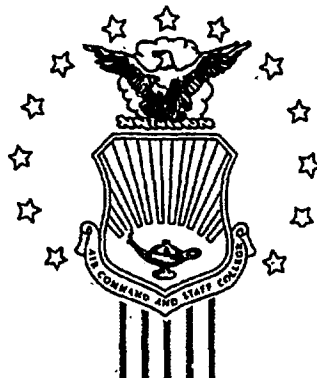


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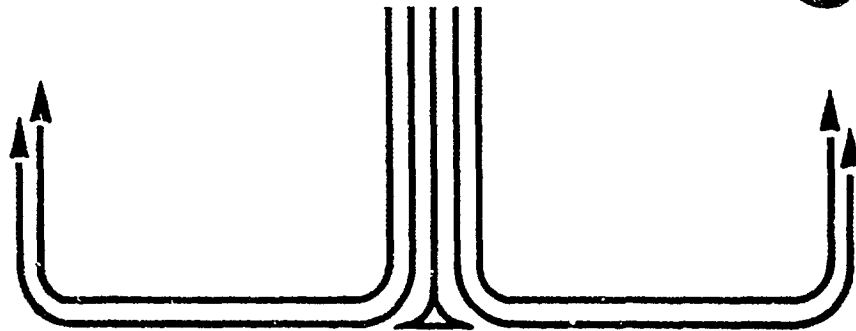
AIR COMMAND AND STAFF COLLEGE

STUDENT REPORT

EVENT-CENTERED SCHEDULING PROGRAM:
THE NEED FOR PERT IN C-141 ISO
INSPECTION MANAGEMENT

MAJOR KENT A. MUELLER 88-1925
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REPORT NUMBER 88-1925

TITLE EVENT-CENTERED SCHEDULING PROGRAM: THE NEED
FOR PERT IN C-141 ISO INSPECTION MANAGEMENT

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Submitted to the faculty in partial fulfillment of
requirements for graduation.

AIR COMMAND AND STAFF COLLEGE
AIR UNIVERSITY
MAXWELL AFB, AL 36112-5542

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE				Form Approved OMB No. 0704-0188	
1a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED			1b. RESTRICTIVE MARKINGS		
2a. SECURITY CLASSIFICATION AUTHORITY			3. DISTRIBUTION/AVAILABILITY OF REPORT		
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE					
4. PERFORMING ORGANIZATION REPORT NUMBER(S) 88-1925			5. MONITORING ORGANIZATION REPORT NUMBER(S)		
6a. NAME OF PERFORMING ORGANIZATION ACSC/EDC		6b. OFFICE SYMBOL (if applicable)	7a. NAME OF MONITORING ORGANIZATION		
6c. ADDRESS (City, State, and ZIP Code) Maxwell AFB, AL 36112-5542			7b. ADDRESS (City, State, and ZIP Code)		
8a. NAME OF FUNDING/SPONSORING ORGANIZATION		8b. OFFICE SYMBOL (if applicable)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER		
8c. ADDRESS (City, State, and ZIP Code)			10. SOURCE OF FUNDING NUMBERS		
			PROGRAM ELEMENT NO.	PROJECT NO.	TASK NO.
11. TITLE (Include Security Classification) UNCLASSIFIED EVENT-CENTERED SCHEDULING PROGRAM: THE NEED FOR PERT IN C-141 ISO MANAGEMENT					
12. PERSONAL AUTHOR(S) Mueller, Kent A., Major, USAF					
13a. TYPE OF REPORT		13b. TIME COVERED FROM _____ TO _____		14. DATE OF REPORT (Year, Month, Day) 1988 April	
15. PAGE COUNT 66					
16. SUPPLEMENTARY NOTATION					
17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)		
FIELD	GROUP	SUB-GROUP			
19. ABSTRACT (Continue on reverse if necessary and identify by block number) Scheduled inspections, specifically the C-141 Isochronal Major, consume a significant amount of time as currently managed. The study proposes that Program Evaluation Review Technique (PERT) methods be applied to this flow management process to produce optimized inspection flow plans. Harvard Total Project Manager (HTPM) software is used to build an optimized flow which demonstrates the potential for flow day savings if attention is shifted from scheduling within a block of time to resequencing of events. The study concludes that current desktop project planning software can be integrated into the ISO flow management process. (S)					
20. DISTRIBUTION/AVAILABILITY OF ABSTRACT ☐ UNCLASSIFIED/UNLIMITED ☒ SAME AS RPT. ☐ DTIC USERS			21. ABSTRACT SECURITY CLASSIFICATION UNCLASSIFIED		
22a. NAME OF RESPONSIBLE INDIVIDUAL ACSC/EDC Maxwell AFB, AL 36112-5542			22b. TELEPHONE (Include Area Code) (205) 293-2867		22c. OFFICE SYMBOL

PREFACE

For years the art of aircraft production scheduling has remained largely unchanged, while the science associated with it has been altered dramatically. As the demands for airlift have increased, the incentive to increase productivity in maintenance management have risen as well. Within the constraints of our old methods and tools great improvements have been made, but we have now reached the part of the production curve which demands too great a price for further gains without change.

This paper is aimed at a possible method to make a leap into new and economical scheduling techniques for C-141 Isochronal Major Inspections. Techniques which might provide further economies in industrial activities, the end result of which will be additional useable aircraft on a daily basis. I call it Event-centered Scheduling Program (ESP), but it is simply a basic application of commercially available project management software. Centered in the Program Evaluation Review Technique, the program will run on any IBM or compatible computer, and provide real-time event management. It constantly recalculates the project critical path and is capable of work schedule building and resource deconfliction.

When applied to the Isochronal Inspection it is possible to create flow time savings without expending additional man-hours. The key is the program's ability to instantly compute event relationships. I believe that the model, although simplified to meet the constraints of this project, demonstrates that savings may be achieved through a change to Event-centered Scheduling and the use of modern production management software.

I would like to acknowledge the assistance of Headquarters MAC/LGXA and MAC/IGF, and especially 438th MAW/MAM and the 438th Organizational Maintenance Squadron.

ABOUT THE AUTHOR

MAJOR KENT A. MUELLER

Major Mueller is an Aircraft Maintenance Officer with thirteen years of experience. He earned his commission through the Reserve Officer Training Corps, graduating from the University of Missouri in 1975 with a Bachelor of Journalism degree. He holds a Master of Arts degree in Industrial Management from Central Michigan University which he completed in 1978.

He began his duties at Charleston Air Force Base, South Carolina, as a C-141 Flightline Supervisor, later serving as Branch Officer in Charge in both Organizational and Avionics Maintenance Squadrons. He rounded out his experience at Charleston as a Wing Job Control Duty Officer and was the senior maintenance officer in Zaire during the airlift of May of 1978. Next assigned to Hickam Air Force Base, Hawaii, Major Mueller was the Avionics Maintenance Supervisor supporting both the 6594th Test Group (AFSC), and the CINCPAC airborne command post aircraft of the 9th Airborne Command and Control Squadron (PACAF). He then began duties as the 834th Airlift Division Staff Maintenance Officer and Chief of the Logistics Readiness Center (LRC). Returning from overseas he became Chief of the Management Function, 21 Air Force, McGuire Air Force Base, and later Chief of the 21 Air Force LRC, a position from which he directed resupply of maintenance units during operation Urgent Fury, the liberation of Grenada.

Most recently Major Mueller was the Maintenance Supervisor of the 438th Organizational Maintenance Squadron, McGuire Air Force Base, New Jersey. He led over 580 people in the maintenance of 58 assigned C-141B aircraft.

Major Mueller was a 1982 Airlift Association Young Leadership Award winner, 1984 21 Air Force Junior Officer of the Year, a 1985 MAC nominee to the Ten Outstanding Young Americans competition, and was selected as the 1986 USAF Company Grade Aircraft Maintenance Manager of the Year.

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EXECUTIVE SUMMARY



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"insights into tomorrow"

REPORT NUMBER 88-1925

AUTHOR(S) MAJOR KENT A. MUELLER, USAF

TITLE EVENT-CENTERED SCHEDULING PROGRAM: THE NEED
FOR PERT IN C-141 ISO INSPECTION MANAGEMENT

I. Purpose: To demonstrate an alternative approach to Isochronal Inspection work flow management using commercially available program management software.

II. Problem: Although improvements in workcenter management have occurred, efficiency and productivity in scheduled inspections have not kept pace with reductions in manpower and increasing demands for airlift resources. In addition, Program Evaluation Review Technique (PERT) methods were formerly not practical due to mainframe computer support requirements and complex data capture mechanics. Therefore, current inspection management techniques have not been designed to minimize flow times, but more to allocate manpower within established blocks of flow time. Automation at the C-141 units supports the current inspection method, but does not provide for flow planning optimization. To achieve increased efficiency in flow planning, event-centered thinking must be adopted and expressed through a PERT project management software program.

CONTINUED

III. Model: The models, ISO 1, ISO 2 and ISO 3 are constructed using the Harvard Software, Harvard Total Project Manager (HTPM) program. The events in the model are the C-141 Isochronal Inspection basic "look phase" items. The flow is expressed in inspection package job control numbers using activity times which are a blend of standard, three month average and random selection. Progressively event-centered, the PERT roadmaps for ISO 1, ISO 2 and ISO 3 demonstrate how savings might occur, as well as the utility of the program's simulation capability in the context of a suggested event-centered flow scheduling cycle.

IV. Conclusions: Event-centered scheduling achieved through such software application does demonstrate possible savings. To make the system work, however, workcenter manpower scheduling will have to be responsive to a flow plan that can be constantly reoptimized as activity times change.

V. Recommendations: Military Airlift Command aircraft maintenance managers, the Air Force Logistics Command C-141 System Program Manager, and Air Force Logistics Management Center aircraft maintenance managers should examine the feasibility of using desktop PERT application software to improve C-141 inspection flow management.

Chapter One

CURRENT GUIDANCE: IF IT'S WORKING, WHY FIX IT?

In the late 1960's the Military Airlift Command (MAC) maintenance engineering community took a look at the airlines and noticed the similarities in maintenance activities and daily requirements for airframes. Under the direction of Air Force Logistics Command, the Maintenance Steering Group-2 (MSG-2) zonal inspection system was developed by C-141 System Program Manager engineers and maintenance management experts. Within that system the Isochronal Inspection System took the basic shape we find it in today. On the surface it appears comprehensive, providing safe and serviceable airframes to meet the daily MAC mission. According to Headquarters Military Airlift Command Flying Safety (IGFF), the C-141 has compiled one of the safest records in aviation history with an average between 1984 and 1987 of only .245 major accidents per 100,000 flying hours.(13:--). The quality of scheduled maintenance being an undeniable part of this equation, why mess with success? The answer is efficiency. With demands for airlift up in 1986 and early 1987, and the fleet of active C-141s down due to transfers to the Air Reserve Forces, there is no room for slack in scheduling. Therefore, total airframe availability days become crucial determinants of the responsiveness of our airlift wings. Just what is an "airframe availability day"? In simplest terms on a yearly basis, it is the number of mission ready airplanes times the number of days per year they are available for missions. Because it is more susceptible to planning efforts, the most lucrative target to increase availability is the time spent in scheduled maintenance, specifically the major inspection. Event-centering, using Program Evaluation Review Technique (PERT) methods, can produce savings. (2:5) To demonstrate this I will begin with a tour of the Isochronal (ISO) Inspection, a discussion of current general policy and practices in scheduling, and the shortcomings of some of the current inspection management methods.

What is the Isochronal (ISO) Inspection, what is our current methodology, and just what do we have to gain? Let's begin with a look at the inspection program itself.

Officially, it is described as follows. "The planned inspection and maintenance concept provides a method of performing required inspections and repairs on a scheduled and planned basis." (8:4-1) One of four approved inspection concepts, the ISO is the most comprehensive inspection performed on the C-141 at the unit level. (7:2-1) It is part of an inspection system that includes the Preflight, Basic Postflight, Home Station Check and Minor and Major inspections. According to TO 00-20-5, "the major inspection is due upon the accrual of the number of calendar days established as the inspection interval in the applicable -6." (7:2-6) All these inspections use a zonal system. That is, the technician has specific items to inspect, but also is responsible for "areas" around those items. (9:1-02) See Figures 1, 2 and 3.

Understanding the basic mechanics of the inspection deck, and the inspection interval helps one understand how PERT scheduling can be applied. I will confine this analysis to the Major ISO. The inspection is printed on 225 cards and is carried out within the guidelines of Technical Order 00-20 series publications and MAC Regulation 66-1. (6:31) A Major or Minor Inspection is due every 200 days. (This recent change based upon a proposal from the 438th Military Airlift Wing at McGuire AFB, New Jersey, raised the interval from 150 days.) The inspection card deck, the 1C-141B-6WC-5, includes both general guidance such as inspection interval, specific inspection requirements and descriptions of the zones to be inspected. (9:--) (See Figures 4 and 5) The deck was prepared and is maintained by the C-141 System Program Manager in cooperation with Military Airlift Command. (8:4-1) For the purposes of this analysis, the inspection items on the cards grouped by Air Force Specialty Code (AFSC) or specific Work Unit Codes (WUC) areas will be treated as PERT activities. Groups of cards are often scheduled on a single work order. For example in our inspection data (appendix A), Job Control Number (JCN) C101 calls for cards M-130 and M-132 through 135 to be accomplished. These groupings will be considered single activities in my discussion and model.

