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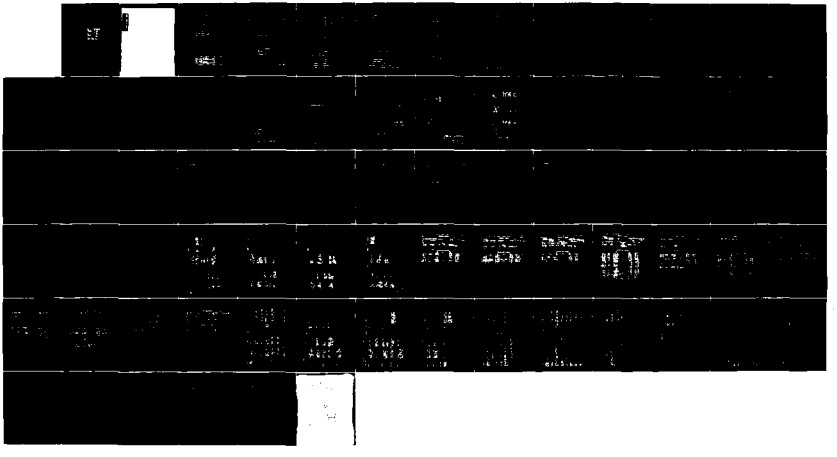

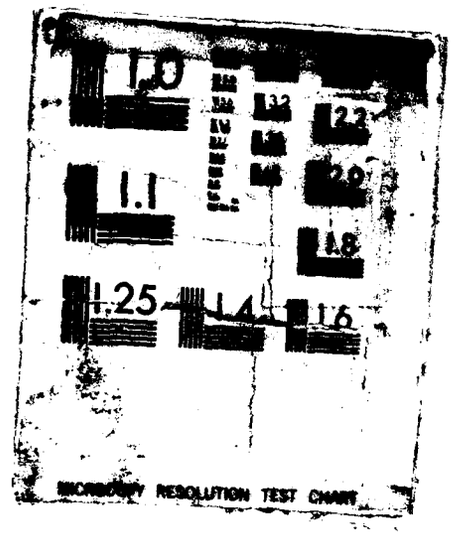
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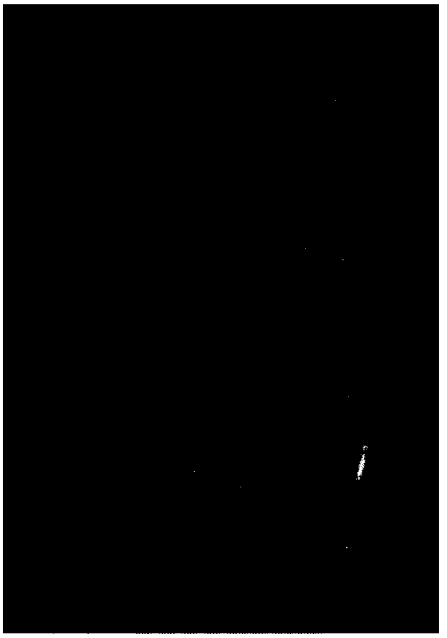

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1.0 INTRODUCTION

The purpose of this report is to provide Aircraft Maintenance Management and Engineering information necessary to select the optimum modernization plan to update the existing sheet metal shop for the Aircraft Division, Building 375, at San Antonio Air Logistics Center (SA-ALC).

During the interim study and analysis report review of December 17, 1985, four conceptual layouts were presented to SA-ALC. It was concluded that one modernization layout would be prepared for the final report.

This report describes the methodology used in accumulating data and how these data were interpreted to derive the proposed modernization layout.

The recommendations and modernization plan to upgrade the existing sheet metal shop are based on surveys and analyses conducted by a Boeing Aerospace Operations (BAO) team representing the Materials and Processes, Facilities, and Manufacturing disciplines. → cont'd pg 3

2.0 EXECUTIVE SUMMARY

Study Purpose

The purpose of this modernization study is to provide recommendations to SA-ALC for modernizing the sheet metal facility. These recommendations include the adoption of the

latest advancements in sheet metal fabrication equipment to improve productivity of the sheet metal facility.

