sec
5 FMS	Notify RPC of repair completion by phone	1 min 00 sec
6 AMS	Complete DD1574 serviceable tag	2 min 02 sec
6 FMS	Complete DD1574 serviceable tag	2 min 02 sec
7 AMS	Complete Automated AFTO 350	10 sec
7 FMS	Complete AFTO form 350 (work completed)	30 sec
8 AMS	No Action Required	00 sec
8 FMS	Annotate shop reparable log (completed)	42 sec
9 AMS	No action required	00 sec
9 FMS	Annotate K-26 report	30 sec
Total Process time - AMS (Inc VI Shops)		9 min 30 sec
Total Process time - FMS (Non-Inc VI Shops)		11 min 21 sec

APPENDIX A - EVALUATION WORKSHEETS

WORKSHEET 1

a. Evaluation Objectives: Determine if AMS Increment VI has provided a measurable manhour savings in the time required to process parts for repair in RPC and/or the shops. Also determine if manual documentation has been reduced and if DIFM reconciliation time has been reduced.

b. Methodology: Interview RPC personnel and shop reparable monitors to determine the activities involved in processing reparables. Perform stopwatch checks to find the time required for each activity. Compare the steps and times for AMS schedulers (with Increment VI) and FMS schedulers (without Increment VI).

INITIAL RPC PROCESSING

Subprocess A - Processing parts from RPC to the shops.

Activities		Average Time
1 AMS	Inspect documentation attached to part	03 sec
1 FMS	Inspect documentation attached to part	03 sec
2 AMS	Enter AFTO Form 350 sched. data in computer and print	15 sec
2 FMS	Fill in scheduling data on AFTO Form 350 and stamp	35 sec
3 AMS	No action required	00 sec
3 FMS	Annotate RPC log	04 sec
4 AMS	"Visible File" automatically generated	00 sec
4 FMS	Place 350 part 2 in visible file with 1348-1	15 sec
5 AMS	Attach automated AFTO Form 350 to part	03 sec
5 FMS	Attach AFTO Form 350 part 1 to part	03 sec
6 AMS	Annotate R-26	02 sec
6 FMS	Annotate R-26	02 sec
7 AMS	Fill out AF Form 1998 (as required)	05 sec
7 FMS	Fill out AF Form 1998 (as required)	05 sec
Total process time - AMS (Inc VI RPC)		28 sec
Total process time - FMS (Non-Inc VI RPC)		1 min 07 sec

FOOTNOTES

[1]Data Project Plan HAF-P76-11, 14 October 1981, Annex C, Section A, paragraph 3.

[2]Ibid., Annex C, Attachment 1, paragraph D.

[3]Automated Maintenance Systems Test Program, Prototype Functional Description, Increment VI, 31 July 1981, Section 1, paragraph 2.2.

[4]Ibid., Section 2, paragraph 2.4.1.

[5]TO 00-20-3, Section 2, "Production Control," paragraph 2-4.

2. Core Automated Maintenance System (CAMS) developers should review and make maximum use of Increment VI programs. (OPR: DSDO/LG))

3. Functional managers should review and revise existing reparable processing procedures (block scheduling) where Increment VI provides a better way of doing business. (OPR: HQ MAC/LG, OCR: 436 MAW/MA))

4. CAMS developers should periodically review Increment VII progress. (OPR: DSDO/CC))

5. AMS/GPS and CAMS developers should review every program prior to implementation to make sure that users do not have to feed the same information to different systems or subsystems. (CAMS OPR: DSDO/CC); (AMS OPR: HQ MAC/LG))

6. A formal user to programmer interface plan should be developed for AMS/GPS Increment VI and VII and for CAMS. This should include hands-on during development and "fix" or "enhance" following initial fielding of software. (OPR: DSDO/CC; AMS OPR: HQ MAC/LG)

CHAPTER 4 - CONCLUSIONS AND RECOMMENDATIONS

SECTION ONE - CONCLUSIONS.

1. The processes constituting AMS Increment VI were found to be technically and operationally feasible. The development of Increment VII, "Maintenance/Supply Interface," is critical to maximizing the ultimate value of Increment VI.

2. Processes constituting Increment VI are applicable to Air Force aircraft maintenance organizations, although the application programs are not directly transferrable to base-level computer systems. This is due to the dissimilarity between the program structure for the central data base-orientation Automated Maintenance System and the standard base-level computers.

3. Changes in existing reparable asset management procedures may be necessary to realize the full potential of Increment VI. The "hourly scheduling" method is better suited to the real-time properties of Increment VI than the "block scheduling" method currently in use at Dover AFB. The use of shop repair logs are not considered necessary for Increment VI users.

4. The AMS/GPS system has provided an ideal laboratory environment for the development and testing of maintenance information systems concepts. Efforts to develop and test AMS Increment VII should be continued to provide better understanding and validation of interface relationships between maintenance and supply policies, procedures, concepts, and information systems.

5. A key "lesson learned" in this evaluation is that an interface between maintenance and supply data systems is essential to make the best use of reparable asset scheduling programs. The most common user complaint was "we have to feed the same information to two systems." Future systems developers should make sure maintenance and supply sub-systems are able to crossfeed information BEFORE implementation.

6. Another "lesson learned" during this evaluation was the need to establish a formal user to programmer feedback system. Many of the AMS/GPS programming fixes which enabled us to conclude individual objectives were "fully met," were identified during our evaluation visit. When we provided feedback to the AMS/GPS programmers of the users' needs, they were "unaware" of the problem. In developing any large data automation data system, there needs to be interface between the users and the programmers both during development and after fielding. Additionally, plans need to be developed to provide programming support after a new system is fielded. This support should include both "getting the bugs out" and "enhancing" the capability of the software package.