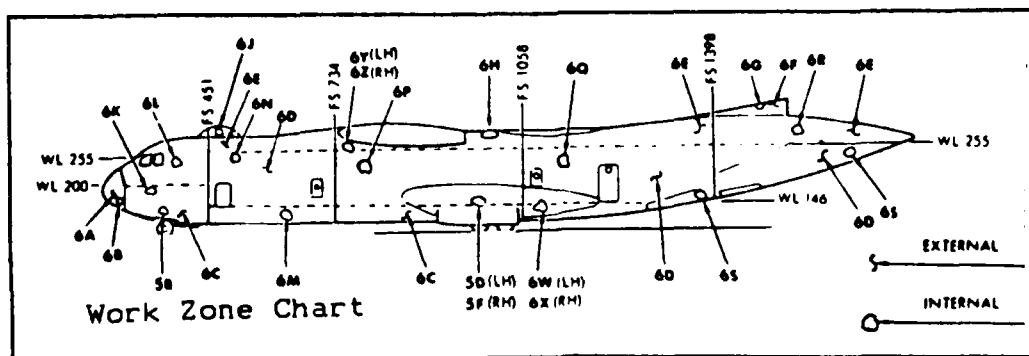


Figure 0

CARD NO 1-02	WORK AREA(S)	TYPE MECH RQR	MECH NO	CARD TIME	PUBLICATION NUMBER AND DATE 1C-141B-6WC-5 10 JUN 83	CHANGE NO
MAN MIN	WORK UNIT CODE SYS SUB-SYS AND COMP	INTRODUCTION			ELECTRICAL POWER	CARD NO 1-02
		1. THIS WORK CARD DECK CONTAINS TWO TYPES OF INSPECTION REQUIREMENTS: A. SPECIFIC INSPECTION REQUIREMENTS IDENTIFY SPECIFIC ITEMS TO BE INSPECTED AND LIST THE CONDITIONS TO BE SOUGHT. B. ZONAL INSPECTION REQUIREMENTS ARE EQUALLY AS IMPORTANT AS SPECIFIC REQUIREMENTS. THESE REQUIREMENTS WHICH ARE PRECEDED BY THE WORD "OBSERVE" ARE GENERAL CONDITION INSPECTIONS OF ZONAL AREAS FOR OBVIOUS DEFECTS. WHEN COMPLYING WITH THESE INSPECTION REQUIREMENTS, MAINTENANCE PERSONNEL WILL REFER TO THE "ZONE OBSERVATION" CARD FOR SPECIFIC CONDITIONS TO BE SOUGHT. 2. ACCOMPLISHMENT OF ZONAL INSPECTION REQUIREMENTS IS THE RESPONSIBILITY OF A MECHANIC/SPECIALIST DESIGNATED ON A WORK CARD WITH A TASK BEGINNING WITH THE WORD "OBSERVE." HOWEVER, EACH ADDITIONAL MECHANIC/SPECIALIST TASKED WITH SPECIFIC INSPECTION REQUIREMENTS WITHIN THE WORK ZONE WILL BE RESPONSIBLE TO "OBSERVE" BOTH THE ITEM BEING INSPECTED AND ALL ASSOCIATED EQUIPMENT/COMPONENTS FOR OBVIOUS DEFECTS. THE RESPONSIBLE MECHANIC/SPECIALIST IS NOT REQUIRED TO MAKE JUDGEMENTAL				
CARD NO 1-02	WORK AREA(S)	TYPE MECH RQR	MECH NO	CARD TIME	PUBLICATION NUMBER AND DATE 1C-141B-6WC-5 10 JUN 83	CHANGE NO

Figure 1

MAP BIN	WORK AREA	WORK UNIT CODE		INTRODUCTION	ELECTRICAL POWER	SERVICE	FIGURE	CARD NO.
		SYS	SUB-SYS AND COMP					
				INTRODUCTION DECISIONS CONCERNING THE VALIDITY OF THE "OBSERVED" DISCREPANCY, BUT IS ONLY REQUIRED TO REPORT AND DOCUMENT THE DISCREPANCY TO ALLOW FINAL DETERMINATION AS TO ITS VALIDITY TO BE MADE BY THE SPECIFIC SPECIALIST.				1-02
				3. WORK ZONE DESCRIPTIONS HAVE BEEN DEVELOPED FOR THE AIRCRAFT. THESE ZONES ARE ILLUSTRATED AND DEFINED ON THE "WORK ZONE CHARTS" AND "ZONAL DESCRIPTION" CARDS IN THIS DECK.				
				4. WHEN WORK CARD DECKS ARE SEPARATED BY SPECIFIC WORK AREAS, THE "ZONAL DESCRIPTION" FOR THE AREA AND THE "ZONE OBSERVATION" CARDS WILL ACCOMPANY EACH SEGMENT OF THE WORK DECK. REQUIRED CARDS WILL BE LOCALLY REPRODUCED.				
				5. THE MINOR/MAJOR INSPECTIONS WILL BE ACCOMPLISHED IN ACCORDANCE WITH THE UTILIZATION CHART SHOWN ON WORK CARD (1-22). IN THE EVENT PROGRAMMED FLYING HOURS ARE CHANGED, ADJUSTMENTS WILL BE MADE TO THE INSPECTION INTERVAL AS REFLECTED ON WORK CARD (1-22). EACH USING COMMAND WILL BE RESPONSIBLE FOR MAKING NECESSARY ADJUSTMENTS.				

Figure 2

CARD NO. I-03	WORK AREA(S)	TYPE MECH REQ	MECH NO	CARD TIME	PUBLICATION NUMBER AND DATE IC-141B-6WC-5 10 JUN 83	CHANGE NO. 2
MAIN MIN	WORK UNIT CODE SYS SUB-SYS AND COMP	INTRODUCTION				CARD NO. I-03
		6. (CONTINUED FROM PREVIOUS CARD) OVERFLYING/UNDERFLYING A SCHEDULED MINOR/MAJOR INSPECTION WILL HAVE NO BEARING ON SCHEDULED INSPECTION DUE TIME. IF A REQUIREMENT EXISTS TO OVERFLY A MINOR/MAJOR INSPECTION THE RED DASH WILL BE APPLIED IAW TO 00-20-5. ACCOMPLISHMENT OF MORE THAN ONE MINOR/MAJOR INSPECTION AT ANY TIME IS NOT AUTHORIZED. INCLUDED IN EACH MINOR/MAJOR INSPECTION ARE REQUIREMENTS FOR CHECKING CERTAIN COMPONENTS. AREAS AND SYSTEMS OF AIRCRAFT TO DETERMINE THAT NO CONDITION EXISTS WHICH IF NOT CORRECTED, COULD RESULT IN FAILURE OR MALFUNCTION OF THE COMPONENT PRIOR TO THE NEXT SCHEDULED MINOR/MAJOR INSPECTION.				
		7. THE MAN-MINUTES ON THE INSPECTION WORK CARDS IS TIME REQUIRED TO ACCOMPLISH EACH INDIVIDUAL INSPECTION ITEM. THIS DOES NOT INCLUDE PREPARATION OR REPAIR TIME. THIS TIME CAME FROM SERVICE TEST USING AN AVERAGE SKILLED MECHANIC/SPECIALIST TO ACCOMPLISH THE WORK PRESCRIBED BY THE CARD. THE TIME DEPICTED IS NOT INTENDED TO REFLECT THE MAXIMUM INSPECTION TIME, THE TIME TO PERFORM INSPECTIONS WILL VARY WITH EACH INDIVIDUAL INSPECTOR.				
CARD NO. I-03	WORK AREA(S)	TYPE MECH REQ	MECH NO	CARD TIME	PUBLICATION NUMBER AND DATE IC-141B-6WC-5 10 JUN 83	CHANGE NO. 2

Figure 3

CARD NO. 1-09	WORK AREA(S)	TYPE MECH INQ	MECH NO.	CARD TIME	PUBLICATION NUMBER AND DATE 1C-141B-6WC-5	10 JUN 83	CHANGE NO.
MAIN WIR	WORK UNIT CODE SYS SUB-SYS AND COMP	INTRODUCTION			INSPECTION REQUIREMENTS	SERVICE	FIGURE
							CARD NO. 1-09

ZONE DESCRIPTIONS	
NO. 1 POWER PLANT AND NACELLE	
1A	NO. 1 PYLON - EXTERNAL THIS ZONE COMPRISES THE EXTERIOR OF THE NO. 1 ENGINE PYLON, AND INCLUDES INLETS, OUTLETS, LEADING EDGE, AND ACCESS DOORS.
1B	NO. 1 PYLON - INTERNAL THIS ZONE COMPRISES THE INTERIOR OF THE NO. 1 ENGINE PYLON, AND INCLUDES ATTACHMENTS, STRUCTURE, DUCTS, PLUMBING, WIRING, AND FUNCTIONAL COMPONENTS MOUNTED WITHIN THE PYLON.
1C	NO. 1 FORWARD NACELLE - INTERNAL THIS ZONE COMPRISES THE INTERIOR OF THE FORWARD NACELLE, FORWARD OF THE AFT VERTICAL FIREWALL (PPS-185), AND INCLUDES THE ENGINE INTERIOR AND MOUNTS, SUPPORT STRUCTURE, CONTROLS, DUCTS, PLUMBING, WIRING, AND FUNCTIONAL COMPONENTS.
1D	NO. 1 FORWARD NACELLE - EXTERNAL THIS ZONE COMPRISES THE EXTERIOR OF THE FORWARD NACELLE, FROM THE ENGINE INLET COWLING TO THE EXHAUST NOZZLE ASSEMBLY (PPS-185), AND INCLUDES ALL INLETS, OUTLETS, DOORS, COWLS, AND DRAINS.

CARD NO. 1-09	WORK AREA(S)	TYPE MECH INQ	MECH NO.	CARD TIME	PUBLICATION NUMBER AND DATE 1C-141B-6WC-5	10 JUN 83	CHANGE NO.
------------------	--------------	---------------	----------	-----------	--	-----------	------------

Figure 4

CARD NO I-05		WORK AREA(S)		TYPE MECH RQR		MECH NO		CARD TIME		PUBLICATION NUMBER AND DATE 1C-141B-6WC-5 10 JUN 83		CHANGE NO	
MAIN MIN		WORK UNIT CODE SYS SUB-SYS AND COMP		INTRODUCTION		INSPECTION REQUIREMENTS		ELECTRICAL POWER		SERVICE		FIGURE	
I-05												I-05	

CARD NO I-05		WORK AREA(S)		TYPE MECH RQR		MECH NO		CARD TIME		PUBLICATION NUMBER AND DATE 1C-141B-6WC-5 10 JUN 83		CHANGE NO	
I-05													

WORK ZONE CHART
POWER PLANT

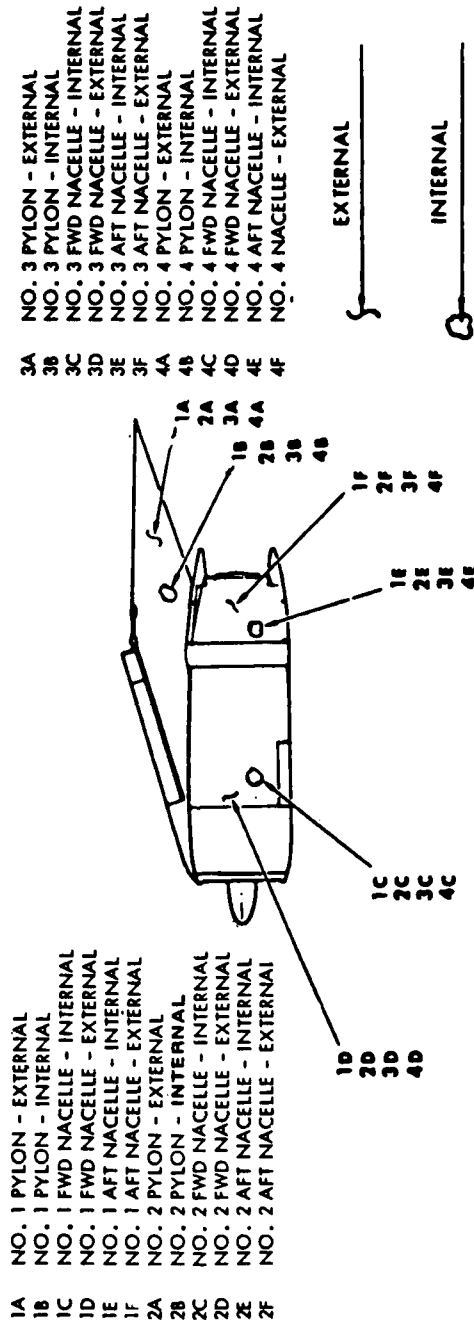
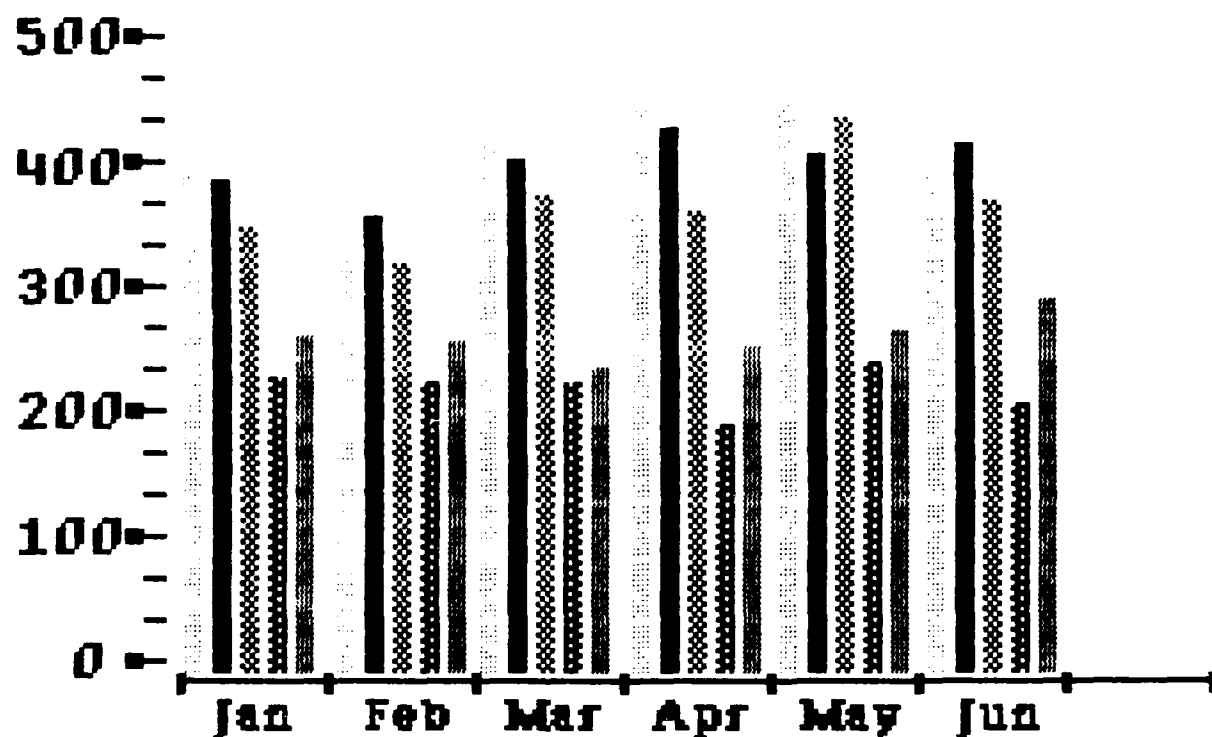