Study Tasks

The tasks of this study were to:

1. Evaluate present sheet metal operations at SA-ALC with regard to organization, workload, and equipment to establish a basis for developing productivity improvement recommendations.

2. Study other sheet metal manufacturers' operations to determine desirable technology and equipment capabilities which could be utilized to improve the sheet metal operations at SA-ALC. This study focused on processes, equipment, workload, work flow, and organizational interfaces.

3. Develop optimum modernization plan to upgrade the present sheet metal shop in Building 375 at SA-ALC.

4. Study the present support organizational interfaces (i.e., Engineering, Planning, Scheduling, etc.), scheduling techniques, and parts accountability; and provide recommendations to minimize work stoppage, misdirected material flow, material shortages, and other parts control problems.

Study Approach

The evaluation activity proceeded through these major steps:

1. Conducted sheet metal shop survey to evaluate and document current conditions.
2. Conducted remote site surveys to evaluate the sites' methods of operation and to ascertain if portions of their technology and techniques could be applied to SA-ALC operations.
3. Conducted equipment evaluation at SA-ALC and evaluated maintenance records.
4. Developed four sheet metal shop conceptual layouts in sufficient detail to provide estimated budgetary costs for new equipment and an indication of increased fabrication capability. Each conceptual layout allowed for integration of new machines with existing equipment and progressive elimination of obsolete machines.
5. Determined potential impact to support organization interfaces due to the large quantities of data and material required to support the proposed modernization plan.

Summary of Findings

The recommended modernization plan was selected from the four conceptual layouts presented to SA-ALC on December 17, 1985. This plan allows for integration of new machines with existing equipment and progressive elimination of obsolete machines. Some existing machines are to be refurbished to return them to near-new capabilities. High-technology ancillary equipment is

Keywords: manufacturing

recommended. This plan can be implemented in small increments so that there will be little or no impact to the sheet metal production capability during the transition period.

With the introduction of new high-technology machines and equipment in the sheet metal shop, large amounts of data (parts fabrication plans, digitized data sets, etc.), tooling, and material are required. The support organization interfaces (i.e., Engineering, Planning, Material, Scheduling, etc.) must be in a position to respond to this increased work load. Recommendations are provided to enhance support organizations' capability.

3.0 SAN ANTONIO FACILITY SURVEY

A survey of the Air Force Air Logistics Center in San Antonio, Texas, was conducted on August 20-23, 1985. The objective of the survey was to familiarize team members with available information on sheet metal operations, facilities, and anticipated shop work loads. Problems with the existing sheet metal fabrication shop and data processing were also noted.

Parts being fabricated in the sheet metal area of Building 375 (reference Figure 1, Sheet Metal Shop - Existing) during the survey were primarily in support of the Pacer-Lite program to replace cowlings on the B-52H. This requires SA-ALC to build replacement cowling assemblies for all of the B-52H aircraft in the inventory. In addition to this major undertaking, the sheet