SECTION TWO - RECOMMENDATIONS

1. AMS/GPS Increment VII should be developed as soon as possible. (OPR: HQ MAC/LG))

Table 4. Potential Time Savings

Activity	Monthly Manhours Freed
KPC and Performing Workcenters Parts Processing Per Unit (2.51 Min) x Avg. Units Proc. Month (2114)	88 hours
Shop Backlog Computation 32.5 Min. Per Day	20 hours
PMEL Master I.D. Update	80 hours
Total Per Month	188 hours

SECTION FOUR - HUMAN FACTORS.

Initial measurements were taken in November 1983, and a follow-up study was completed in May 1984. Definite improvements in attitudes were apparent after users had time to learn the system and programmers had made needed changes. The AFHRL survey and report are found in Appendix B. Below is a synopsis of key AFHRL findings.

1. Training - In November 1983, many users indicated training was one of the program's biggest problems. Only 5 percent said training was a problem in the May 1984 surveys. Once past the "learning curve", users found the system very friendly.

2. Difficulty in Implementation - Users indicated their jobs were made easier by Increment VI in the May 84 survey, with positive responses 10-20 percent higher than in the November 83 survey.

3. Usability - 63 percent of the users indicated the automated system is less difficult than the old manual system. Responses in May 84 were much more positive than in the November 83 survey.

4. User Acceptance - Responses in this area indicate the system is well accepted by the users and it provides them with the information they need to do their jobs. 63 percent indicated Increment VI should be a permanent part of AMS/GPS.

SECTION FIVE - SUMMARY

Increment VI provides a significant improvement in tracking reparables through the repair process. There are still some additional actions required to obtain the full benefits of the system. However, by automating this process, supervisors and technicians' time has been freed to allow them to accomplish their assigned jobs: leading and repairing. Summarized below is a table of the potential time savings which should accrue from Increment VI.

Table 3. Average RCT and NRTS Days per Unit

	RCT DAYS Non-VI Shops	RCT DAYS Inc VI Shops	NRTS DAYS Non-Inc VI Shops	NRTS DAYS Inc VI Shop
Pre Inc VI	6.15	3.64	4.76	2.48
Post Inc VI	5.67	3.61	4.40	4.14

RCT and NRTS averages are shown in Table 3 above. The first and third columns provide averages for those shops which did not have Increment VI. The second and fourth columns show the averages for shops which did have Increment VI. The first row shows "before" averages and the second row shows "after" averages.

RCT for Increment VI shops is relatively unchanged while NRTS days increased more than a full day. We would expect to see both RCT and NRTS dropping in shops which have a better way to process parts. This was not found in our results.

However, the Increment VI shops were affected by a significant change in policy from the non-Increment VI shops. Under Increment VI, parts cannot be turned into supply until Maintenance Data has been input against the repair action. In the case of NRTS items, prior to Increment VI, an item declared NRTS was returned to supply. Maintenance Data was input separately and, often trailed the supply turn-in.

In addition, in our interviews with AMS RPC personnel, (see Appendix A, worksheet 2), they said that parts were not moving through the system faster even though their processing time and manual documentation had been reduced. They gave two primary reasons for this: (1) parts spent more time awaiting transport than in administrative processing; (2) shops did not update MDC in a timely manner, causing some parts to be held in RPC until the following day. Our analysis appears to support their view. We believe Increment VI has likely reduced processing time but that time has been masked by two factors: (1) mandatory MDC update prior to turn-in to Supply and, (2) the use of "Block Scheduling"[5] (a batch processing method) with a real-time Increment VI system. Holding parts until MDC is complete is a significant advantage to the repair process. Therefore the increase in repair time associated with this, in our estimation less than one day, is worth the delay. Additionally, by using an "Hourly Scheduling"[5] method instead of "Block Scheduling" the advantage of Increment VI real-time processing would reduce RCT and NRTS time.

FINDING: Increment VI has not significantly impacted average repair cycle time. Average NRTS days has shown a rise since Increment VI was implemented. This is attributed largely to the use of a real-time system to batch-process parts through the system, and the delays in completing MDC inputs.

BENEFIT 5: Eliminate the time required for production control personnel to compute shop backlog.

ANALYSIS: In stopwatch studies, FMS schedulers took 32.5 minutes to compute and record the reparable asset backlog on the AF Form 2443 without Increment VI (see Appendix A, Worksheet 3). In AMS RPC, Increment VI automatically computed and displayed on demand the shop backlog report. AMS schedulers reported that before Increment VI, they normally took from 15 minutes to one and one half hours to compute and record backlogs each day.

FINDINGS: The shop backlog computation has been eliminated for Increment VI-equipped shops and has resulted in a direct manhour savings and has eliminated the manual AF Form 2443.

BENEFIT 6: Reduce MICAP verification time.

ANALYSIS: At the time of the evaluation, MICAP verifiers were not using Increment VI to get reparable parts status, location and ETJC. Instead, from Increment VI, they would have to call up the 9129 report and page through all assets in a given shop and manually extract the needed data. Verifiers indicated they would use Increment VI if they could get parts status and location by stock number, part number, and/or work unit code (WUC).

FINDING: Increment VI did not result in a reduction of MICAP verification time because they found the system unusable for this purpose. However, AMS/GPS programmers have since developed a new program to facilitate location of parts status by a variety of categories which should enhance MICAP verification in the future.

SECTION THREE - REPAIR CYCLE TIME EVALUATION

HYPOTHESIS: Aggregate Repair Cycle Time (RCT) for workcenters operating under Increment VI should be reduced if a real increase in production processing efficiency has occurred.

METHODOLOGY: Dover AFB RCT data was analyzed for 606 stock items associated with six shops which used Increment VI. We also analyzed 263 items associated with shops which did not use Increment VI. This was done to isolate outside influences which may have caused changes in average RCT. Increment VI "before" data consisted of the second calendar quarter of 1982 through the first calendar quarter of 1983, while "after" data consisted of the second calendar quarter of 1983 through the first calendar quarter of 1984. This test was also applied to average NRTS/Condemned days over the same period.