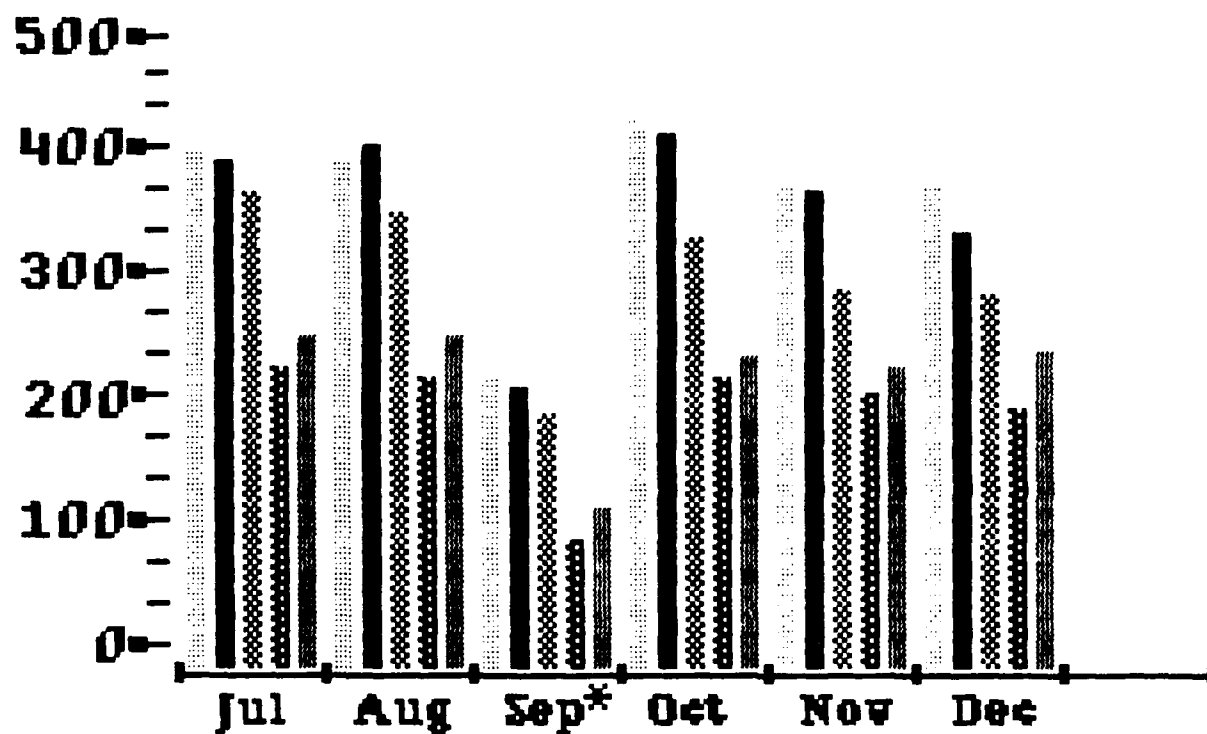
Figure 5

Home Station Departures **Mission and Training**



..... 437th MAW ■ 438th MAW
 x x x x x 63rd MAW - - - - - 60th MAW
 - - - - - 62nd MAW

Figure 6



***September Training launch
figures not available.**

The best way to appreciate shortening scheduled maintenance inspection flow times is to consider the cost of "down time" for scheduled events. All industrial activities have costs, and in MAC the best expression of cost in terms of the mission is the previously defined concept of airframe availability days. The reason is the fact that the success of the daily world-wide MAC mission depends on mission-ready aircraft. From a more parochial view, the fewer days scheduled events take, the more aircraft are mission ready on a daily basis, thus creating greater scheduling latitude for maintenance control schedulers. More important, scheduled activities lend themselves to management techniques, whereas the unscheduled malfunctions (random events) must be handled as they arise. Better management of scheduled maintenance will therefore lessen the impact created by random failures as more aircraft (scheduling alternatives) become available. From the scheduling perspective, faster scheduled events reduce the impact of random events, resulting in the possibility of greater scheduling flexibility. This is the case simply because efficient use of manpower during scheduled events makes more man-hours available each day to handle random failures.

Recognizing this need for economy and its benefit in scheduling and airframes, let's further zero in on the choke point in the industrial process. ISO inspections are performed using stands and facilities of limited quantities. Usually an airlift wing has only one enclosed facility for the inspection. McGuire, for example, has been limited to one ISO facility due to construction for several years. Therefore, another powerful argument for trimming flow times is facility maximization. In the civilian industrial world the fixed and variable costs of operating a facility always inspire economy. For units like McGuire, the inspiration is an annual schedule with few slack days. To assess the current costs in flow days I will use data from the 438th MAW at McGuire AFB, New Jersey. This unit was selected because it has one of the most demanding flying schedules among the C-141 units in MAC. (See figure 6) Based upon the December 1987 Maintenance Digest for McGuire, the ISO flow cost in days averaged eight. (14:-->) This includes a wash day, two "look phase" or dock days, and the rest of the time consumed in repair or "fix phase." A comparison of flow days between the wings is impossible due to the fact that there is not a standard way for computing this figure. (16:-->) The dock days are the "in facility" days. It is during this period that the actual inspection occurs. It is this time, specifically the look phase activities, that are the focus of this application of PERT methods and thinking as the Event-centered Scheduling Program (ESP).

After the roll out at the end of day two (upon completion of the activities which require the industrial stands and the facility) the fix phase continues. This time is referred to as "back line." Based upon my own experience and of those currently working the problem, the back line flow days are often complicated by poorly orchestrated scheduling as well.(15:--) During my tenure at McGuire, 438th MAW personnel were able to trim 33 percent from the total back line time just through aggressive scheduling. This was accomplished through relentless use of the Maintenance Preplan, Air Force Form 2406, and quite honestly, many hours of extra attention by management. Jobs were scheduled and followed by Inspection Branch managers 24 hours a day. Personal intervention by top management was frequently needed to keep the effort on the "back line" jobs. I observed no institutional bias for economy, and the improvements would regress without daily emphasis. We will get at the solution when we explore the models.

In my opinion current policies and practices in scheduling inspection items and manpower are static, and not responsive to changes which occur once the inspection is underway. For example, once the inspection package is begun, the plan is no longer actively refined. It is useful only as a guide, not as a dynamic management tool. Based upon my experience, the MAC Regulation 66-1, Maintenance Management, Volume II, guidance for Maintenance Plans and Scheduling produces basic chronologies of events which usually are modified to meet workcenter availability at the expense of the optimum flow. Chapter 2, paragraph 2-34, describes the planning process.(6:31) First, Plans and Scheduling prepares the AFTO 349 Maintenance Data Collection (MDC) forms based upon known requirements. At the 438th, 437th, 443rd, 63rd, 62nd and 60th Military Airlift Wings (MAW) this has been replaced by the generation of automated products which perform the same function. Then the work package is built. Delayed discrepancies and Time Compliance Technical Orders (TCTO) are then factored into the flow. A pre-inspection meeting is held at which the flow is presented to the workcenters. The workcenters approve the flow based upon their forecast capability. Then the flow is plotted on an Air Force Form 2406 and final 349s or computer products are generated. Unscheduled items are presented to the dock coordinator, and the 2406 adjusted. The result is less than optimal coordination of ongoing activities, but more importantly, it is scheduling jobs to fill a block of "dock time" rather than creating an optimized flow of jobs to minimize facility time. This problem is complicated by the dynamics of Maintenance Job Control. According to MAC Regulation 66-1, Volume II, Job Control "controls all maintenance on assigned aircraft and equipment."(6:13)

Unfortunately, scheduled activities are traditionally not given equal footing with the demands of the flying schedule.(6:12) I have observed this, and confirmed it in conversation with the 438th MAW Deputy Commander for Maintenance Production. (14:-->) The result can be further disruption of the Plans and Scheduling flow plan for inspection workorders.

The manual, reactive nature of this scheduling process is one of the factors which makes scheduling less than optimally efficient. Generally the weekly scheduling meeting endorses or condemns the plan based upon established workcenter manpower shift arrangements. Plans and Scheduling "reacts" by modifying the flow, but once the inspection is underway, there is no procedure to revisit and optimize the order of activities. This manpower centered response does not come to grips with the demands of production. What emerges from this process is an allocation of specialists which meets the requirements for blocked facility time, but doesn't seek to shorten it.

Control of specialist dispatch is also a problem. The Inspection Branch of the Organizational Maintenance Squadron is responsible for the management of the ISO flow.(5:19) Job Control used to dispatch, but that control has been transferred to the Inspection Branch with the advent of the Airlift Interim Consolidated Aircraft Maintenance Supply and Reliability Maintainability Information System (AICARS) computer system. The electronic dispatches now issue from the Inspection Branch "Dock Coordinator" directly to the shops. The specialists who perform the workcards, other than the Airplane General (APG) are not assigned to the Inspection Branch, rather to the specialist squadrons, Avionics Maintenance and Field Maintenance Squadrons.(5:-->) This supervisory disconnect reduces management's control over activity start and completion times. The ISO production manager's static plan, limited control of specialist dispatch, and "two day block of time" dock philosophy insure that facility flow times are rarely reduced.

In terms of order of events and dynamic scheduling to produce the shortest flow times, current specialist dispatch methods are, in my opinion, an area where improvement is possible. Currently it is manpower availability centered with insufficient regard for when activities need to take place. My experience in managing an organization which produced well over 100 major and minor inspections a year taught me that the bottom line is that the workcenters will "pay for the activities" called for in the inspection sooner or later. The question I hope to answer at the end of this

paper is, why not cover the activity in its optimized order? To do this I'll argue that some current conventions must be discarded, and the notion of adjusting shift availabilities to take advantage of PERT methods must be adopted.

The pitfalls of the current methods provide fertile ground for PERT innovation. Dispatch of specialists for the ISO flow work requirements is often done on a "make it fit" basis. Job Control defaults in favor of the generation effort. As previously stated, with the new automated system, the dock coordinator can control the dispatch of specialist to the dock. But Job Control often is dispatching from the same pool of manpower, and the launch "red streak" workorders come first. In MAC, the aircraft on the schedule within two hours of launch, and those in the first eight hours of recovery are priority 02. The ISO aircraft is priority 03. There is nothing bad in that, in and of itself, except that it is habit-forming, and we have institutionalized the lower prioritization of inspection activities. I have observed no real incentive for the specialist workcenters to modify the way in which they schedule manpower against inspections. Hence, swing and grave shift support may suffer when management attention decreases at the end of the day shift. Why not redefine priorities in terms of efficiency? With PERT methods the same number of man-hours will produce a shorter flow. I'll show you how this works in the explanation of the model "look phase" flow.

Essentially what has evolved is a flow plan which meets minimum "block" time constraints with little regard for the minimizing of facility time or total flow days. In addition, commitment of manpower resources and priority of dispatch have produced a system in which the job seems to expand to fit the facility time--or exceed it. There is an opportunity with PERT methodology to right some of these problems.

Chapter Two

OVERLOOKING THE OBVIOUS: THE PERT METHOD'S ADAPTABILITY TO ISOCHRONAL INSPECTION SCHEDULING

Program Evaluation Review Technique(PERT) was developed in the early 1960's to support a defense contractor's effort to manage the Polaris submarine development program.(2:4) It is a basic graphic way of chronologically ordering a project to allow the simultaneous completion of compatible activities.(1:425) Activities are defined as basic work groupings.(1:424) In our application the activities will be specific inspection work cards or groupings of carded work items by AFSC/WUC. The result of this ordering is the shortening of the project, by minimizing slack time. Before adapting the methodology to the ISO inspection program, let's take a look at the terminology and concepts of PERT as described in PERT-Time System Description Manual.(3:II-1)

EVENT-symbolized by a box an event consumes no time itself, but signals the start/finish of an activity. Events are best thought of as milestones.

ACTIVITY-the task, in this case a ISO card item or items is symbolized by an arrow. The arrow length in the PERT chart does not necessarily relate to length of the activity, but is used to connect events.

CRITICAL ACTIVITY-This is an activity which occurs along the critical path.

CRITICAL PATH-Simply put, this is the shortest way through the production process being analyzed. Critical path activities have no slack time.

TE-In the PERT chart this symbolizes the earliest expected event time.

TL-The latest allowable event time is represented by TL. If the required event does not occur by TL, a delay will be incurred.

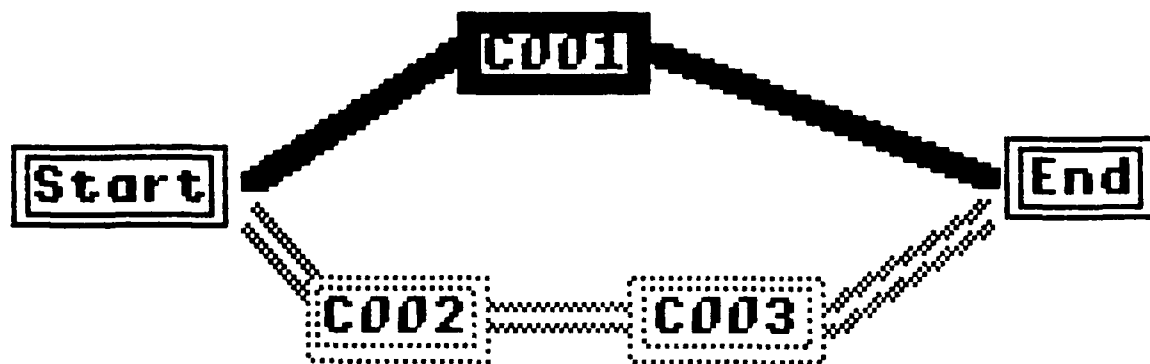
SLACK TIME-Expressed mathematically this is $TL - TE$. Each path in the chart is evaluated for slack time, activity by activity. Activities with zero slack time lie on the critical path.

ROADMAP-Also called a network, this is the graphic model which results from PERT scheduling. It is a lattice of event boxes and milestones connected by activity arrows.