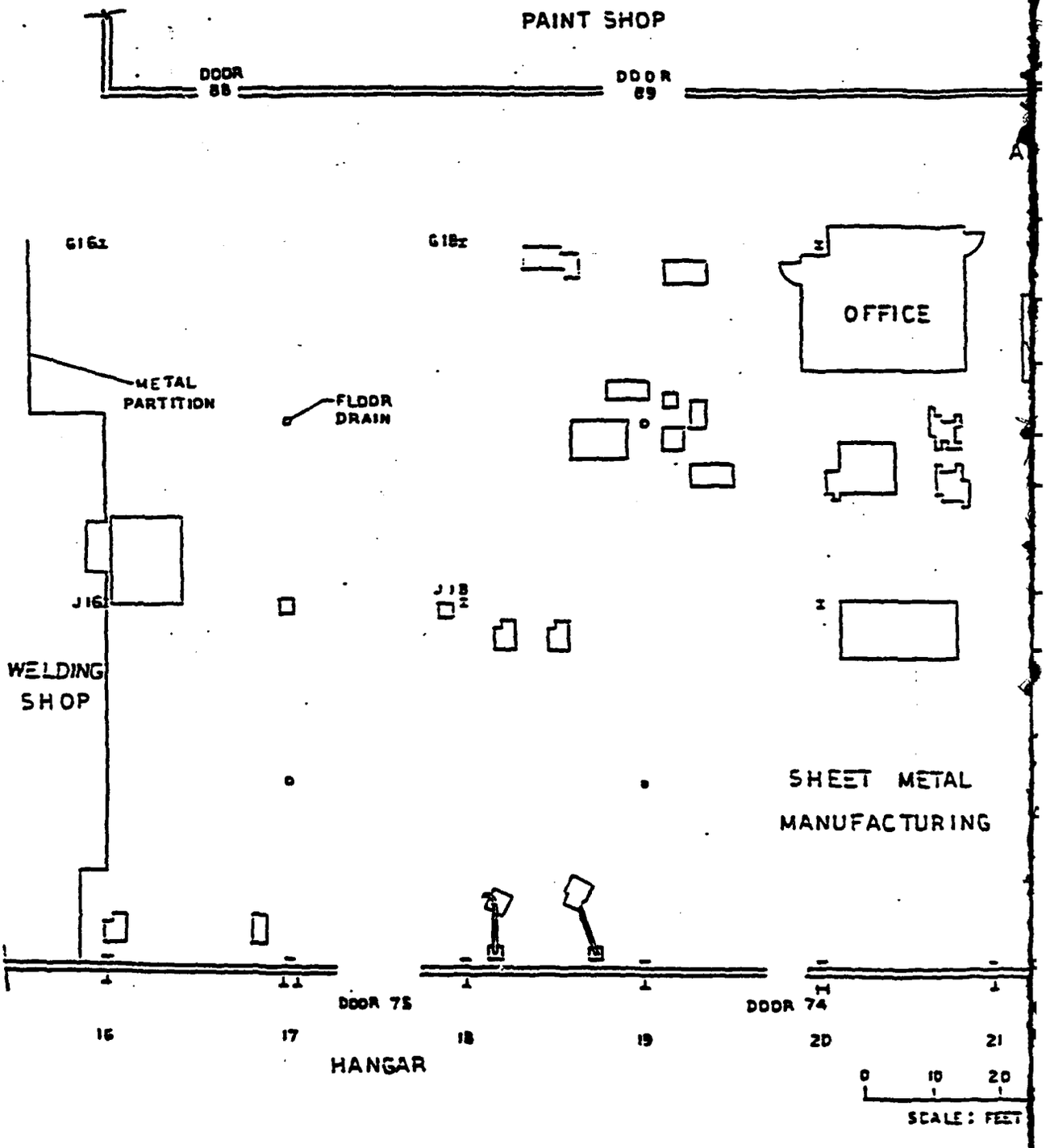