ANALYSIS: The analysis was performed by computing an average RCT value for each stock item for the twelve month period prior to Increment VI implementation and for the first twelve month period after implementation. The difference in the average value was then tested for statistical significance using a matched-pair t-test. This test was also applied to NRTS days over the same period.

ANALYSIS: Audit trails were established for items in the repair cycle process. MDC inputs were checked after the items were returned to RPC, prior to their return to supply. No errors were detected in the parts sample. Attempts to "fool" the system with erroneous serial numbers and Work Unit Code inputs were rejected in 100 percent of samples. Parts could not be closed out of the system until MDC had been input. The program also checked to see if bits and pieces were still on order and would not allow job closure until repair parts were either received or cancelled.

FINDING: Increased accuracy of MDC and Supply data was achieved. The edits included in Increment VI represent a major step forward from independent supply and maintenance data systems. From a maintenance standpoint, Increment VI requires maintenance to input accurate MDC and combines this with edits on parts on order. Thus, unneeded parts must be cancelled prior to work order closeout. Although the requirement to input AWP data has created an additional workload (see Table 1, subprocess C), in our opinion, the potential for dollar savings and increased data accuracy far outweigh the additional time required.

BENEFIT 4: Increase MDC reporting percentage rate.

ANALYSIS: We collected MDC off-equipment units completed by Avionics shops from the four calendar quarters prior to Increment VI implementation, and the five quarters following its implementation. As an independent verification source, we also collected Supply units returned-to-service (RTS) for the same shops over this period. We found that MDC off-equipment units completed were steadily increasing from about 3000 units to over 6000 units while the number of RTS units showed a fairly constant trend. The table below shows MDC off-equipment units completed versus RTS units. If every unit returned-to-service was reported in MDC, off-equipment units completed should equal at least 100 percent of RTS units. This was clearly not the case prior to Increment VI implementation (quarters 82-1 through 82-4). After Increment VI implementation began in quarter 83-1, MDC off-equipment units more than doubled and exceeded 100% of RTS units. This indicates that units being returned to service in Supply are now being documented in MDC. The MDC units complete quantity also includes such maintenance actions as Condemned, Not-Reparable-This-Station, etc.

Table 2. MDC Off-Equipment Units Vs RTS Units

Cal. Qtr.	82-1	82-2	82-3	82-4	83-1	83-2	83-3	83-4	84-1
MDC Units	3183	2663	2593	2736	3974	4226	6758	6058	6218
RTS Units	3018	3087	3558	3077	3288	2976	3173	2280	2525
MDC% of RTS	105%	86%	72%	89%	120%	142%	212%	265%	246%

FINDING: MDC off-equipment units reported has shown a more than 100 percent increase since Increment VI implementation. Comparison of MDC and Supply data indicates that RTS units are now being fully reported in MDC.

an average of 28 seconds. FMS schedulers took 1 minute, 7 seconds per part without Increment VI or an advantage of 39 seconds for Increment VI users.

For in-shop processing, (see Appendix A, worksheet 1), subprocesses B, C, and D, AMS shops (with Increment VI) took an average of 9 minutes, 30 seconds to in-process each part while FMS shops (without Increment VI) took 11 minutes, 21 seconds.

Ordering bits and pieces took 5 minutes, 52 seconds in AMS shops while FMS shops required an average of 4 minutes, 8 seconds (it took AMS shops longer to fill in AWP data for the automated AFTO 350). Processing NRTS items back to RPC took 6 minutes, 26 seconds in AMS and 8 minutes, 5 seconds in FMS.

When processing parts for return to Supply, AMS RPC schedulers (with Increment VI) took 13 seconds to process a part for return to supply while FMS schedulers took 39 seconds (see Appendix A, worksheet 1, subprocess E). This 26 second advantage for increment VI users resulted from the automation of the AFTO 350 tag.

Avionics production schedulers reported no appreciable change in DIFM reconciliation time. In place of the visible files, schedulers were using the AMS/GPS M376S14 printout and the Shop Repair Cycle Assets Report to validate the R-26 DIFM Listing from Supply. R-26 updates were still accomplished using the handscribed AF Form 1998. An attempt had been made to update the R-26 through a card interface to the Supply computer but was found to produce erroneous data and was discontinued.

Table 1. Increment VI vs Manual Processing Time (*Minutes*)

Subprocess	Average Time AMS	FMS	INC VI DIFF
A Processing parts from RPC to the shops.	0:28	1:07	-:39
B Processing parts for repair in the shop.	9:30	11:21	-1:51
C Ordering repair parts.	5:52	4:08	+1:44
D Close out NRTS action in shop.	6:26	8:05	-1:39
E Processing parts from RPC to Supply.	:13	:39	-:26
TOTAL	22:29	25:20	-2:51

FINDING: Increment VI produced an overall net advantage of 2 minutes 51 seconds per part processed. Manual documentation was reduced, but DIFM reconciliation time was not significantly affected.

BENEFIT 3: Increase accuracy of MDC and supply data.

and found that AMS/GPS status was almost always one day ahead of the supply computer status and in some cases, two days ahead.

FINDING: PARTIALLY MET. The data needed to interface the two systems is available. The disparities of feeding data from a "batch-oriented" scheduling system through a "real-time" maintenance information system to a "batch processed" supply information system has led to problems in the comparability of maintenance data versus supply data. Detailed processing procedures must be developed to insure data timeliness before the two systems are interfaced.

SECTION TWO - POSTULATED BENEFITS:

Benefits 1, 2, 7 and 8 are very closely related. The activities associated with these benefits often overlap. Rather than attempt to assign each activity to an associated benefit, we combined our analysis to cover all four of these postulated benefits.