Lawrence Lapin's text on Quantitative Methods best describes the utility of PERT. "A major advantage of PERT is that the network provides a basis for establishing a compatible activity schedule that permits project completion in a minimum amount of time." (1:430) This essential quality of PERT makes it very adaptable to the ISO inspection process. As for specific drawbacks, the PERT method used to become unmanagable rapidly because it was done manually, and required main frame data automation support. It is likely that for this reason its application has not become more wide spread until recently. The solution appeared with the proliferation of desk top computing capability, and the emergence of simple application software for PERT. More than one of these programs exists, but I have used Harvard Total Project Manager (HTPM) as my tool for this project. (12:--)

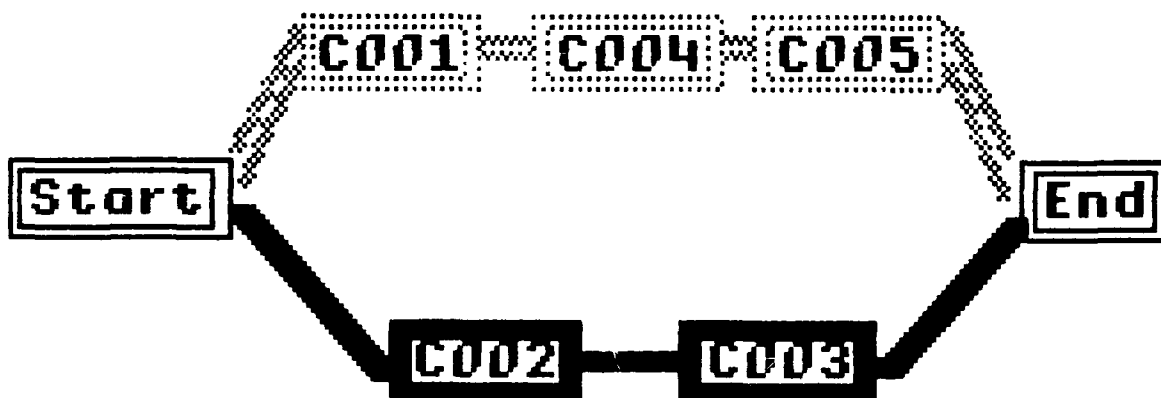
Let's examine a generic PERT roadmap so that you will be comfortable with the process when I get to my ISO application. I'll use terminology and symbols which come from the program with which I have built my event-centered schedules. (Figures 9, 10 and 11) First, as in Figure 7, the START and FINISH are clearly labeled. The numbered boxes are the EVENTS. Remember these do not "take time", but represent the beginning and end of adjacent ACTIVITIES. The lines (or sometimes arrows) between EVENTS are the ACTIVITIES. These represent the time it takes to do the tasks within the ACTIVITY. Next, to construct the ROADMAP with the program, a scheduler simply loads the EVENTS and their expected ACTIVITY times. Then he or she indicates to the program if an EVENT must precede or follow the particular tasks being loaded. Finally, once accepted, the new items are automatically computed into the ROADMAP (OR NETWORK). The CRITICAL PATH appears as a double line. If adding an activity to the ROADMAP changes the CRITICAL PATH, it will be displayed automatically. Gone forever are the tedious calculations and requirements for mainframe computer support. Because the model constantly reevaluates the CRITICAL PATH, changes in ACTIVITY time can instantly be evaluated by the scheduler and production manager to revise the schedule or redirect resources to meet the goal. This power to simulate results of changes is an especially powerful tool in the decision making that goes into how to expend manpower resources. (3:1-5) This feature is very well suited to the ISO inspection, in that each inspection involves adjustments based upon subtle differences from aircraft to aircraft. Harvard Total Project Manager is also

Typical PERT Roadmap



----- critical path

Path Change With Added Event



----- critical path shift

The revised critical path is automatically recalculated and displayed by the Project Manager software.

Figure 7

capable of relating calendars and resource limitations to industrial activities, but I have utilized only the scheduling portion of the program.

If it's such a great system, why hasn't it been put to wider use? The answer is that up until recently the calculations for each event, as well as for the critical path had to be done by hand. At best they were done by large main frame computers, at great expense. PERT-Time System Description Manual spends seven chapters explaining the mathematics and data automation needed to make the system work. This cumbersome process is no longer needed to carry out PERT scheduling.(12:--) Now the constraints of the past are gone as PERT ROADMAPS and resource allocation for industrial activities exceeding two thousand activities may be done in any wing Plans and Scheduling equipped with a IBM compatible computer and dot-matrix printer capable of printing 180 column width.(12:iii) PERT methodology indeed provides a unique tool for industrial managers to exert control over the architecture of their activities, to both more effectively use their resources and shorten production times. In 1963 as the method was just gaining acceptance in its most rudimentary form, its strengths for production were already well defined. Volume 1, PERT-Time System Description Manual, published by Air Force Systems Command identified ten advantages of PERT which are as true today as they were twenty-five years ago.

PERT:

1. provides disciplines which insure complete program coverage, avoids omission of important tasks at the outset of a program, and provides visibility from the total program objective down to the lowest supporting task.(3:I4)
2. fixes responsibility and assures continuity of effort despite turnover in either executive or operating personnel.(3:I4)
3. assists in identifying real time requirements and provides limits for detailed scheduling.(3:I4)
4. spots potential problem areas in time for preventive action or for improvement.(3:I4)
5. uses the management-by-exception principle in reporting to higher levels of management.(3:I4)
6. measures accomplishment against current schedules plans and objectives.(3:I4)
7. provides an opportunity for consideration of trade offs in funds, manpower, performance, and time between critical and noncritical areas of effort as a means of improving schedule plans for one or more programs.(3:I5)
8. permits rescheduling and provides periodic evaluation of plans.(3:I5)

9. makes it possible through its simulation techniques to evaluate and forecast outcomes of alternate plans before implementation.(3:15)

10. provides a historical data bank for the program which can be drawn upon for new programs.(3:15)

Now that I've discussed why we need to make improvements, the strengths of the PERT method, and some of the details of the program I've chosen and its advantages, let's go on to the scheduling exercise I've done to illustrate my point. I call it Event-centered Scheduling Program (ESP), and it's a combination of PERT, and a shift away from some of the scheduling thinking I have already addressed.

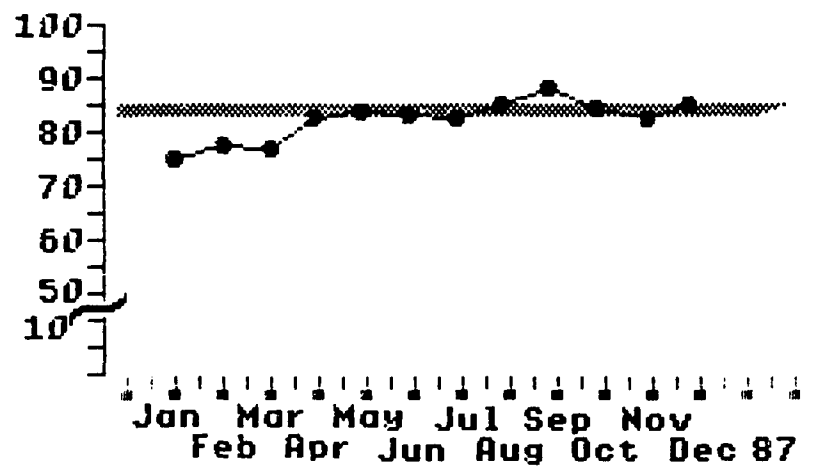
Chapter Three

THE EVENT-CENTERED SCHEDULING PROGRAM(ESP): MAXIMIZING FACILITY USE, MINIMIZING INSPECTION FLOW DAYS

The success of brief periods of schedule compression during my tenure at McGuire left me convinced that significant slack time existed in the ISO program. Although people seemed fully employed, it was apparent that their activities could be fit together in a more efficient fashion. The test came in 1987 when we at the 438th Military Airlift Wing were tasked under the MAC/AFRES memorandum of agreement on the C-141B transfer to handle additional ISO inspections. Local managers told us that we could "just not go below two dock days." Plans and Scheduling calculated that a day-and-a-half flow (36 hours of "in facility time") would provide enough room for the additional inspections. So, over objections, we established the day-and-a-half flow, and it worked. Most aircraft had 28 to 36 hours of "in facility" time. One rolled out in 24, and they were all different. An important feature of this flow is that short facility time did not significantly increase the "back line" days. The result was fewer total days of scheduled inspection down time. This contributed to the rising mission capable rate for the 438th MAW during the spring of 1987.(14:--)(15:--)(See figure 8)

What kind of guidance is available for production? Technical Order 00-20-5, paragraph 2-1, a.,3 merely outlines the inspection system; paragraph 2-10 defines the concept.(7:2-6) MAC Regulation 66-1, Volume III, Chapter 2, section C, clearly defines the Inspection Branch Chief's duties. It discusses tools, charts, cards and the Maintenance Preplan form 2406.(5:19) MAC Regulation 66-1, Volume II, Chapter 2 is explicit in explaining the use of the form 2405, Personnel Availability Forecast, and an explanation of shop backlog. (6:31) In addition, MAC Pamphlet 66-66, Workcenter Management Handbook, devotes a good deal of space to the mechanics of repair cycle work scheduling.(4:4-32) As described in Chapter One, the resulting scheduling process produces only roughly deconflicted chronologies. What is missing across the board is reference to personnel scheduling to optimize schedules of industrial activities. As strange as this lack

Percent Mission Capable
438th Military Airlift Wing



source: Maintenance Digest
 438th MAW, Dec 87.

MAC standard is 85%

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
75.7	77.2	76.2	82.5	84.6	84.2	83.7	85.2
Sep	Oct	Nov	Dec				
88.3	85.0	83.2	86.0				

Figure 8

of guidance may seem, I have witnessed it for thirteen years. I am suggesting the analysis of ISO flows, scheduling based upon the shortest path, and constant simulation within the PERT computer program to update and optimize the use of personnel resources. Now, let's look at a simple scheduling exercise using the Harvard Total Project Manager(HTPM), data provided by HQ MAC(11:-->) and 438th MAW(10:-->) and some event-centered thinking.

First, discard the conventional notion that workcenter manpower availability is less adjustable than industrial event schedules. Assume that based upon recomputed requirements workcenter manpower can be tailored for maximum efficiency in event order. Thus "event-centered" we can get on with the model. The basic data for the model is a standard AICARS report and may be found in Appendix A. Numbered 7143-M378SR and titled AFTO 349 Special Discrepancy Verbiage Listing, it is sequentially numbered by Job Control Number(JCN) beginning with C001 and ending with C278.(10:20) Also used was Appendix B, VIRP-M379S11, Man-Hours for McGuire ISO's (Major) October-December 1987, and Appendix C, which is a summary of hours expended against a randomly selected inspection of aircraft 157. As previously mentioned, jobs frequently encompass more than one card. I limited the model to the cards which reflect preparation, opening and "look phase" items. I selectively included service and repair activities that I know require the industrial stands in the dock. In short, the object of this exercise is to shorten the "in the stands" or facility time. Here are some explanations of key elements of the model.

A. EXPECTED TIME for the purposes of the model is a synthesis of the the 7143 report job standard, the by job number recap of the randomly selected inspection of aircraft 157, and a HQ MAC/LGXA three month average, by job number, of 13 major inspections at McGuire. This cross-checking was necessary due to the fact that Maintenance Data Collection (MDC) figures for "look phase" cards are frequently inflated inadvertently through the inclusion of "fix" activity time.

B. CREW SIZE was the job standard designated number. This was the most reasonable estimate because MDC units for the inspection reflect zero except for the single entry in which the inspection is cleared. In addition the crew size is in fact a resource variable which may be manipulated in a more sophisticated model. Crew size was used to divide total times for activities to create a straight line expected time estimate.

C. EARLIEST TIME was calculated by the HTPM program.

D. LATEST TIME was calculated by the HTPM program.

E. SLACK TIME was calculated by the HTPM program and used to continuously calculate the critical path.

F. CRITICAL PATH calculated and graphically presented in the roadmap display of the HTPM program.

The data was input by Job Control Number(JCN) up to the "close cards" (panel up). This essentially produced a ready to roll aircraft. The first run, titled ISO 1, was input with regard for sequencing, but with no attempt to optimize. For example engine cowlings were opened (JCN C063-66) before the engine inspections were scheduled (JCN C079-80 and C083-84). The second run, ISO 2, was very simply event-centered, by moving the start of JCN C079/109, the aft fuselage and fuel cell cards, to immediately follow the inspection start. This could be accomplished due to the fact that no other event must precede these cards. Furthermore, the areas and specific actions do not conflict with other activities. Run number three, ISO 3, reflects further simple event-centered refinement. The Aero Repair cards, organized under the JCN C106, were moved out of a chain of events upon which they did not depend. They were placed after JCN C001/38 which are prep and open card items. Since experience has indicated that total flow days need not go up if facility time is limited, the differences in flow times (delta) may represent savings in down time for scheduled major inspections.

Manpower requirements would vary from inspection to inspection, but would become more predictable as the data base developed. The ESP scheduling product would be available to all workcenters. As events occurred or activity times changed, the scheduler could use the simulation capability of the program to give optimized and finely tuned requirements to the shops literally on a minute-by-minute basis. In Chapter Four I will describe the ESP scheduling process.

Keeping in mind that two days (48 hours) was an accepted "in facility" flow time, the ISO 1 schedule produced a rollout in less than 40 hours, 35.8 hours to be exact.(Figure 9) The order of events was revisited in ISO 2 and, activity start times moved to get more shops employed performing more cards concurrently. The aircraft was complete in 27.5 hours, a savings of 8.3 hours.(Figure 10) In ISO 3 (Figure 11), as previously explained, activities were further deconflicted, resulting in more simultaneous events and a facility flow time of 23.7 hours, 12.1 hours better than ISO 1.(Figure 9) The standard 48 hour/ISO 3 difference of 24.3 hours represents a significant possible savings in flow time. This delta, extrapolated in a straight line fashion over 60 major inspections per year equates to just over two months of additional airframe availability for one of the unit's assigned aircraft. It is

literally like increasing the number of unit assigned aircraft. Admittedly such straight line predictions are dangerous, but the point of this paper is not to produce an airtight model, but to point out a new way of approaching the scheduling task. What has been demonstrated is that if we change our perspective, pick up some off-the-shelf software, and reorient our scheduling effort, we may be able to improve efficiency and realize some flow day savings, savings which equate to available aircraft.

Chapter Four

PRODUCTION MANAGEMENT IMPROVEMENTS; WHO NEEDS 'EM?