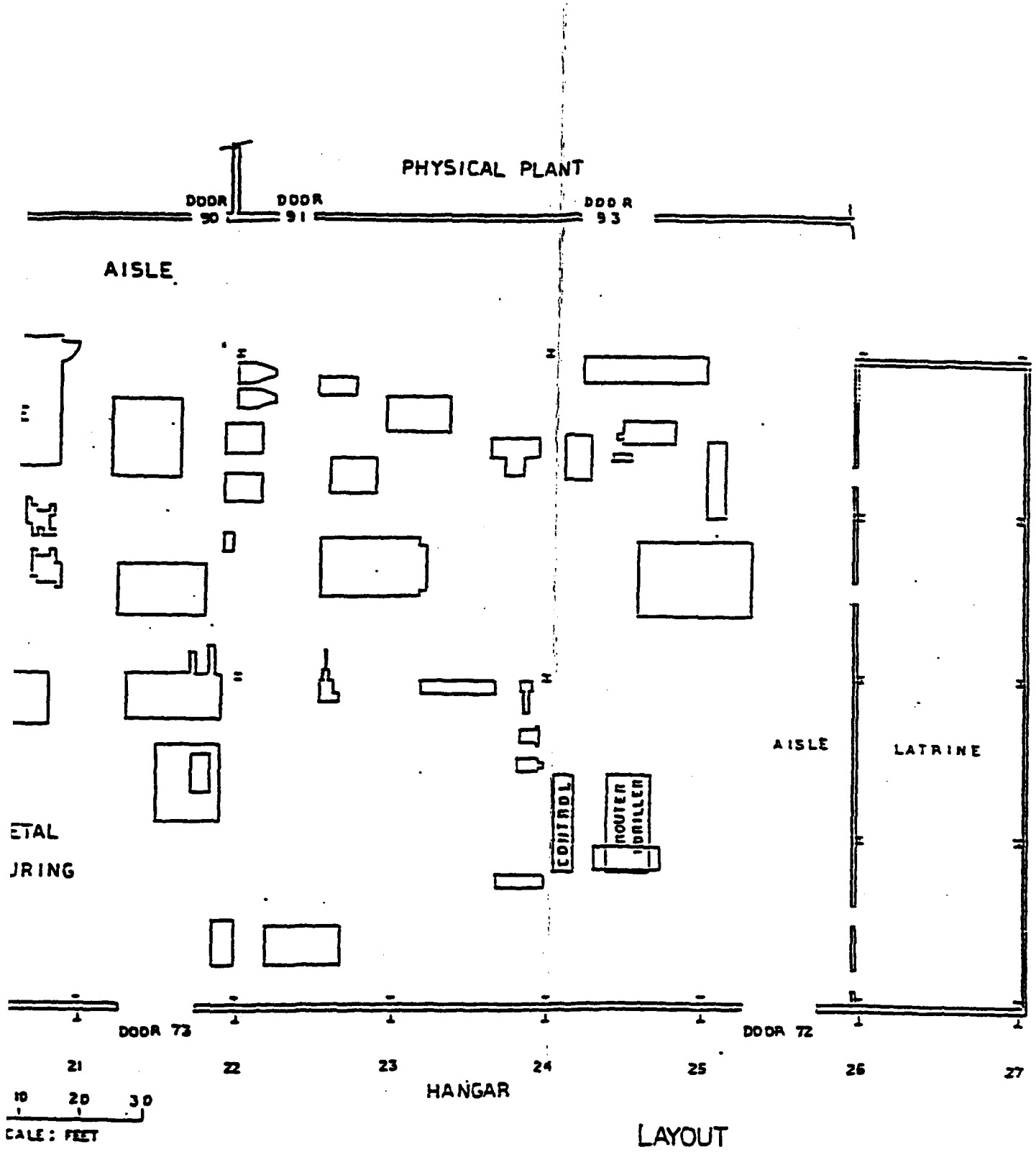