BENEFIT 1: Reduce the time required to schedule and monitor status of in-work (INW) reparable assets.

BENEFIT 2: Reduce the time required to process components into the repair cycle process.

BENEFIT 7: Reduce the time required for due-in-from-maintenance DIFM listing reconciliation.

BENEFIT 8: Reduce manual documentation required to track the flow of reparables.

ANALYSIS: The above benefits encompass the administrative activities involved in getting a part through the entire repair cycle process. This includes initial RPC processing, shop processing, and RPC processing for return to Supply. We divided the overall process into several sub-processes and broke these down by individual activities as shown in Appendix A, Worksheet 1. We tracked parts through the repair cycle process both in FMS (without Increment VI) and in AMS (with Increment VI) to see if the Increment VI was more efficient. We looked at the manual versus automated documents used to accomplish the activities, along with the average time required to perform the activity with and without Increment VI.

In some cases, we found that Increment VI users were still tracking repair cycle information in shop logs even though the information was available on-line in the computer. This appeared to be a back-up measure in case the computer went down; however, the same information could be kept by simply printing out the shop report 9129. Keeping manual logs was a local management decision which does not take full advantage of Increment VI. Therefore, to provide a more accurate picture of the repair cycle process using Increment VI, manual log entries accomplished by AMS workcenters were not included in the analysis.

For Initial RPC processing, (see Appendix A, worksheet 1), subprocess A, Schedulers using Increment VI in the AMS RPC processed parts to the shops in

ANALYSIS: Job averages (or more properly, "job standards") were present in the system. Shop chiefs and schedulers alike expressed a high degree of confidence in these standards and said they were being used to establish ETJCs and to compute shop backlogs.

FINDING: FULLY MET.

OBJECTIVE 9: Provide on-line input/edit of repair cycle data.

ANALYSIS: User's demonstrated the ability to inquire/edit the full range of repair cycle data. This capability provides a solid basis for development of a maintenance/supply interface. RPC schedulers and shop personnel demonstrated the on-line input and editing of repair cycle data for individual assets. Users expressed a high degree of confidence and satisfaction with this capability.

FINDING: FULLY MET.

OBJECTIVE 10: Provide automated AFTO Form 349 maintenance data collection (MDC) records for repair/calibration actions.

ANALYSIS: Automated MDC had fully replaced manual MDC in the Avionics Maintenance Squadron. Program edits prevented a wide variety of common MDC errors. Users were the strongest supporters of automated MDC because they can now get "do it yourself" on-line MDC feedback. Avionics RPC, PME schedulers and shop personnel demonstrated this capability along with input edits which prevented most types of common errors.

FINDING: FULLY MET.

OBJECTIVE 11: Provide automated AFTO Form 350 reparable item processing tags for repair actions.

ANALYSIS: This capability was fully provided and was being used to process all reparables in the Avionics Maintenance Squadron. Users demonstrated the capability of inputting and printing AFTO Form 350 item processing tags for repair actions.

FINDING: FULLY MET.

OBJECTIVE 12: Provide for an interface with AMS Increment VII to provide real-time tracking of parts from requisition to time of turn in.

ANALYSIS: Increment VI has established the basis for the maintenance/supply interface. The specified data elements for both maintenance and supply requirements to be interfaced are present. However, Increment VI was designed to operate in "real time" while supply repair cycle data is "batch-processed." During peak usage periods, batch processing of AMS/GPS data caused delays in parts processing for turn in. In many cases, repaired parts were not documented by supply closeout time, and consequently were not processed through supply until the following day. Because of this anomaly, a previous attempt to update supply repair cycle data through a card interface proved unworkable. Also, we compared sample R-26 reports to AMS/GPS off-line reports

Subprocess D - Continued

Activities		Average Time
7 AMS	No action required	00 sec
7 FMS	Annotate R-26 report	05 sec
Total process time - AMS		6 min 26 sec
Total process time - FMS		8 min 05 sec

RPC PROCESSING PARTS FOR RETURN TO SUPPLY

Subprocess E - Processing parts from RPC back to Supply.

Activities		Average Time
1 AMS	Inspect documentation attached to part	03 sec
1 FMS	Inspect documentation attached to part	03 sec
2 AMS	Annotate Automated AFTO Form 350	08 sec
2 FMS	Annotate AFTO Form 350	30 sec
3 AMS	Annotate R-26	02 sec
3 FMS	Annotate R-26	02 sec
4 AMS	No Action Required	00 sec
4 FMS	Annotate RPC log	04 sec
Total process time - AMS (Inc VI RPC)		13 sec
Total process time - FMS (Non-Inc VI RPC)		39 sec

Note: In cases where processes were exactly the same for both Increment VI shops and non-Increment VI shops, the overall average time was used.

WORKSHEET 2

a. Evaluation Objective: Determine if AMS Increment VI has reduced time required to process and monitor reparable assets from the RPC viewpoint. Determine if workload has been increased, decreased or unchanged. Determine if users perceive and increase, decrease, or no change in their efficiency as a result of Increment VI implementation.

b. Methodology: Interview RPC and PMEL personnel to determine their perceptions of Increment VI impacts on their jobs.

Organization: Avionics Maintenance RPC and PMEL RPC

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(1) Has AMS Increment VI changed your processing time for assets?

AMS RPC schedulers - It has decreased processing time by about half primarily due to automation of the AFTO Form 350 and the elimination of the scheduling boards.

AMS AWP monitor - It has increased processing time for AWP parts due to the requirement to enter supply data into the maintenance computer. If the maintenance and supply computers could talk to each other this problem would be eliminated.

PMEL scheduler - Automated MDC has decreased processing time for both calibration items and reparables.

(2) Has Increment VI added to your paperwork?