Now that the possibility for flow day savings has been demonstrated, just how would the program be managed in the scheduling process? Further, are there other production management improvements which have obvious application in the ESP approach to scheduling?

ESP would fit the current planning cycle outlined in MAC Regulation 66-1, Volume 2, Chapter 2.(6:31) For C-141B units the AICARS inspection package could serve as the source for the ESP flow plan. Just as in the product I used for my model, inspection card items, or groups of items, would be organized by specific JCN. Prior to the scheduling meeting, Plans and Scheduling would optimize the flow to meet the Deputy Commander for Maintenance Production flow requirement, let's say 24 hours in the facility. Then delayed discrepancies and Time Compliance Technical Orders (TCTOs) would be factored, and the ESP program would automatically recalculate the optimum flow.

The workcenters and Job Control would then join Plans and Scheduling at the Pre-Inspection Meeting. Usually held once a week, several inspections would be refined at this meeting. The optimized ESP flow would be critiqued using event-centered priority. The workcenters would plan for shift tailoring if needed. After the meeting a resulting "start" ESP flow would be used to generate an AICARS product reflecting estimated specialist dispatch times. The ESP program would replace the Air Force Form 2406 as the Inspection Branch Chief's primary flow planning tool.

Once the inspection was underway, control of specialist dispatch, and the active ESP flow plan management would shift to the Dock Coordinator of the Organizational Maintenance Squadron Inspection Branch. In the Dock Coordinator's "cage" the active ESP flow program would be booted up, and AICARS specialist dispatches accomplished as planned. Unscheduled problems, or anything which might affect the ESP projected flow would be loaded into the program by the Dock Coordinator, and the new flow automatically calculated by the ESP program. The Dock

Coordinator would inform the workcenters through AICARS, adjust dispatch times accordingly, and update Job Control. Completed ESP flow plans would be recorded on a hard disk drive, and the resulting data base managed by the Documentation Section of Maintenance Control.

As for related innovations, based upon the fact that the standard computers in C-141 maintenance squadrons are IBM compatible, it is likely that the ESP program would be networked to the various workcenters using modems. This would allow for simultaneous update of each manager's flow plan. The reports generating capability of the program would be used by management to assess the success of the scheduling and production effort. Further, the resource management elements of the program which I have not exploited in my proposal would be fully developed by the unit level managers.

In addition, repair cycle innovations should be applied to ESP scheduling. Specifically, prepositioning of frequently replaced hardware and assemblies could prevent flow delays. On the C-141 items like the main landing gear yokes, trunions and adapters, the latrine, galley, the life raft silos, life raft straps and radome are good examples of items that could be removed on the wash day, and replacements installed during the first eight hours of the inspection. Such planned repair cycle replacements would have to be balanced against their additional cost, but are exploitable in an effort to provide more mission capable aircraft through event-centered flow plans. Frequently replaced expendable panels could be kept on supply point in the Dock, with a library of trim/drill templates to expedite installation. The templates would be accumulated by tail number during the first cycle of the new program. Although it would have to be carefully evaluated against required spares levels, propulsion managers could plan for an average of one engine replacement per inspection due to cracks, corrosion or other factors. These types of initiatives would enhance the application of ESP scheduling.

The encouraging conclusion reached is that event-centered scheduling does present the promise of savings in an industrial activity such as a C-141B Major Isochronal Inspection. Flow day savings are not predictable, but those likely economies are not the only benefits which can be reasonably expected from such an application of PERT methodology. Man-hour expenses should not increase. For example card C061, removal of an engine pylon drip pan, will cost you the same two hours no matter when you expend them in the flow plan.(9:61) Based upon deconfliction and Propulsion Branch availability, why not do

it as early on day one of the inspection as possible? This is the premise which, if applied through existing production management software, can result in savings. In fact, using the deconfliction capability the program simulator gives the scheduler, I believe, savings in absolute man-hours expended during the inspection can be achieved.

As stated in the Materials Management Institute book PERT/CPM, "PERT is not the end all, but has advantages not offered by other systems."(2:5) It was designed for large projects but is well suited for small groups of activities as well.(12:1-1) Event-centering forces organization and demands logical control. Not only a major organizing tool, it can be a superior communication instrument for all layers of management.(2:5) In the case of HTPM and other project management software, it is also an excellent report generator, and a tremendous industrial management simulator. PERT, if exploited through a method such as event-centered scheduling (ESP), will furnish the ISO Dock Coordinator "...not a tool that will do his job for him, but one which will extend his ability to act effectively with the best information available."(2:3)

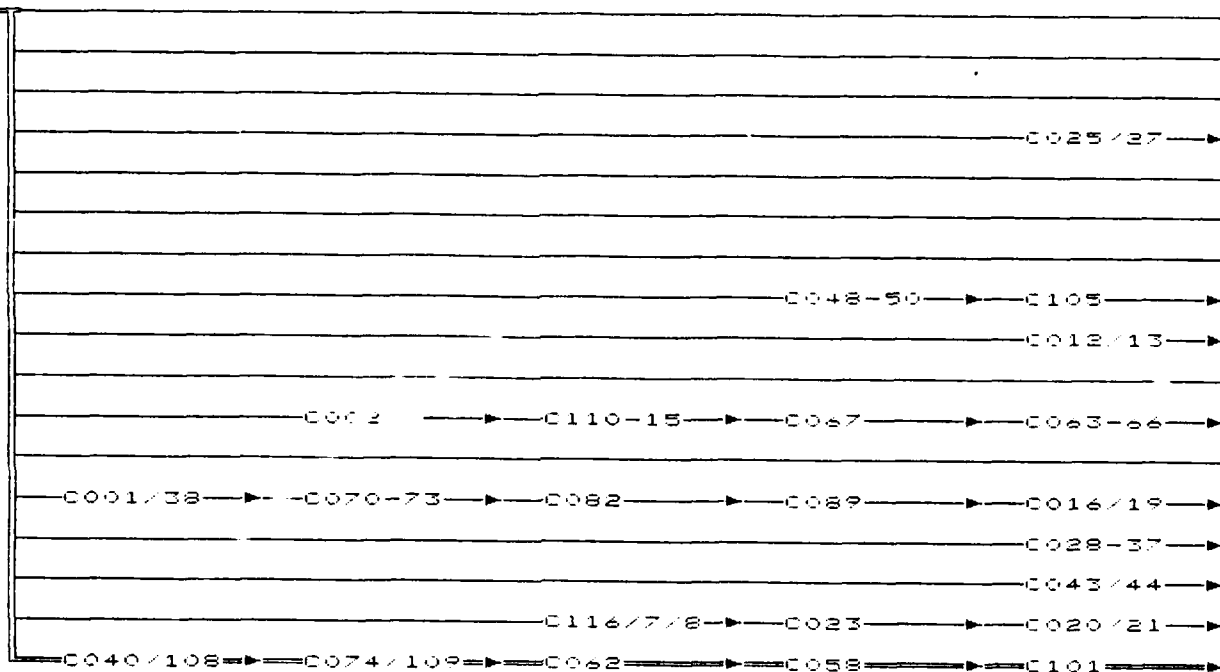
HTPM PROJECT: ISO 1

Project: 1301

30-Jan-1988

Page 1

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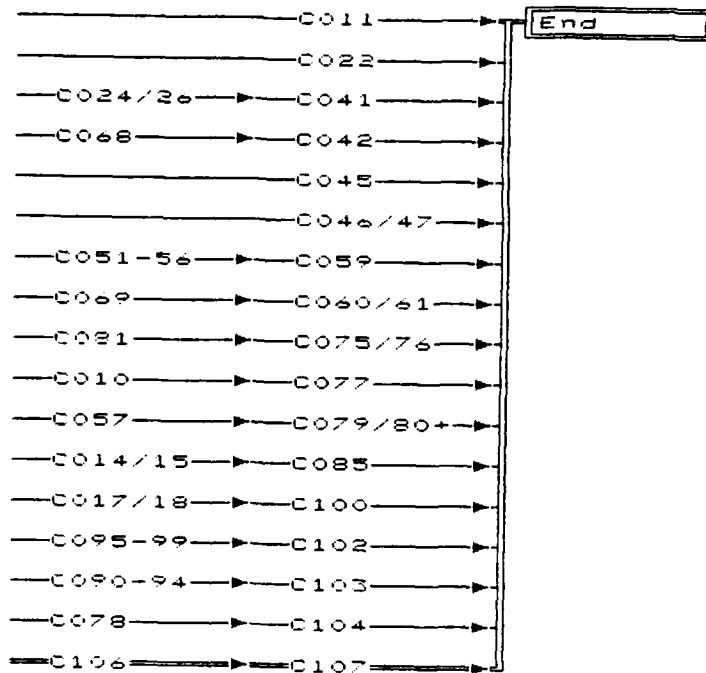
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Figure 9

HTPM PROJECT: ISO1

Project: **1301**

20-Jan-1988



35.8 hrs.

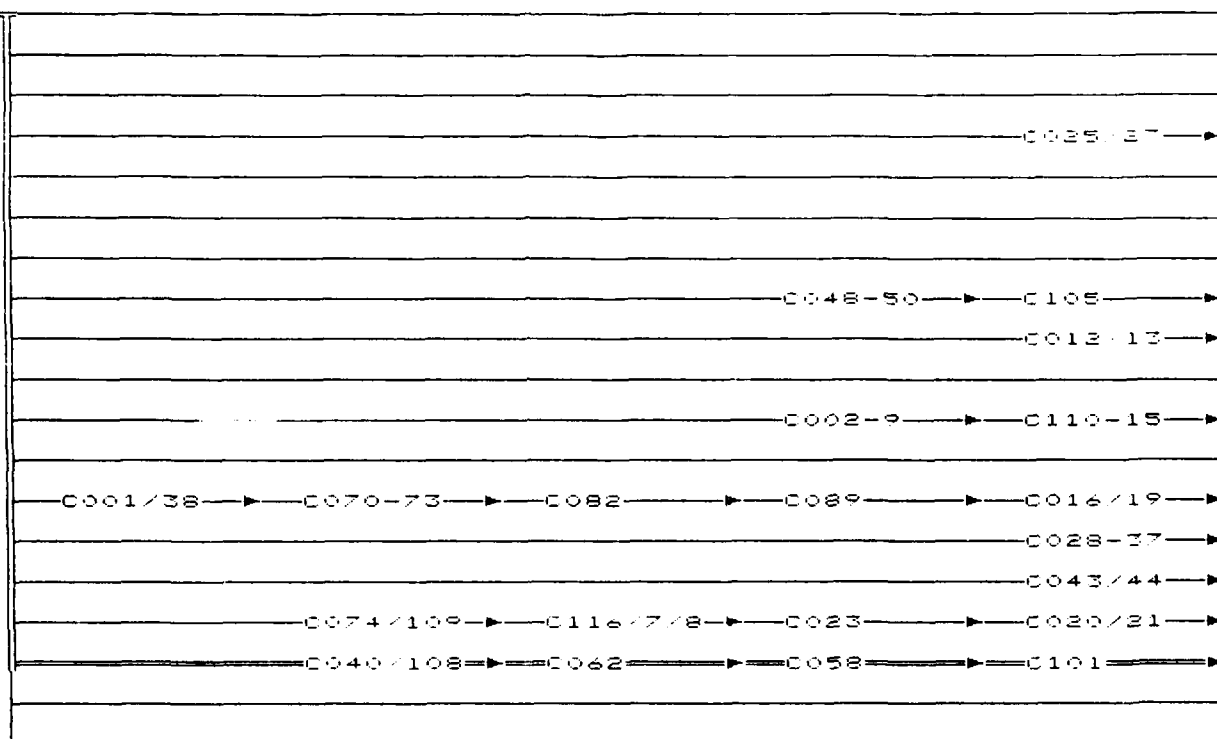
Project: 1302

HTPM PROJECT: ISO 2

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Page 1

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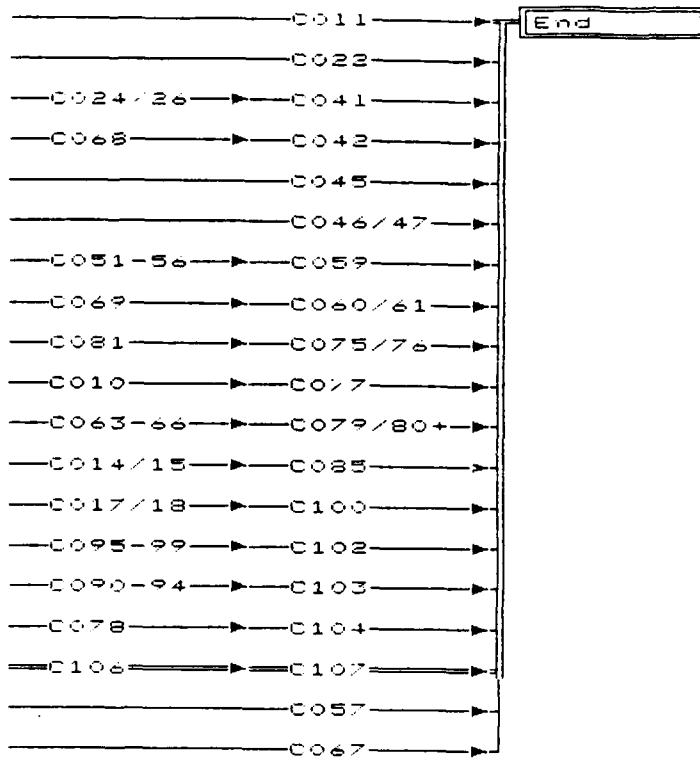
Duration 27.8 hrs

Figure 10

HTPM PROJECT: ISO 2

Project: **ISO2**

31-Jan-1988



27.8 hrs.