FIGURE 1 - SHEET METAL SHOP - EXISTING



LAYOUT
EXISTING SHOP

metal area was also supporting Material Inventory Center (MIC) replacement and Maintenance Items Subject to Repair (MISTR) hardware.

The various processing shops (heat treat, cleaning, painting, etc.) were not surveyed. Their ability to support an increase in productivity of the sheet metal shop is not known and would be difficult to determine without detailed knowledge of current and anticipated work loads.

During the shop survey, several situations were observed which appear to be counterproductive and would not support a proposed schedule-oriented system. They were:

1. Shop mechanics devised their own tooling.
2. Parts were being made on a hydraulic press using a rubber assist on some of the tools (form block). This resulted in unacceptable flanges which required hand working to achieve a finished part.
3. Band saws had apparent excess chatter, possibly indicating the wrong type of blade. Shop mechanics indicated saw blades were not appropriate for the job at hand. Correct blades had been ordered but substitution was made during procurement.
4. Large pallets of raw material were setting idle because of:
   - Job being held because of shop "earned-hours" requirements to satisfy bookkeeping.

- Material waiting release of job or being held waiting for other materials or parts.

5. There was no evidence of a controlled production schedule.
6. Tool proofing was not being conducted.

Poorly maintained power machines also contributed to less than optimum productivity. Those noted during the survey were:

1. Hydroform press were out of service for long periods of time.
2. Visible cracks in structural members of major machines limited the machine's capability and also presented potential personnel safety hazards.
3. There were no modern "state-of-the-art" attachments or high-technology add-ons, such as trapped rubber heads on hydraulic presses or punching capability on brake presses.