AMS RPC schedulers - It has cut paperwork.

AMS AWP monitor - It has increased paperwork.

PMEL scheduler - It has cut paperwork greatly.

(3) What additional forms are now required?

AMS RPC schedulers - None.

AMS AWP monitor - None, but the amount of information tracked on the AWP visible file has increased.

PMEL Scheduler - None

(4) What new reports must you now fill out or monitor?

AMS RPC schedulers - The on-line 9129 (shop DIFM report) and the off-line VIRP-M376S14 (Shop Repair Cycle Assets Report) replaced the old visible files on the scheduling board.

AMS AWP monitor - The off-line VIRP M376S17 (AMS supply listing for AWP section) must now be compared to the D-19 (AWP validation listing) from supply.

PMEL scheduler - The AMS/GPS master equipment list replaces the old master ID listing from the B-3500.

(5) How much added work time is spent using these reports.

AMS RPC schedulers - About the same amount of time is now spent using these reports as was previously spent using the visible file.

AMS AWP monitor - It now takes 1 to 2 hours longer to complete AWP validation because AWP information now has to be updated in both the maintenance and supply computers.

PMEL scheduler - The AMS/GPS report has resulted in a net savings of time since it is automatically updated by MDC. The old B-3500 master ID listing was always outdated and a lot of time and trouble was spent getting it updated.

(6) What forms are you no longer using as a result of Increment VI? For each form no longer used (if any):

AMS RPC schedulers - The AFTO 350 and the AF 2443 have now been automated.

AMS AWP Monitor - N/A.

PMEL Scheduler - AFTO 350 is now automated.

(7) How long does it take to fill out this form?

AMS RPC schedulers - About 5 minutes to key in the entire AFTO 350. The AF 2443 is automatically completed by the computer. (Note: During stopwatch checks, schedulers routinely input AFTO 350 scheduling data in an average of 15 seconds.)

AMS AWP Monitor - N/A

PMEL Scheduler - Just a few seconds to input the AFTO 350. Before Increment VI it took a couple of minutes.

(8) Has Increment VI changed the number of phone calls and/or visits you used to make to the shops?

AMS RPC Schedulers - Phone calls increased primarily because parts cannot be closed out in the computer until MDC is completed. Shops often get behind in MDC inputs and must be reminded.

AMS AWP Monitor - Phone calls and visits increased because parts cannot be closed out in the computer with bits and pieces on order in supply. If the supply computer could interface with maintenance computer when a part is issued, there would be fewer phone calls required.

PMEL Scheduler - Dramatically decreased. AMS/GPS Management notices have cut the number of items going overdue calibration, reducing the number of times the shop must be called.

(9) What automated reports did you use before Increment VI and what automated reports are you using now?

AMS RPC Schedulers - Mainly the R-26 prior to Increment VI. Now the 9129 report and the VIRP M376S14 have replaced the scheduling boards and visible files while the R-26 is still in use.

AMS AWP Monitor - The D19 prior to Increment VI. Now the VIRP M376S17 has been added.

PMEL Scheduler - The master ID listing from the B-3500 before Increment VI. This was replaced by the AMS/GPS master equipment listing, a much better product.

(10) Are you confident that repair cycle asset (or calibration) status in AMS/GPS is up to date and accurate.

AMS RPC Schedulers - As long as the computer does not go down for more than a couple of hours. However there is little confidence in mockup status (serviceable or unserviceable) in the 9129 report and ETJCs are not updated by shops in a timely manner.

AMS AWP Monitor - The supply computer is more up to date. It takes a lot of work to update AF 2005 information in the maintenance computer.

PMEL Scheduler - Much more confident in calibration status information.

(11) How do the supply R-26 report and AMS/GPS status listings compare for accuracy and timeliness?

AMS RPC Schedulers - The R-26 at the scheduler's board is kept updated continuously (manually). It is the most accurate document.

AMS AWP Monitor - The R-26 is more accurate and timely.

PMEL Scheduler - N/A.

(12) Are you required to reconcile supply listings with AMS/GPS listings.

AMS RPC Schedulers - Yes, but it requires no more time than it did with visible files. Maybe less.

AMS AWP Monitor - Yes and it takes an additional 1 to 2 hours per day.

PMEL Scheduler - N/A

(13) Have shop AWM, AWP, or calibration backlogs been reduced as a result of Increment VI?

AMS RPC Schedulers - AWM has shown as increase on the automated AF 2443. This is because of machine downtime and the shops not updating status in a timely manner.

AMS AWP Monitor - AWP time has increased because the requirement to enter AF 2005 information in the maintenance computer has caused an increase in processing time.

PMEL Scheduler - Backlogs have decreased.

(14) Regarding reparable asset information:

(a) What information should be deleted from AMS/GPS?

AMS RPC schedulers - None.

AMS AWP Monitor - There is no need for tech order, figure, index, and time ordered in the 9131 input.

PMEL Scheduler - None.

(b) What information should be added to AMS/GPS?

AMS RPC Schedulers - An automatic ETJC management notice would be very helpful. The computer should automatically show all ETJC's due in the next hour.

AMS AWP Monitor - It needs to be able to communicate with the supply computer to save inputting the same information into two different computers.

PMEL Scheduler - Job standards for item calibration should be printed on the AFTO Form 350.

(c) What changes should be made to screen input/output formats?

AMS RPC Schedulers - There should be a way to terminate the 9129 report and to back up to previous pages. Currently, you have to keep pressing PA1 until you get to the end of the report and some shops have 20 to 30 page reports. (Note: This problem has now been corrected.)

AMS AWP Monitor - The 9131 input screen needs to be easier to follow and should not require so many inputs. Better yet, it could be eliminated altogether if the supply computer could send the maintenance computer AF Form 2005 information.