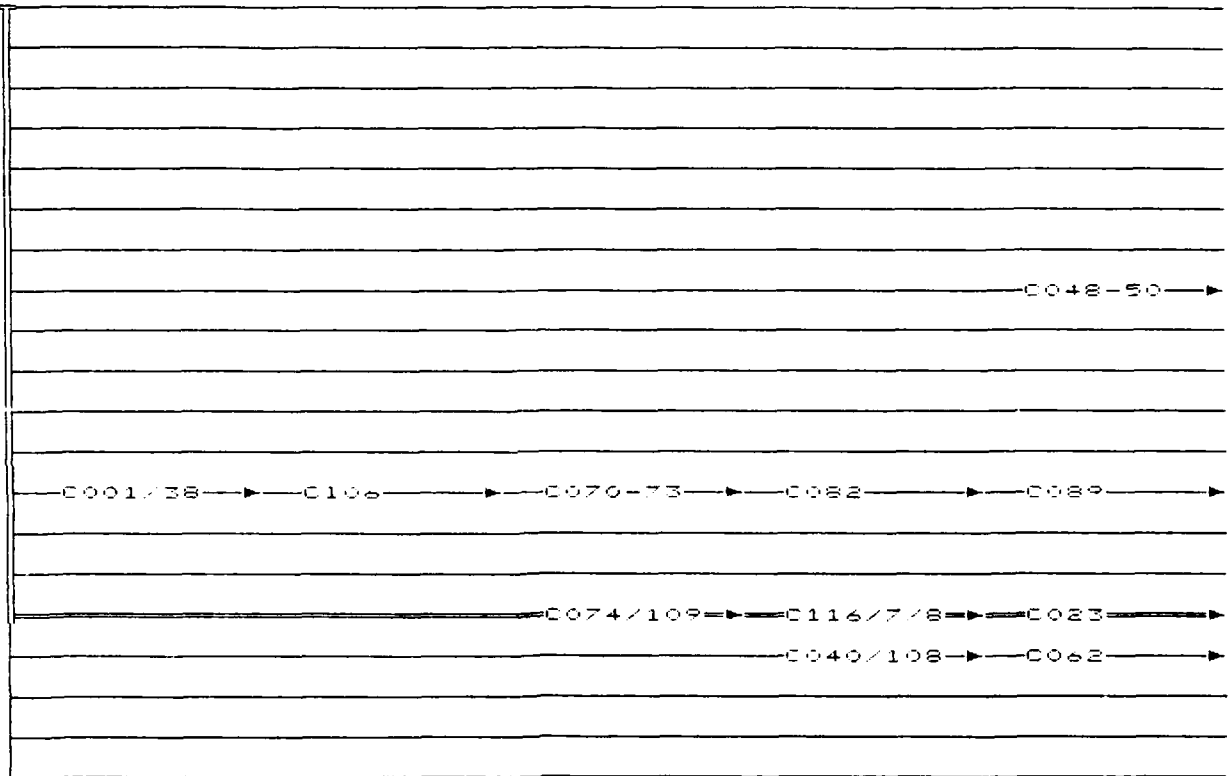
HTPM PROJECT: ISO 3

Project: 1903

21-Jan-1988

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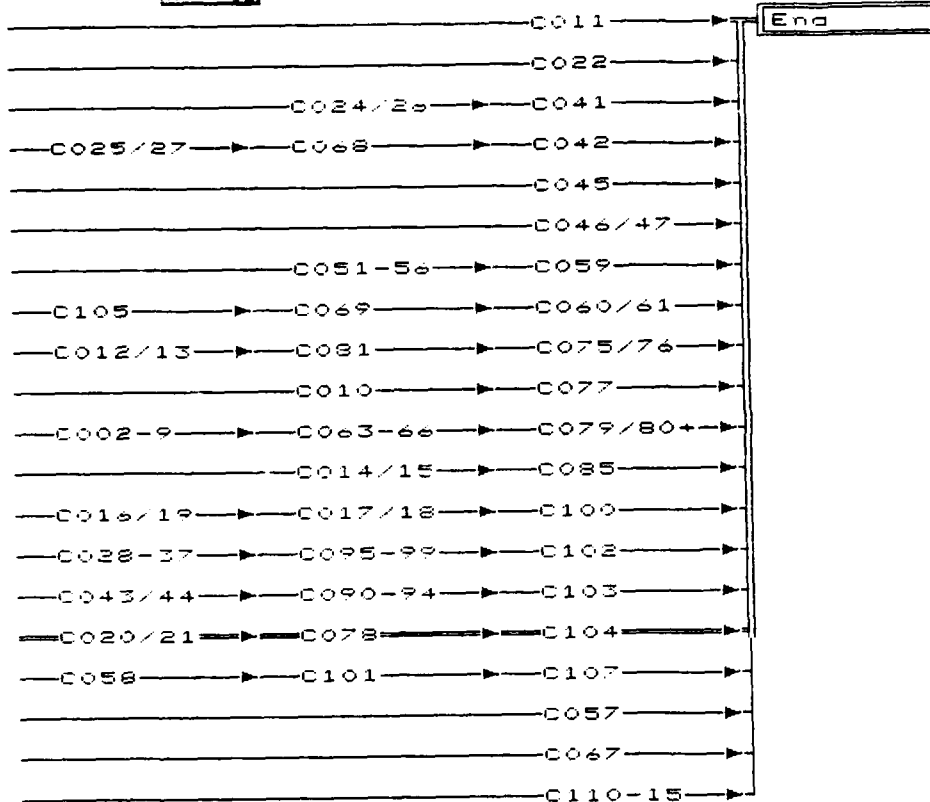
Duration 23.7 hrs.

Figure 11

HTPM PROJECT: ISO 3

Project: 1303

21-Jan-1988



23.7 hrs.

BIBLIOGRAPHY

Books

1. Lapin, Lawrence L.. Quantitative Methods for Business Decisions with Cases. New York, NY: Harcourt Brace Jovanovitch, Publishers, Inc., 1975.
2. Stires, David M., Murphy, Maurice M.. PERT/CPM. Boston, Mass: Materials Management Institute, 1964.

Official Publications

3. US Department of the Air Force, Volume I, PERT-Time System Description Manual, Air Force Systems Command, September, 1963.
4. US Department of the Air Force, MAC Pamphlet 66-66, Equipment Maintenance Workcenter Management Handbook. Military Airlift Command, August, 1983.
5. US Department of the Air Force, MAC Regulation 66-1, Aircraft Maintenance Management, Volume III, Chapter 2, Military Airlift Command, 1986.
6. US Department of the Air Force, MAC Regulation 66-1, Aircraft Maintenance Management, Volume II, Chapter 2, Military Airlift Command, 1986.
7. US Department of the Air Force, Technical Order 00-20-5, Aircraft, Drone, Aircrew Training Devices, Engines and Air Launch Missile Inspections, Flight Records and Supporting Maintenance Documents, 15 October 1987.
8. US Department of the Air Force, Technical Order 00-20-1, Preventative Maintenance Programs, General Policies, Requirements and Procedures, 1 December 1987.
9. US Department of the Air Force, Technical Order 1C-C141B-6WC-5, Work Cards, Major and Minor Inspections, USAF Series C-141A and C-141B Aircraft, Warner Robins Air Logistics Center/MMEDT, Change 9, 30 June 1986.

BIBLIOGRAPHY

Computer Products

10. Airlift Interim CAMS and REMIS System (AICARS),
7143-M378SR, AFTO Form 349 Special Discrepancy Listing, 29 October 1987.
11. Airlift Interim CAMS and REMIS System (AICARS),
VIRP-M379S11, Man Hours for McGuire Iso. Oct-Dec 87, 6 January 1988.
12. Harvard Total Project Manager, Harvard Software, Inc.,
Harvard Ma.

Other Sources

13. Interview, Lt Col. Robert Gee, Headquarters Military
Airlift Command, Flying Safety (IGFF), Scott Air
Force Base, Illinois, 20 December 1987.
14. Telecon, Lt Col. Miles O'Brien, 438th Military Airlift
Wing, Deputy Commander for Maintenance Production,
McGuire Air Force Base, New Jersey.
15. Telecon, Major James Russell, Commander, 438th
Organizational Maintenance Squadron, McGuire Air
Force Base, New Jersey.
16. Telecon, Lt Col. Benjamin Fallin, Headquarters Military
Airlift Command, Weapons Systems Division (LGMW),
Scott Air Force Base, Illinois.

APPENDICES

APPENDIX A--AFTO Form 349 Special Discrepancy Listing
APPENDIX B--Man-hours for McGulre ISO's (Major) Oct-Dec 87
APPENDIX C--Man-hour Summary, Random ISO, Aircraft 157

MAJOR

Note:
 - completed packing
 - re-printed
 - do not add to minis.
 CFB

WUC	M/D	START	WORK DISC	M/D	A/T EVENT	JOB	BASE	ELEC	HYD	ROD	INSP	ITEM	ZONE	IND	JEN	SPS	M/M	ID	STND	LINE	OFF	PER	ACT	DISCREPANCY VERBIAGE LISTING
12	1010	6	NM/A	03710	M	B	1 MAN	.0																DOCK -MAJOR ISO INSPECTION IN PROGRESS IAW T.O. IC-14186HG-5 INFO-MAJOR ISO INSP. PKG
				02201			.5 HRS																	
				E001																				
12	1020	6	NM/A	03710	M	B	1 MAN	.0																DOCK -BATTERY REMOVED FOR CAPACITY CK DANGER TAG INSTALLED INFO-350 TAG NO.
				02201			.5 HRS																	
				E002																				
12	1030	6	NM/A	03710	M	H	1 MAN	.0																DOCK -M/L/G INSPECTION WINDOW OPEN FOR INSP INFO-
				02201			.5 HRS																	
				E003																				
12	1050	6	NM/A	03710	M		1 MAN	.0																DOCK -LT AND RT HLG INSPECTION WINDOWS OPEN FOR INSPEC TION INFO-
				02201			.5 HRS																	
				E004																				
12	1060	6	NM/A	03710	M	B	1 MAN	.0																DOCK -#2 ESCAPE HATCH OPEN FOR INSPECTION INFO-
				02201			.5 HRS																	
				E005																				
12	1070	6	NM/A	03710	M	H	1 MAN	.0																DOCK -#3 ESCAPE HATCH OPEN FOR INSPECTION INFO-
				02201			.5 HRS																	
				E006																				
12	1090	6	NM/A	03710	M	R	1 MAN	.0																DOCK -#4 ESCAPE HATCH OPEN FOR INSPECTION INFO-
				02201			.5 HRS																	
				E007																				
12	1100	5	NM/A	03710	M		1 MAN	.0																DOCK -FOUR NOSE WHEEL WELL PRESSURE PANELS (L/H AFT, R

	02201	1.0 HRS	/H AFT, OVAL, AND FWD) REMOVED FOR INSP
	C098		INFO-
12 1110 6A	NM/A 03710	M 2 MAN .0	DOCK -NOSE RAUONE OPENED FOR INSP
	02201	.5 HRS	
	C099		INFO-
12 1120 5A	NM/A 03710	M 1 MAN .0	DOCK -MLG STEERING RACK COVER REMOVED FOR INSP
	02201	.5 HRS	
	C010		INFO-
12 1140 6R	NM/A 03710	M 1 MAN .0	DOCK -TAIL CONE LOWERED FOR INSP
	02201	.5 HRS	
	C011		INFO-
12 1150 8Y	NM/A 03710	M 2 MAN .0	DOCK -CENTER WING PANELS F-66, F-67, F-68, F-69, F-80,
	02201	2.0 HRS	F-84, F-86, F-89, F-71, F-72, F-73 REMOVED FOR INSP.
	C012		INFO-
12 1150 8Y	NM/A 03710	M 1 MAN .0	DOCK -CENTER WING PANELS F-74, F-87, F-75, F-80, F-86,
	02201	1.0 HRS	AND 2 EACH ADF PANELS, F-94, F-95, REMOVED FOR INSP.
	C013		INFO-
12 1180 5U	NM/A 03710	M 1 MAN .0	DOCK -LT MLG POD, APU ACCESS PANELS, 2 EA. REMOVED FOR
	02201	.5 HRS	INSP.
	C014		INFO-BACKLINE

		WUC		W/D		START															
WORK	DISC	W/C	A/T	EVENT	JOB	BASE	ELEC	4/11	RCD												
INSE	ITEM	ZONE	IND	JCH	SFS	H/M	ID	STND	LINE	OFF	RED	ACT	DISCREPANCY VERRIAGE LISTING								

12 1150 50 NM/A 03710 M 1 MAN .0 DOCK -LT M/G DOOR FLAPPER DOOR ACTUATOR ACCESS PANEL R
02251 .3 HRS EMPLOYED FOR INSP.
C015

INFO-

12	1700	50	NM/A	03710	M	1 MAN	.0	DOCK -LT HLG DOOR UNLOCK LATCH ASSY SPRING CARTRIDGE R
				02201		.5 HRS		EMPLOYED FOR CLEAN AND LUBE
				0015				

INFO-

12 1220 55	NM/A 03210 M	1 MAN .0	DOCK -RT MLG F00, TROOP LOX ACCESS PANEL F-44 REMOVED
	02201	.5 HRS	FOR INSP.
	0017		

INFO-

12	1235	SF	MM/A	03710	M	1 MAN	.0	DOCK -RT MLG DOOR FLAPPER DOOR ACTUATOR ACCESS PANEL R
				02001		.3 HRS		EMOVED FOR INSP.
				0018				

INF 9-

12	1250	5F	MM/A	03714	M	1 MAN	.0	DOCK -RT MLG DOOR UNLOCK LATCH ASSY SPRING
				0220		.5 HRS		CARTIDGE REMOVED FOR CLEANING AND LUBE
				0019				

INFO-

12 1760 9A NM/A 03210 H 2 MAY .0 DOCK -HORIZ. STAB PANELS HS-31, HS-33, HS-34,
02201 2.0 HRS HS-37, HS-39, HS-45, HS-46 REMOVED FOR INSP.
(070)

INFO-

12 1200 9A NM/4 03210 H 2 MAN .0 DOCK -VERTICAL STAB PANELS VS-1, VS-5, VS-11, VS-15, VS-19, VS-21, VS-23, VS-56 AND SNF 12 EACH ELEVATOR HINGE
02201 2.0 HRS
0021 ACCESS PANELS REMOVED FOR INSP.