4.0 REMOTE SITE SURVEYS

Remote site surveys were conducted to evaluate the sites' methods of operation and to ascertain if portions of their technology and techniques could be applied to SA-ALC operations. To perform these surveys, a BAO team representing Manufacturing Engineering, Manufacturing Planning, and Materials and Processes Engineering was organized to survey the following sites:

Boeing Commercial Airplane Company (BCAC) - Seattle, Washington, September 3 through 5, 1985

Uniqueness - Automated planning and scheduling systems. This is a low lot size production operation with many lot sizes of 10 to 20 parts. BCAC's automation system controls material procurement, scheduling, shop routing, and tooling for a scheduled quantity of up to 4.6 million parts/year.

Boeing Military Airplane Company (BMAC) - Wichita, Kansas, September 9 through 13, 1985

Uniqueness - Insertion of single part requirements into standardized system. Conversion of multiple airframe manufacturers' drawing data (L1011, DC10, DC8, or A300) to usable BMAC working data is a major undertaking. This conversion is digitized for NC machines and put in the standard planning system (same as BCAC). The parts are then processed to the airplane in 10 to 17 calendar days.

Sacramento Air Logistics Center (SM-ALC) - Sacramento, California, September 24 and 25, 1985

Uniqueness - Innovations to standard Air Force regulations. SM-ALC is implementing a new parts control system which schedules work to shops on a parts-needed basis. This starts with a preplanning function which improves material procurement, defines materials for volume procurement, and reduces lost or misplaced parts and materials.

United Airlines (UAL) - San Francisco, CA., September 26, 1985

Uniqueness - Like BMAC, UAL has all airframe manufacturers represented in its inventory. UAL's is a repair and maintenance operation, whereas BMAC's is a modification operation. To meet its demands, UAL has taken standard company processes and applied them to all airframes. It also is involved in quick turnaround for repairs and has devised an organizational interface communication system. This system starts with the preplanning meeting, which defines expected requirements. Each responsible organization preplans its preliminary work on the basis of this expected requirement and is then in a position to implement work when engineering releases final data.

Machines, facilities, and craftsmen at each site were found to be basically the same. The difference in productivity is significant and is caused by the difference in requirements at each facility. Each site visited is applying new technology to its operations and facilities, each in a different manner. Many of these techniques can be applied to the SA-ALC modernization layout. Appendix A (Industrial Site Survey Technology Assessment Report) provides additional information regarding techniques and methods utilized in the various facilities.

5.0 EQUIPMENT EVALUATION AT SA-ALC

The sheet metal shop facilities encompass some 24,245 square feet divided into two areas: 13,300 square feet for power machines and the balance for hand operations. Machines are old, averaging 24

years of service. The major items of sheet metal power equipment at SA-ALC are shown in Appendix B, Table B-1. This table identifies year of delivery, spare parts availability, and other evaluation data.

Maintenance data were provided for 11 items of power equipment as shown in Appendix B, Tables B-2 through B-12. These maintenance data were evaluated to arrive at anticipated maintenance costs as illustrated in Appendix B, Figures B-1 through B-5. Analyses of these data were used to arrive at the conclusions and recommendations in Table B-1.

6.0 SHEET METAL SHOP MODERNIZATION LAYOUT

6.1 Production Capacity

Since baseline data were not available for the sheet metal shop parts count, part size, material, process flow, etc., the following reference documents were utilized to arrive at projected requirements and capabilities:

1. A-G013, A12-UD-MB4 MMSIP Monthly Production Count Summary/Analysis, dated June 30, 1985.
2. Analysis of Material and Parts Processing at Aircraft Division, Contract Number F41800-85-C0090, dated October 18, 1985.
3. Integrated Computer-Aided Manufacturing (ICAM) Sheet Metal Center Concept Design Volume II, Contract Number F33615-78-C-5149, dated September, 1981.

From item 1. above and conversations with SA-ALC personnel, it was determined that the SA-ALC baseline sheet metal parts output is between 9,000 and 10,000 parts per month. An output of 10,000 parts per month will be utilized for this study. Figures 4.4 and 4.5, in Volume I of item 2. above, provide a 6-year growth projection of 21.2 percent. This figure also identifies the numbers and types of aircraft subject to SA-ALC's control during this 6-year period. Assuming that this growth would be applicable to work load growth in the sheet metal area, a 21 percent growth estimate is used for calculations.