PMEL Scheduler - The discrepancy block on the AFTO Form 350 needs to be longer.

(d) What changes should be made to print out formats?

AMS RPC Schedulers - The AFTO Form 350 printed copy gets greasy, wadded up and unusable. Having to get a new copy printed out is an irritant and you cannot get a new copy when the computer is down. The AFTO Form 350 should be printed on cardboard.

AMS AWP Monitor - None.

PMEL Scheduler - None.

(15) Is Increment VI response time adequate for your needs?

AMS RPC Schedulers - Yes except around 1330 to 1530 the shops bog down the system.

AMS AWP Monitor - Yes.

PMEL Scheduler - Yes except an hour or so before the day shift gets off, response time gets pretty slow.

WORKSHEET 3

a. Evaluation Objective: Determine if AMS Increment VI has eliminated the time required to compute shop backlogs.

b. Methodology: Through interviews with RPC schedulers in AMS and FMS, define the individual steps involved in gathering backlog information and computing shop backlogs. Through stopwatch studies, quantify the time required to perform shop backlog computations manually.

Process - Computing shop backlogs.	
Description of Activity	
1. Count AWM INW units each shop from visible file.	
2. Count AWM INW hours each shop from visible file.	
3. Get local manufacture AWM INW units/hours from local manufacture monitor.	
4. Call shop for other in shop AWM and INW units/hours.	
5. Summarize on AF Form 2443.	
Total time to perform in FMS	32 min 30 sec
Total time to perform in AMS (automatically computed)	0 min 08 sec

Note: In FMS, these activities were not performed in finite sequence, so we measured the overall time to compute the backlog. In AMS, the scheduler requested the shop backlog report from the AMS/GPS terminal and the automated AF 2443 was displayed in 8 seconds.

APPENDIX B

HUMAN FACTORS ASSESSMENT

AIR FORCE HUMAN RESOURCES LABORATORY
WRIGHT-PATTERSON AFB, OHIO
MAY 1984

INTRODUCTION:

The AMS Test Program is designed to test the impact and usefulness of automating aircraft maintenance management processes using the database of the C-5 Malfunction Detection Analysis and Recording System (MADARS) and the associated Ground Processing System (GPS). This program provides an opportunity to exploit computer technology to assist management in a direct mission support maintenance environment. The program is being implemented in seven increments, and is being evaluated in an operational base environment at Dover AFB, Delaware. The Air Force Logistics Management Center (AFLMC) has overall program evaluation responsibility, with the Air Force Human Resources Laboratory (AFHRL) participation limited to evaluation of user acceptance and user perception of usability of the system. The acceptance and usability evaluation for Increment VI, Maintenance Production Scheduling Process was conducted during the period from 14 through 17 November 1983. A follow-on evaluation was conducted on 9 and 10 May 1984. This report is submitted to summarize the findings of the follow-on evaluation of Increment VI.

The overall program is designed to increase the effectiveness of maintenance management personnel by providing real-time updating of maintenance information, computer generation of aircraft maintenance forms, and elimination of the requirement for certain manual files. Increment VI, Maintenance Production Scheduling Process is responsible for the management and scheduling of two areas: repair cycle assets and precision measurement equipment. The repair cycle asset control system provides for processing, accountability and control of repair cycle items. The precision measurement equipment scheduling function manages and schedules calibration and repair of requirement precision measurement equipment.

PURPOSE:

The purpose of this study was to reevaluate the attitudes of maintenance personnel toward the changes incorporated by Increment VI of the AMS Test Program.

METHOD:

Questionnaires and interviews were used to collect data from personnel in the 436th MAW who are primary users of the new processes. A total of 30 questionnaires were distributed to various individuals. All individuals were chosen randomly throughout the using workcenters.

1. Training - Surveys showed a drastic change from the November evaluation in requirements (reference question V-F). In November, 22% of the surveys stated that lack of training was one of the largest problems with Increment VI. This was only reflected on 5% of the May surveys. Responses to questions in Section II indicate relatively little training is required to understand and use the system. This indicates it is an extremely user-friendly system.

2. Difficulty in Implementation - Responses to all items in Section III of the questionnaire indicate tasks affected by the Increment VI are easier to do with the new system than with the old method. There is a noticeable

difference in responses to the November and May surveys. Responses to the November survey indicated only 5 of the 7 tasks are easier with the new system. The May survey indicated that all tasks are easier. Also, the percentages of positive responses to each question were from 10 to 20 percent higher than for the May survey. These results indicate as they gain experience with the system, more technicians find the task easier to perform using the new system than using the old method.

3. Usability - The usability and user friendliness of the system were highly praised in the most recent interviews. These comments are generally supported by responses to Section IV of the questionnaire. Again, there was a definite trend toward more positive response to the survey questions in May than in November. For example, 63 percent of the responses to question IV-A indicated the new method is less difficult to learn than the old method. In November, only 17 percent indicated the new method is easier.

4. User Acceptance - Responses in this area indicate the system is well accepted by the users and it provides them with the information they need to do their jobs. Most (63 percent) felt that Increment VI should be permanently added to the Ground Processing System. Again, the responses in May were noticeably more positive than the responses in November.

DISCUSSION:

This study has provided information on acceptance and usability of Increment VI of the AMS Test Program. The evaluation is based strictly on the results of questionnaires and on personal interviews. Attachment 1 shows both the results of the November evaluation and the May reevaluation. There was a noticeable increase in the positive attitudes toward Increment VI after it had had time to grow and mature. Personnel were better utilizing the available products and the efficiency of the system has improved considerably. The overall feeling expressed by the users; it is getting better and better with time.