INFO -

11 1231 6A NM/A 03210 M M 2 MAN .0 DOCK -AERIAL REFUELING SLIFWAY DOOR OPENED AND SAFETY

02201	.5 HRS	LOCK INSTALLED
C022		
		INFO-
12 1300 9A NM/A 03710 M M 2 MAN .0		RADI -ELT CANNON PLUG DISCONNECTED FOR PANEL REMOVAL
04110	.5 HRS	ELT REMOVED TO RDO SHOP
C023		DANGER TAG INSTALLED
		INFO-350 TAG
12 1320 1A NM/A 03710 M 1 MAN .0		DOCK -NO. 1 PYLON UPPER TENSION REGULATOR PANEL REMOVE
02201	.5 HRS	D FOR INSP.
C024		
		INFO-
12 1330 2A NM/A 03710 M 1 MAN .0		DOCK -NO. 2 PYLON UPPER TENSION REGULATOR PANEL REMOVE
02201	.5 HRS	D FOR INSP.
C025		
		INFO-
12 1360 1A NM/A 03710 M 2 MAN .0		DOCK -NO. 1 PYLON PANELS PP-16L, PP-17L, PP-24R AND
02201	1.0 HRS	PP-16R REMOVED FOR INSP
C026		
		INFO-
12 1370 2A NM/A 03710 M 2 MAN .0		DOCK -#2 PYLON PANELS PP-16L PP-17L, PP-24R AND PP-16R
02201	1.0 HRS	REMOVED FOR INSP
C027		
		INFO-
12 1380 7A NM/A 03710 M 2 MAN .0		DOCK -LT WING NO. 2 (WRAP AROUND) PANEL R
02201	1.0 HRS	EMOVED FOR INSP.
C028		
		INFO-

			02201		1.0 HRS		ISO INSP.
			C036				
							INFO-
12	1414	7A	NM/A	03710	M	M	1 MAN .0
			02201		1.0 HRS		DOCK -LT WING LANDING LIGHT PANEL OPEN DURING ISO INSP
			C037				
							INFO-
12	1420	7	NM/A	03710	M	M	10 MAN .0
			02201		3.0 HRS		DOCK -C/W ISO PREP CARDS M-001 THRU M-009
			C038				
							INFO-
12	1430	8Y	NM/A	03710	M	M	1 MAN .0
			02201		1.0 HRS		DOCK -C/W I.P.I. BOTH CENTER WING LIFE RAFTS
			C039				
							INFO-
12	1440	6A	NM/A	03710	M	M	2 MAN .0
			02201		2.0 HRS		DOCK -LT WING FUSELAGE PANELS F-3, F-5, F-7, F-9, F-11
			C040				, F-13, F-15, F-19, F-21, F-23, F-25, F-27, F-31, AND
							F-33 REMOVED
							INFO-
12	1470	1A	NM/A	03710	M	M	2 MAN .0
			02201		.5 HRS		DOCK -NO. 1 PYLON DRIP PAN REMOVED FOR INSP.
			C041				
							INFO-
12	1480	2A	NM/A	03710	M	M	2 MAN .0
			02201		.5 HRS		DOCK -NO. 2 PYLON DRIP PAN REMOVED FOR INSP.
			C042				
							INFO-

	02201	1.0 HRS	PP-13R REMOVED FOR INSP
	C050		INFO-
12 1570 BA NM/A	03710	M M 1 MAN .0	DOCK -RT WING NO. 4 (WRAP AROUND) PANEL REMOVED FOR
	02201	1.0 HRS	INSPECTION
	C051		INFO-
12 1580 BA NM/A	03710	M M 1 MAN .0	DOCK -RT WING 20 EACH BLOWOUT DOORS REM'D DURING ISO
	02201	1.0 HRS	INSP.
	C052		INFO-
12 1581 BA NM/A	03710	M M 1 MAN .0	DOCK -RT WING 9 EACH FLAP CARRIAGE PANELS OPEN
	02201	1.0 HRS	DURING ISO INSP.
	C053		INFO-
12 1582 BA NM/A	03710	M M 1 MAN .0	DOCK -RT WING 3 EACH AILERON SEAL ACCESS PANELS
	02201	1.0 HRS	LOWEDED DURING ISO INSP.
	C054		INFO-
12 1583 BA NM/A	03710	M M 1 MAN .0	DOCK -RT WING 3 EACH AILERON TAB SEAL ACCESS PANELS
	02201	1.0 HRS	LOWEDED DURING ISO INSP.
	C055		INFO-
12 1584 BA NM/A	03710	M M 1 MAN .0	DOCK -RT WING LANDING LIGHT PANEL OPEN DURING ISO INSP
	02201	1.0 HRS	
	C056		INFO-

INSP	ITEM	ZONE	IND	JCN	SRS	H/M	ID	STND	LINE	OFF	REQ	ACT	DISCREPANCY VERBIAGE LISTING
12	1590	6L	IN/A	03710	M	M	2 MAN	.0					DOCK -C/W FLT STA INSP CARDS M-013 THRU M-016 Q2201 4.0 HRS C057 INFO-
12	1600	6R	IN/A	03710	M	M	2 MAN	.0					DOCK -C/W AFT FUSELAGE INSP CARDS M-025/M-036/M-037/M-070 Q2201 4.0 HRS C058 INFO-
12	1610	6A	IN/A	03710	M	M	2 MAN	.0					DOCK -RT WING FUSELAGE PANELS F-4, F-6, F-8, F-10, F-12, F-14, F-16, F-18, F-20, F-22, F-24, F-26, F-28, F-29, F-30, F-32, F-34 REMOVED FOR INSP. Q2201 2.0 HRS C059 INFO-
12	1640	3A	IN/A	03710	M	M	2 MAN	.0					DOCK -NO. 3 PYLON DRIP PAN REMOVED FOR INSP. Q2201 .5 HRS C060 INFO-
12	1650	4A	IN/A	03710	M	M	2 MAN	.0					DOCK -NO. 4 PYLON DRIP PAN REMOVED FOR INSP. Q2201 .5 HRS C061 INFO-
12	1660	6N	IN/A	03710	M		2 MAN	.0					DOCK -C/W FWD CARGO INSP CARDS M-017/M-026 THRU M-028 Q2201 4.0 HRS C062 INFO-
12	1670	10	IN/A	03710	M		1 MAN	.0					ENGI -NO.1 ENG FWD AFT COWLING OPEN FOR INSP Q2230 .5 HRS C063 INFO-
12	1680	20	IN/A	03710	M		1 MAN	.0					ENGI -NO.2 ENG FWD AFT COWLING OPEN FOR INSP

0323C .5 HRS
C064

INFO-BACKLINE

12 1690 30 NM/A 03710 M 1 MAN .0
0323C .5 HRS
C065

ENGI -NO.3 ENG FWD &AFT COWLING OPEN FOR INSP

INFO-BACKLINE

12 1700 30 NM/A 03710 M 1 MAN .0
0323C .5 HRS
C066

ENGI -NO.4 ENG FWD &AFT COWLING OPEN FOR INSP

INFO-BACKLINE

12 1710 50 NM/A 03710 M 1 MAN .0
03360 .5 HRS
C067

ENVI -APU FIRE BOTTLE CANNON PLUG DISCONNECTED FOR CON
TINUITY CK

DANGER TAG INSTALLED

INFO-

12 1720 1A NM/A 03710 M 1 MAN .0
03360 .5 HRS
C068

ENVI -NO.1 PYLON FIRE BOTTLES CANNON PLUGS DISCONNECTE
D FOR CONTINUITY CK

DANGER TAG INSTALLED

INFO-

12 1730 4A NM/A 03710 M 1 MAN .0
03360 .5 HRS
C069

ENVI -NO.4 PYLON FIRE BOTTLES CANNON PLUGS DISCONNECTE
D FOR CONTINUITY CK

DANGER TAG INSTALLED

INFO-

12 1740 50 NM/A 03710 M 1 MAN .0
03310 1.0 HRS
C070

REFR -LT MLG BELLCRANK DRIVE ASSY REMOVED FOR INSP.

INFO-

WUC	W/D	START	WORK DISC	W/C	A/T	EVENT	JOB	BASE	ELEC	HYD	RCD	DISCREPANCY VERBIAGE LISTING
INSP	ITEM	CODE	IND	JCN	SRS	W/M	ID	STND	LINE	OFF	REQ	ACT
12	1750	5F	NM/A	03710	M	1 MAN	.0					
				03310		1.0 HRS						REPR -RT MLG BELLCRANK DRIVE ASSY REMOVED FOR INSP
				0071								INFO-
12	1760	5D	NM/A	03710	M	1 MAN	.0					
				03340		1.0 HRS						PNEU -LT MLG BOGIE DISCONNECTED FOR SERVICE
				0072								INFO-
12	1770	5F	NM/A	03710	M	1 MAN	.0					
				03340		1.0 HRS						PNEU -RT MLG BOGIE DISCONNECTED FOR SERVICE
				0073								INFO-
12	1780	6H	IN/A	03710	M	2 MAN	.0					
				02201		4.0 HRS						DOCK -C/W AFT CARGO INSP CARDS M-029 THRU M-034;EXCEPT
				0074								M-034 ITEM 10
												INFO-
12	1790	8I	NM/A	03710	M	1 MAN	.0					
				02201		1.0 HRS						DOCK -RT WING LIFE RAFT REMOVED FOR INSP
				0075								COMPARTMENT DOOR OPEN
												INFO-
12	1800	8I	NM/A	03710	M	1 MAN	.0					
				02201		1.0 HRS						DOCK -LT WING LIFE RAFT REMOVED FOR INSP
				0076								COMPARTMENT DOOR OPEN.
												INFO-
12	1810	5A	IN/A	03710	M	2 MAN	.0					
				02201		4.0 HRS						DOCK -C/W MLG INSP CARDS M-038 THRU M-040
				0077								INFO-
12	1820	9A	IN/A	03710	M	2 MAN	.0					
												DOCK -C/W T-TAIL INSP CARDS M-071 THRU M-072

			02201		4.0 HRS		AND M-071A
			C078				INFO-
12	1830	10	IN/A	03710	M	1 MAN .0	ENGI -NO.1 ENGINE MAJOR ISO INSPECTION DUE I/A/W
			0323C			.5 HRS	1C-141B-6WC-5. C/W INSP CARDS M-224, AND M-077 THRU M
			C079				-082.
							INFO-
12	1860	20	IN/A	03710	M	1 MAN .0	ENGI -NO. 2 ENGINE MAJOR ISO INSPECTION DUE I/A/W
			0323C			.5 HRS	1C-141B-6WC-5. C/W INSP CARDS M-224, AND M-083 THRU M
			C080				-088
							INFO-
12	1880	80	IN/A	03710	M	2 MAN .0	DOCK -C/W CTR WING INSP CARDS M-018 THRU M-025
			02201			4.0 HRS	M-034 ITEM 1D
			C081				INFO-
12	1890	50	IN/A	03710	M	2 MAN .0	DOCK -C/W LT MLG INSP CARDS M-041 THRU M-046
			02201			4.0 HRS	INFO-
			C082				
12	1910	30	IN/A	03710	M	1 MAN .0	ENGI -NO.3 ENGINE MAJOR ISO INSPECTION DUE I/A/W/
			0323C			.5 HRS	1C-141B-6WC-5. C/W INSP CARDS M-224, M-089 THRU M-094
			C083				INFO-
12	1940	40	IN/A	03710	M	1 MAN .0	ENGI -NO.4 ENGINE MAJOR ISO INSPECTION I/A/W
			0323C			.5 HRS	1C-141B-6WC-5. C/W INSP CARDS M-224, AND M-095 THRU M
			C084				-100
							INFO-

		WUC	W/D	START									
WORK	DISC	W/C	A/T	EVENT	JOB	BASE	ELEC	HYD	RCD				
INSP	ITEM	ZONE	IND	JCN	SRS	H/M	ID	STND	LINE	OFF	REQ	ACT	DISCREPANCY VERBIAGE LISTING
12	1970	5D	IN/A	03710	M	1 MAN	.0						APUS -APU COMPARTMENT INSFECTION DUE I/A/W 1C-141B-6WC-5. C/W INSP CARD M-101
				0323H		.5 HRS							INFO-
				C085									
12	1990	5D	IN/A	03710	M	1 MAN	.0						APUS -APU STARTER REMOVED TO FOM
				0323H		.5 HRS							INFO-
				C086									
12	2090	5D	IN/A	03710	M	1 MAN	.0						APUS -APU STARTER CLUTCH REMOVED FOR BENCH CHECK.
				0323H		.5 HRS							INFO-
				C087									
12	2090	1	IN/A	03710	M	1 MAN	.0						ENGD -ALL ENGINES NO. 6 BEARING EXTERNAL OIL STRAINER DUE LEAK CHECK.
				0323H		.5 HRS							INFO-**FOST DOCK**
				C088									
12	2090	5F	IN/A	03710	M	2 MAN	.0						DOCK -C/W RT MLG INSP CARDS M-047 THRU M-051
				02201		4.0 HRS							INFO-
				C089									
12	2110	8A	IN/A	03710	M	4 MAN	.0						DOCK -C/W RT WING INSP CARDS M-061 & M-062.
				02201		4.0 HRS							INFO-
				C090									
12	2111	8A	IN/A	03710	M	4 MAN	.0						DOCK -C/W RT WING INSP CARDS M-063 & M-064.
				02201		4.0 HRS							INFO-
				C091									
12	2112	8A	IN/A	03710	M	4 MAN	.0						DOCK -C/W RT WING INSP CARDS M-065.

02201 4.0 HRS
C092

INFO-

12 2120 84 IN/A 03710 M 4 MAN .0
02201 4.0 HRS
C093

DOCK -C/W RT WING INSP CARDS M-065A.

INFO-

12 2121 84 IN/A 03710 M 4 MAN .0
02201 4.0 HRS
C094

DOCK -C/W RT WING INSP CARDS M-066 & M-067.

INFO-

12 2130 7A IN/A 03710 M 4 MAN .0
02201 4.0 HRS
C095

DOCK -C/W LT WING INSP CARDS M-052 & M-053.

INFO-

12 2131 7A IN/A 03710 M 4 MAN .0
02201 4.0 HRS
C096

DOCK -C/W LT WING INSP CARDS M-054 & M-055.

INFO-

12 2132 7A IN/A 03710 M 4 MAN .0
02201 4.0 HRS
C097

DOCK -C/W LT WING INSP CARDS M-056.

INFO-

12 2140 7A IN/A 03710 M 4 MAN .0
02201 4.0 HRS
C098

DOCK -C/W LT WING INSP CARDS M-065A.