From the supporting documents listed above, the following data were derived.

1. The present sheet metal production count is 10,000 parts per month with a total increase of 21 percent in 6-years to 12,100 parts per month. (Reference document 1. above.)

   Where single-year increases are calculated, the factor of 12.86 percent will be used, which is the percent age gain from fiscal year 85 to fiscal year 86. This factor will be considered the "surge" load baseline. (Reference document 2. above.)

2. Material usage (Reference document 3. above.) percentages are as follows:

   86% = Aluminum Alloys

   7% = Stainless Steel

3.5% = Carbon Steel

Balance = Titanium & Other Alloys

3. Parts shape percentages (Reference document 3. above.) are as follows:

Aluminum Parts

23% = Flat

77% = Formed

57% by Brake Press

28% by Hydroform (Guerin Rubber Form)

2.0% by Drop Hammer

2.1% by Stretch Press

10.8% Other

4. The DAO survey team considers the pacing items for improving the sheet metal shop capability to be the NC router and the NC profile punch press. Users of this equipment and the supplier data indicate the following parts-per-hour capability based on a .080" x 10.0" x 10.0" aluminum part.

NC ROUTER

Sheet size 48" x 96"

Single-Sheet Load = 3S/hour

Five-Sheet Load = 17S/hour

Ten-Sheet Load = 35S/hour

NC PROFILE FABRICATOR PUNCH PRESS

Single-Sheet Load = 3S/hour

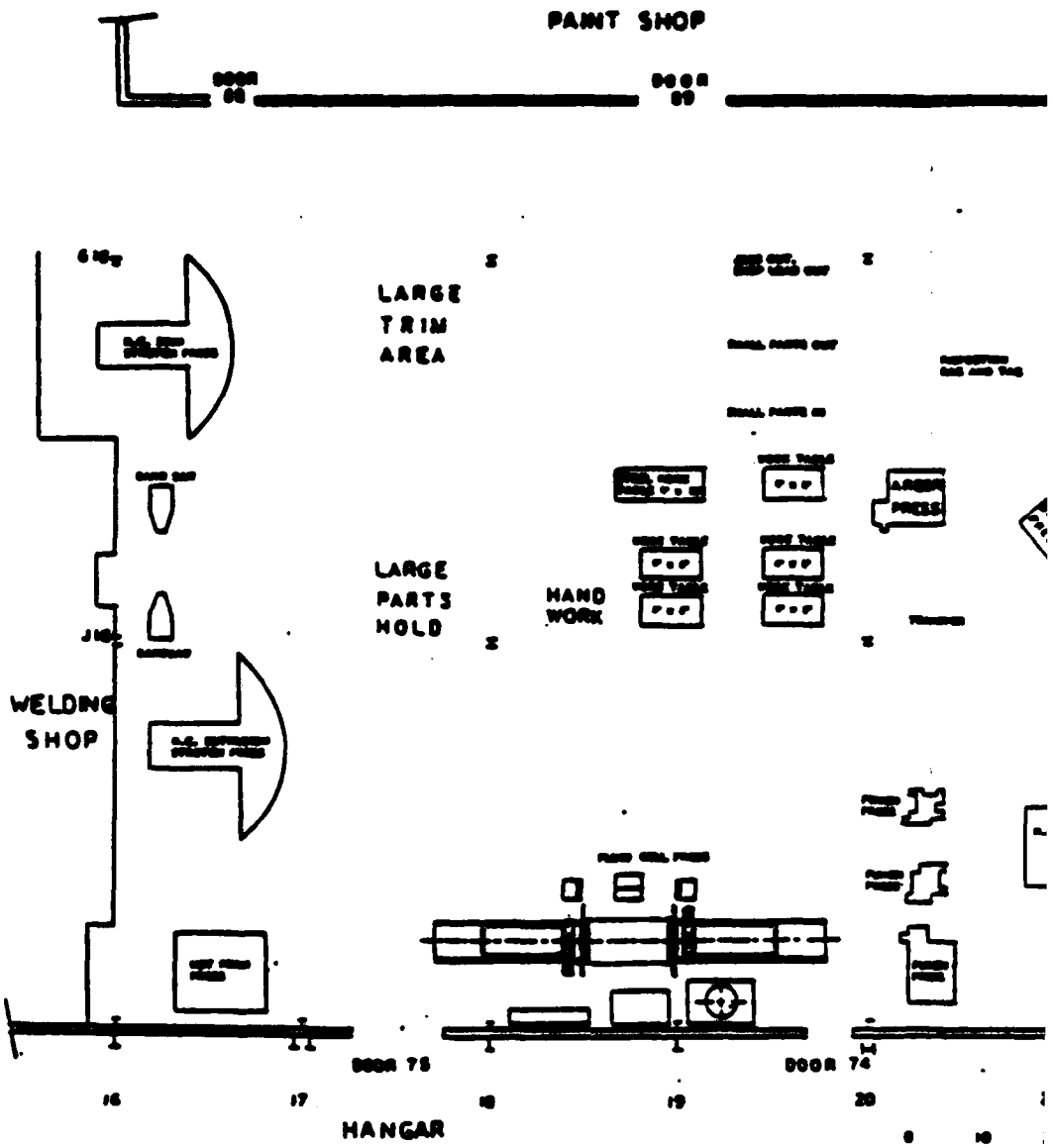
These values are conservative and will vary based on data processing, flow patterns, material, shop mechanic skills, and processing shop support. These data have been used to calculate the potential increased fabrication capability as shown in Figure 2, Sheet Metal Shop Modernization Layout, and in Figure 3, Parts Data.