RECOMMENDATIONS:

1. Continue to observe the effects of AMS on maintenance efficiency and sortie production.

2. Implement Increment VII as soon as possible and develop more uses of the system.

3. Accept user inputs to improve the system.

4. Try to incorporate as many aspects of AMS as possible into the Core Automated Maintenance System (CAMS).

Attachment 1

GROUND PROCESSING SYSTEM (GPS) INCREMENT VI
IMPLEMENTATION QUESTIONNAIRE

The Ground Processing System (GPS) has been modified to provide greater maintenance management processes through automation. These processes are to be accomplished in seven increments. Thus far, increments one through six have been implemented.

The Air Force Human Resources Laboratory has been requested to determine user perceptions of and acceptance of the new processes and products which resulted from implementing the new system.

This questionnaire has been designed specifically to ascertain your views on Increment VI, Maintenance Production Scheduling Process.

Your response to this questionnaire will aid the Laboratory in determining user perception of system usability, user acceptance and difficulties encountered during system implementation. In addition, any comments you may have concerning the acceptance, usability or implementation of the entire GPS program (Increments I-VI) not covered herein can be stated on the back of this questionnaire. All responses to this questionnaire will be kept in strict confidence.

I. POPULATION PROFILE

A. What is your job title?

B. What is your AFSC?

C. How long have you been at your present job?

INDICATE YOUR RESPONSE TO THE REMAINING QUESTIONS BY MARKING AN "X" NEXT TO THE APPROPRIATE ANSWER.

II. TRAINING

A. How much formal (classroom) training on Increment VI did you receive prior to implementation?

May 84			Nov 83
70%	(1)	None	87%
7%	(2)	One Hour	3%
13%	(3)	Two Hours	3%
3%	(4)	Four Hours	3%
7%	(5)	Six or More Hours	3%

B. How much on-the-job training on Increment VI did you receive prior to implementation?

May 84			Nov 83
60%	(1)	None	53%
7%	(2)	One Hour	27%
17%	(3)	Two Hours	3%
3%	(4)	Four Hours	3%
13%	(5)	Six or More Hours	13%

C. How much additional training time do you feel would be required to fully understand the new system? (On reverse please indicate in what areas you would increase training.)

May 84			Nov 83
57%	(1)	None	33%
10%	(2)	One Hour	10%
20%	(3)	Two Hours	3%
3%	(4)	Four Hours	27%
10%	(5)	Six or More Hours	27%

D. How much training time could be deleted from the formal classroom training you received on Increment VI and still be adequate? (On reverse please indicate what areas of training could be deleted.)

May 84			Nov 83
33%	(1)	None	17%
3%	(2)	One Hour	0%
3%	(3)	Two Hours	3%
3%	(4)	Four Hours	0%
0%	(5)	Six or More Hours	3%
57%	(6)	Did Not Receive Formal Training	77%

III. DIFFICULTY IN IMPLEMENTATION

During the implementation phase of Increment VI, how would you describe the amount of difficulty you encountered performing the following tasks when compared to the old method?

A. Monitoring the status of due-in-from-maintenance (DIFM) items:

May 84			Nov 83
10%	(1)	More difficult than before	23%
3%	(2)	No Change	10%
43%	(3)	Less Difficult than Before	30%
43%	(4)	No Comment	37%

B. Monitoring the status of precision measurement equipment (PME):

May 84			Nov 83
3%	(1)	More difficult than before	17%
23%	(2)	No Change	17%
43%	(3)	Less Difficult Than Before	27%
33%	(4)	No Comment	40%

C. Determining the location and status of an individual repair cycle asset:

May 84			Nov 83
10%	(1)	More difficult than before	30%
20%	(2)	No Change	23%
33%	(3)	Less Difficult than Before	17%
37%	(4)	No Comment	30%

D. Determining labor hour backlog for off-equipment work and for PME assets awaiting repair/calibration:

May 84			Nov 83
17%	(1)	More difficult than before	7%
0%	(2)	No Change	27%
50%	(3)	Less Difficult than Before	23%
33%	(4)	No Comment	43%

E. Monitoring estimated times of job completion (ETJC) for off-equipment/ PMC work orders:

May 84			Nov 83
13%	(1)	More difficult than before	3%
13%	(2)	No Change	33%
27%	(3)	Less Difficult Than Before	10%
47%	(4)	No Comment	53%

F. Monitoring mission capability (MICAP) repair cycle assets:

May 84			Nov 83
0%	(1)	More difficult than before	10%
13%	(2)	No Change	17%
27%	(3)	Less Difficult Than Before	13%
60%	(4)	No Comment	60%

G. Determining job averages for component repair/calibration:

May 84			Nov 83
3%	(1)	More difficult than before	3%
17%	(2)	No Change	27%
30%	(3)	Less Difficult Than Before	13%
50%	(4)	No Comment	57%

IV. USABILITY

A. How would you describe your experiences in learning the new processes?

May 84			Nov 83
13%	(1)	More difficult to learn than the Previous Methods.	47%
40%	(2)	No Differences in Learning the two Processes.	37%
63%	(3)	Less Difficult to Learn Than the Previous Methods.	17%

B. How would you describe your experiences in retrieval of data with the new system?

May 84			Nov 83
17%	(1)	More difficult to Retrieve the Data I Want.	30%
33%	(2)	No Difference in Retrieval Times.	17%
50%	(3)	Easier to Retrieve the Data.	53%

C. Do you find the language/terminology used in the new system hard to understand or confusing:

May 84			Nov 83
0%	(1)	Frequently	3%
27%	(2)	Occasionally	3%
40%	(3)	Seldom	67%
33%	(4)	Never	27%

D. How has the new system affected the number of phone calls between the concerning Work Centers?

May 84			Nov 83
13%	(1)	Increased the Number of Calls.	13%
37%	(2)	No Change in the Number of Calls.	73%
50%	(3)	Decreased the Number of Calls.	13%