INFO-

WORK	DISC	M/C	A/T	EVENT	JOB	BASE	ELEC	HYD	RCD	DISCREPANCY VERBIAGE LISTING		
INCP	ITEM	ZONE	IND	JCN	SRS	H/M	ID	STND	LINE	OFF	REQ	ACT
12	2141	7A	IN/A	03710	M	4 MAN	.0					
				02201		4.0 HRS						
				0099								
												DOCK -C/W LT WING INSP CARDS M-057 & M-058.
												INFO-
12	2150	5D	IN/A	03710	M	1 MAN	.0					
				03340		4.0 HRS						
				0100								
												PNEU -C/W HYD MLG INSP CARDS M-127 THRU M-129
												INFO-
12	2160	6H	IN/A	03710	M	1 MAN	.0					
				03340		4.0 HRS						
				0101								
												PNEU -C/W HYD INT INSP CARDS M-130, M-132 THRU M-135
												INFO-
12	2170	7A	IN/A	03710	M	1 MAN	.0					
				03340		4.0 HRS						
				0102								
												PNEU -C/W HYD LT WING INSP CARD M-137
												INFO-
12	2180	8A	IN/A	03710	M	1 MAN	.0					
				03340		4.0 HRS						
				0103								
												PNEU -C/W HYD RT WING INSP CARD M-138
												INFO-
12	2230	9A	IN/A	03710	M	1 MAN	.0					
				03340		4.0 HRS						
				0104								
												PNEU -C/W HYD TAIL INSP CARD M-136
												INFO-
12	2240	1	IN/A	03710	M	1 MAN	.0					
				03340		4.0 HRS						
				0105								
												PNEU -C/W HYD PYLON INSP CARD M-131
												INFO-
12	2250	1	IN/A	03710	M	5 MAN	.0					
												REFR -C/W A/R INSP CARDS M-102 THRU M-117

03310 6.0 HRS
C106

INFO-

12 2260 1 IN/A 03710 M M 3 MAN .0
03170 6.0 HRS
C107

NDIS -C/W NDI INSP CARDS M-073 THRU M-075

INFO-

12 2280 6 IN/A 03710 M M 3 MAN .0
03140 6.0 HRS
C108

CORP -C/W CORR INSP CARDS M-142

INFO-

12 2290 6 IN/A 03710 M M 2 MAN .0
03320 6.0 HRS
C109

FUEL -C/W FUEL CELL INSP CARD M-139 THRU M-141

INFO-

12 2300 6 IN/A 03710 M M 4 MAN .0
04230 4.0 HRS
C110

ELEC -C/W ELECT INSP CARDS M-153, M-154.

INFO-

12 2310 6 IN/A 03710 M M 2 MAN .0
04110 4.0 HRS
C111

RADI -C/W RDO INSP CARD M-144 THRU M-146

INFO-

12 2320 6 IN/A 03710 M M 1 MAN .0
04140 4.0 HRS
C112

COMP -C/W COMP INSP CARD M-143

INFO-

WUC	H/D	START	WORK	DISC	W/C	A/T	EVENT	JOB	BASE	ELEC	HYD	RCD	DISCREPANCY VERIFIAGE LISTING
INSP	ITEM	ZONE	IND	JCN	SRS	H/M	ID	STND	LINE	OFF	REQ	ACT	
12	2330	6	IN/A	03710	M	M	1 MAN	.0					RADA -C/W NAVX INSP CARDS M-150 THRU M-152
				04120			4.0 HRS						INFO-
				C113									
12	2340	5	IN/A	03710	M	M	1 MAN	.0					AUTO -C/W AUTO PILOT INSP CARD M-148
				04210			4.0 HRS						INFO-
				C114									
12	2350	6	IN/A	03710	M	M	2 MAN	.0					INST -C/W INST INSP CARDS M-147 AND M-149
				04220			4.0 HRS						INFO-
				C115									
12	2360	6M	IN/A	03710	M	M	2 MAN	.0					ENVI -C/W ECS INTERIOR INSP CARDS M-118 THRU M-120
				03360			4.0 HRS						INFO-
				C116									
12	2370	8Y	IN/A	03710	M	M	2 MAN	.0					ENVI -C/W ECS CTR WING INSP CARD M-121
				03360			4.0 HRS						INFO-
				C117									
12	2380	1	IN/A	03710	M	M	2 MAN	.0					ENVI -C/W ECS INSP CARD M-069A/M-122 THRU M-126
				03360			4.0 HRS						INFO-
				C118									
12	2390	EL	IN/A	03710	M	M	2 MAN	.0					DOCK -C/W FLT STA LUBE CARD M-170
				02201			2.0 HRS						INFO-
				C119									
12	2400	6M	IN/A	03710	M	M	2 MAN	.0					DOCK -C/W CARGO LUBE CARD M-171, M-172, M-223, AND M-2

				Q2201		2.0 HRS		25 AND M-182
				C120				
								INFO-
12	2410	6R	IN/A	03710	M	M	1 MAN	.0
				Q2201		2.0 HRS		DOCK -C/W RAMP LUBE CARDS M-174 THRU M-179 AND
				C121				M-198
								INFO-
12	2420	5D	IN/A	03710	M	M	1 MAN	.0
				Q2201		1.0 HRS		DOCK -C/W LT MLG LUBE CARDS M-190 THRU M-197
				C122				
								INFO-
12	2430	5F	IN/A	03710	M	M	1 MAN	.0
				Q2201		1.0 HRS		DOCK -C/W RT MLG LUBE CARD M-199 THRU M-206
				C123				
								INFO-
12	2440	7A	IN/A	03710	M	M	1 MAN	.0
				Q2201		3.0 HRS		DOCK -C/W LT WING LUBE CARD M-207 THRU M-214
				C124				
								INFO-
12	2450	8A	IN/A	03710	M	M	1 MAN	.0
				Q2201		3.0 HRS		DOCK -C/W RT WING LUBE CARD M-215 THRU M-221
				C125				
								INFO-
12	2460	5A	IN/A	03710	M	M	1 MAN	.0
				Q2201		1.0 HRS		DOCK -C/W MLG LUBE CARDS, M-186 THRU M-189 AND M-222
				C126				ADD: M-172 ITEM 1
								INFO-

WOPY	DISC	W/C	A/T	EVENT	JOB	BASE	ELEC	HYD	REQ	ACT	DISCREPANCY VERBIAGE LISTING
INSP	ITEM	ZONE	IND	JCN	SRS	H/M	ID	STND	LINE	OFF	
12	2470	9A	IN/A	03710	M	M	1	MAN	.0		DOCK -C/M T-TAIL LURE CARDS M-180 THRU M-185
				02201				1.0	HRS		
				C127							INFO-
12	2480	7	IN/A	03710	M	M	10	MAN	.0		DOCK -C/M ISO CLOSE CARDS M-155 THRU M-161
				02201				6.0	HRS		
				C128							INFO-
12	2490	1	IN/A	03710	M	M	2	MAN	.0		OHS -ALL 4 PYLON SAIL BOAT PANELS REMOVED PRIOR TO POST DOCK ENG RUNS
				OHS				.5	HRS		
				C129							INFO-** POST DOCK **
12	2500	1	IN/A	03710	M		1	MAN	.0		OHS -NO.1 ENG INLET DUE FOD INSP PRIOR TO RUN
				OHS				.3	HRS		
				C130							INFO-** POST DOCK **
12	2510	2	IN/A	03710	M		1	MAN	.0		OHS -NO.2 ENG INLET DUE FOD INSP PRIOR TO RUN
				OHS				.3	HRS		
				C131							INFO-** POST DOCK **
12	2520	3	IN/A	03710	M		1	MAN	.0		OHS -NO.3 ENG INLET DUE FOD INSP PRIOR TO RUN
				OHS				.3	HRS		
				C132							INFO-** POST DOCK **
12	2530	4	IN/A	03710	M		1	MAN	.0		OHS -NO.4 ENG INLET DUE FOD INSP PRIOR TO RUN
				OHS				.3	HRS		
				C133							INFO-** POST DOCK **
12	2550	1	IN/A	03710	M	M	1	MAN	.0		OHS -CK ALL ENG AND LSO OIL AFTER POST DOCK ENG RUN

APPENDIX

APPENDIX B--Manhours for McGuire ISO's (Major) Oct-Dec 87

06 JAN 88/0819 (VIRP-M379S11) MAN HRS FOR MCGUIRE ISO'S (MAJOR) OCT - DEC 87

JCN	MAN HR	JCN	MAN HR
C001	215.0	C037	36.6
C002	31.4	C038	920.8
C003	22.5	C039	4.4
C004	57.0	C040	^{61.0} (7) 58.2
C005	17.5	C041	53.0
C006	30.5	C042	35.1
C007	38.5	C043	10.0
C008	6.5	C044	30.8
C009	5.4	C045	22.0
C010	18.3	C046	17.8
C011	38.8	C047	13.0
C012	25.0	C048	36.0
C013	30.5	C049	35.5
C014	25.0	C050	41.0
C015	17.5	C051	30.5
C016	10.9	C052	23.0
C017	28.8	C053	26.0
C018	18.1	C054	16.5
C019	33.0	C055	12.0
C020	28.3	C056	18.4
C021	17.7	C057	253.0
C022	2.2	C058	121.8
C023	15.7	C059	47.0
C024	56.5	C060	24.2
C025	27.6	C061	13.8
C026	37.5	C062	591.1
C027	29.9	C063	13.1
C028	32.2	C064	10.1
C029	15.5	C065	11.1
C030	39.3	C066	13.3
C031	34.0	C067	83.0
C032	42.6	C068	56.5
C033	26.9	C069	42.5
C034	34.7	C070	47.4
C035	19.8	C071	25.4
C036	14.9	C072	8.0

06 JAN 88/0819 (VIRP-M379S11) MAN HRS FOR MCGUIRE ISO'S (MAJOR) OCT - DEC 87

JCN	MAN HR	JCN	MAN HR
C074	187.0	C112	71.2
C075	20.8	C113	79.5
C076	21.7	C114	170.0
C077	74.0	C115	70.1
C078	191.4	C116	73.0
C079	295.8	C117	73.0
C080	331.5	C118	94.0
C081	335.1	C119	59.0
C082	120.4	C120	162.0
C083	280.1	C121	137.9
C084	285.1	C122	51.0
C085	179.5	C123	04.5
C088	74.8	C124	257.5
C089	169.5	C125	148.5
C090	488.2	C126	83.5
C091	569.5	C127	89.8
C092	118.5	C128	763.8
C093	46.0	C129	30.0
C094	61.0	C130	5.4
C095	326.8	C131	4.5
C096	119.5	C132	4.5
C097	107.5	C133	4.7
C098	79.5	C134	13.1
C099	86.1	C135	74.5
C100	96.0	C136	24.3
C101	159.4	C137	20.3
C102	56.5	C138	27.4
C103	64.2	C139	8.0
C104	121.0	C140	11.0
C105	59.9	C141	76.0
C106	296.0	C142	8.2
C107	442.0	C143	6.5
C108	155.0	C144	42.5
C109	187.1	C145	43.0
C110	114.8	C146	44.0
C111	159.1	C147	11.0

APPENDIX

APPENDIX C--Manhour Summary, Random ISO, Aircraft 157

SRD	WUC	PWC	T M	UNIT	HOURS	ID NBR	START HOUR	DAY PROC	C S	C L	JCN	ID
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868 hrs

AM6	03710	Q2201	P	0	9.5	QA0133	133	307	1	1	306C016	A
AM6	03710	Q2201	P	0	9.0	QA0133	073	307	3	1	306C057	A
AM6	03710	Q2201	P	0	6.0	QA0133	133	307	1	1	306C094	A
AM6	03710	Q2201	P	0	1.0	QA0133	010	307	1	1	306C121	A
AM6	03710	Q2201	P	0	16.0	QA0133	073	307	1	1	306C078	A
AM6	03710	Q2201	P	0	16.0	QA0133	073	307	1	1	306C107	A
AM6	03710	Q2201	P	0	9.9	QA0133	080	307	1	1	306C081	A
AM6	03710	Q2201	P	0	16.0	QA0133	080	307	1	1	306C107	A
AM6	03710	R2201	P	0	1.0	QA0133	073	307	1	1	306C098	A
AM6	03710	R2201	P	0	8.0	QA0133	080	307	1	1	306C107	A
AM6	03710	R2201	P	0	3.0	QA0133	080	307	1	1	306C094	A
AM6	03710	R2201	P	0	12.0	QA0133	120	308	1	1	306C117	A
AM6	03710	R2201	P	0	14.3	QA0133	143	309	1	1	306C145	A
AM6	03710	R2201	P	0	0.3	QA0157	093	317	1	3	316C195	A
AM6	03710	R2201	P	0	3.0	QA0157	073	317	2	1	316C180	A
AM6	03710	R2201	P	0	6.0	QA0157	093	317	1	3	316C037	A
AM6	03710	R2201	P	0	1.5	QA0157	073	317	1	3	3143930	A
AM6	03710	R2201	P	0	6.0	QA0157	093	317	1	3	316C095	A
AM6	03710	R2201	P	0	6.0	QA0157	083	317	2	1	316C061	A
AM6	03710	R2201	P	0	4.0	QA0157	073	317	2	1	316C144	A
AM6	03710	R2201	P	0	5.5	QA0157	080	317	1	3	3143931	A
AM6	03710	R2201	P	0	1.0	QA0157	103	317	2	1	316C177	A
AM6	03710	R2201	P	0	3.0	QA0157	073	317	2	1	316C053	A
AM6	03710	R2201	P	0	1.0	QA0157	083	317	1	3	316C018	A
AM6	03710	R2201	P	0	2.0	QA0157	093	317	2	3	316C092	A
AM6	03710	R2201	P	0	1.0	QA0157	074	317	1	3	316C022	A
AM6	03710	R2201	P	0	7.0	QA0157	073	317	2	1	316C183	A
AM6	03710	R2201	P	0	7.0	QA0157	073	317	1	3	316C157	A
AM6	03710	R2201	P	0	7.0	QA0157	120	317	2	3	316C176	A
AM6	03710	R2201	P	0	7.0	QA0157	094	317	1	3	316C174	A
AM6	03710	R2201	P	0	7.0	QA0157	093	317	1	3	316C173	A
AM6	03710	R2201	P	0	6.0	QA0157	093	317	1	3	316C175	A
AM6	03710	R2201	P	0	6.0	QA0157	090	317	1	1	316C191	A
AM6	03710	R2201	P	0	6.0	QA0157	110	317	1	3	316C055	A
AM6	03710	R2201	P	0	2.5	QA0157	143	317	2	1	3143940	A
AM6	03710	R2201	P	0	1.3	QA0157	163	316	1	2	316C011	A
AM6	03710	R2201	P	0	1.5	QA0157	153	316	1	3	3143934	A
AM6	03710	R2201	P	0	1.0	QA0157	160	315	1	1	3130130	A

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