E. Do you feel that the automated GPS System is reliable (operational) when you need it?

May 84			Nov 83
63%	(1)	Yes	60%
37%	(2)	No	40%

F. As compared with the previous methods, how has data accessibility from the automated system affected your efficiency?

May 84			Nov 83
40%	(1)	Increased my Efficiency Significantly.	13%
23%	(2)	Increased my Efficiency Slightly	30%
17%	(3)	No Change.	27%
17%	(4)	Decreased my Efficiency Slightly	13%
3%	(5)	Decreased my Efficiency Significantly	17%

G. The new automated GPS systems have eliminated the need to maintain an AFTO Form 349 file.

May 84			Nov 83
33%	(1)	I Strongly Agree	17%
23%	(2)	I Agree	30%
13%	(3)	I am Neutral	7%
10%	(4)	I Disagree	23%
3%	(5)	I Strongly Disagree	13%
17%	(6)	No Comment	10%

H. The availability of a machine-resident file containing DIFM and PME assets status has been of benefit to me in my job.

May 84			Nov 83
27%	(1)	I Strongly Agree	10%
27%	(2)	I Agree	30%
13%	(3)	I am Neutral	20%
3%	(4)	I Disagree	3%
3%	(5)	I Strongly Disagree	7%
13%	(6)	No Comment	3%
13%	(7)	I Do Not Use That Information	27%

I. The maintenance of a machine-resident file of standards/job averages for calculation of repair times and estimated in-commission times has been of benefit to me in my job.

May 84			Nov 83
20%	(1)	I Strongly Agree	7%
20%	(2)	I Agree	7%
10%	(3)	I am Neutral	27%
7%	(4)	I Disagree	3%
3%	(5)	I Strongly Disagree	7%
10%	(6)	No Comment	10%
30%	(7)	I Do Not Use That Information	40%

J. The availability of determining by video display terminal the number of personnel engaged in a specific task has been of benefit to me.

May 84			Nov 83
30%	(1)	I Strongly Agree	3%
23%	(2)	I Agree	10%
3%	(3)	I am Neutral	20%
13%	(4)	I Disagree	10%
3%	(5)	I Strongly Disagree	7%
7%	(6)	No Comment	10%
20%	(7)	I Do Not Use That Information	40%

K. Having complete machine-resident job standards have helped in establishing Estimated Time In Commission (ETIC).

May 84			Nov 83
23%	(1)	I Strongly Agree	3%
17%	(2)	I Agree	7%
43%	(3)	I am Neutral	57%
10%	(4)	I Disagree	20%
7%	(5)	I Strongly Disagree	13%

L. With this new system, I have encountered difficulties in generation of work orders.

May 84			Nov 83
0%	(1)	Yes, Frequently	13%
27%	(2)	Yes, Occasionally	37%
43%	(3)	No, Seldom	40%
30%	(4)	Never	10%

M. With this new system, I have encountered difficulties in monitoring work orders.

May 84			Nov 83
0%	(1)	Yes, Frequently	7%
20%	(2)	Yes, Occasionally	53%
43%	(3)	No, Seldom	33%
30%	(4)	Never	7%

N. As compared with the previous methods, I have encountered difficulties when an asset has extended delays.

May 84			Nov 83
3%	(1)	Yes, Frequently	10%
37%	(2)	Yes, Occasionally	30%
27%	(3)	No, Seldom	53%
33%	(4)	Never	7%

O. As compared with the previous methods, I have encountered difficulties in the close out of work orders.

May 84			Nov 83
10%	(1)	Yes, Frequently	30%
40%	(2)	Yes, Occasionally	33%
23%	(3)	No, Seldom	30%
27%	(4)	Never	7%

V. USER ACCEPTANCE

COMMENTS ABOUT YOUR ANSWERS ARE ENCOURAGED. THESE MAY BE WRITTEN ON THE BACK OF THE PAGES. PLEASE INDICATE THE LETTER OF THE QUESTION YOU ARE RESPONDING TO BEFORE WRITING YOUR COMMENTS.

A. Overall, how did Increment VI, Production Scheduling affect your job?

May 84			Nov 83
13%	(1)	Made it More Difficult	33%
33%	(2)	Made it Easier	20%
17%	(3)	Made it Longer	30%
7%	(4)	Made it Shorter	0%
30%	(5)	No Change	17%

B. In your opinion, is Increment VI a success?

May 84			N 3
33%	(1)	Yes	57%
20%	(2)	No	23%
47%	(3)	No Opinion	20%

C. Should Increment VI, Production Scheduling be permanently added to the Ground Processing System?

May 84			Nov 83
63%	(1)	Yes	50%
10%	(2)	No	30%
27%	(3)	Don't Know	20%

D. Was the information you required to do your job readily available with Increment VI?

May 84			Nov 83
70%	(1)	Yes	57%
20%	(2)	No	37%
10%	(3)	I Do Not Require Information From System	7%

E. Do you feel the information available from the new automated system is satisfactorily accurate for your job?

May 84			Nov 83
67%	(1)	Yes	73%
17%	(2)	No	17%
17%	(3)	I Do Not Require Information	10%

F. What do you feel is the largest problem with Increment VI? (Indicate as many as you feel are applicable.)

May 84			Nov 83
7%	(1)	Errors in Data	12%
10%	(2)	Availability of System Hardware (Terminal Available to Work on)	15%
35%	(3)	Computer Down-time	25%

G. Did you have any trouble learning to use GPS, specifically those processes associated with Increment VI, in order to obtain the data necessary to perform your job?

May 84			Nov 83
10%	(1)	Yes, a Lot	0%
30%	(2)	Yes, Some	40%
60%	(3)	No	60%

H. Would you recommend that Increment VI be incorporated throughout the Air Force?

May 84			Nov 83
53%	(1)	Yes	57%
17%	(2)	No	23%
30%	(3)	No Opinion	20%

END

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