6.2 Recommended Modernization Plan

To assist SA-ALC management in the selection and justification of the most appropriate facility, cost estimates for new equipment were prepared for both the existing facility and a new facility. Four conceptual layouts were prepared: two layouts for the existing facility and two for a proposed new facility.

Each conceptual layout allowed for integration of new machines with existing equipment and progressive elimation of obsolete machines. The layouts could be implemented one at a time with minimum impact to ongoing sheet metal production. At the interim review in December 1985, after reporting the cost for each layout, SA-ALC direction was given to concentrate on estimating the updating of the existing facility.

The existing sheet metal shop is not designed for an optimum flow of parts. The modernization layout repositioned most major items of equipment for optimum flow of parts and material through the shop. The Hydra press, 300-ton press, and Arbor press were not relocated because of subfloor installation.

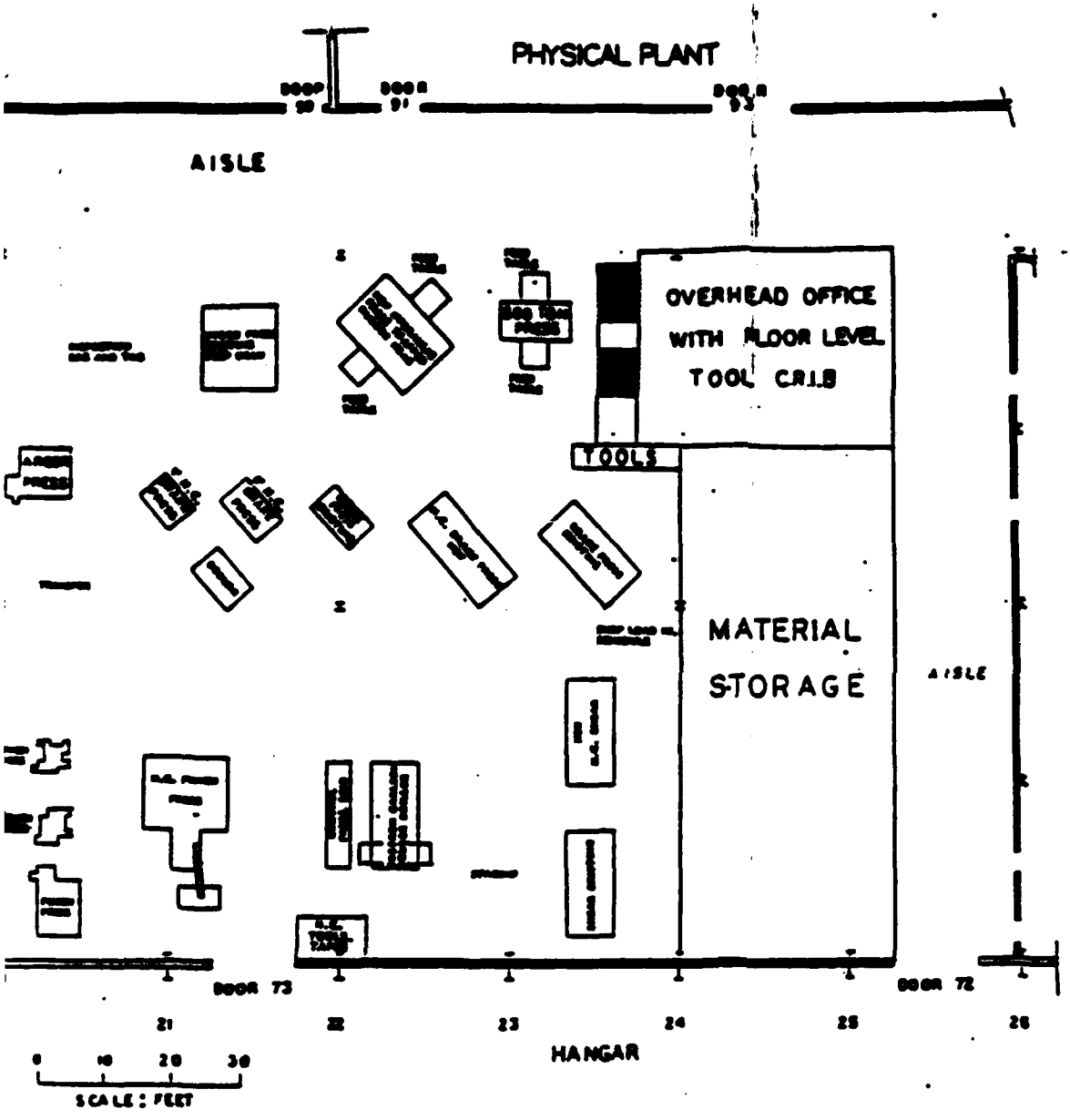


NOTES:

(1) EXISTING SHOP, NEW MACHINES INSTALLED TO UPGRADE CAPABILITY WITH SELECTED OLD MACHINES AS BACKUP, ADDED MATERIAL STORAGE AND NEW OFFICE SPACE.

(2) DROP HAMMER TO REMAIN AS IS.

FIGURE 2: SHEET METAL SHOP MODERN



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LAYOUT
MODERNIZATION PLAN
SA-ALC SHEET METAL

28945 SK 10051-2

OP MODERNIZATION LAYOUT

PART COUNT DATA (A)			
PART FORM METHOD	EXISTING PART QTY PER MO.	GROWTH ESTIMATE PER MO.	PARTS CAPABILITY PER MO.
HYDROFORM	2,156	2,609	5,440 & <
BRAKE PRESS	4,389	5,311	8,400 & <
FLAT PARTS	2,300	2,783	18,200 & <
DROP HAMMER	154	186	280 & <
OTHER			
• NC EXTRUSION STRETCH PRESS	0	416	500 & <
• NC SKIN STRETCH PRESS	0	196	280 & <
• HOT FORM	0	280	320 & <
• DEEP DRAW	280	280	280 & <
• HAND WORK, ETC.	721	40*	-
TOTAL	10,000	12,101	33,700 & <

PART COUNT DATA (B)			
SHAPE FLAT PARTS	EXISTING PART QTY PER MO.	GROWTH ESTIMATE PER MO.	PARTS CAPABILITY PER MO.
NC ROUTER	0	4,700	4,900 & <
NC PROFILE PUNCH PRESS	0	2,700	4,900 & <
SHEARS & OTHERS	10,000	4,700	8,400 & <
TOTAL	10,000	12,100	18,200 & <

*PART COUNT IN THIS AREA WILL DROP.
PARTS WILL BE MADE ON NEW EQUIPMENT.

FIGURE 3 PARTS DATA

The modernization layout is shown in Figure 2, Sheet Metal Shop Modernization Layout. This plan can be implemented in small increments.

1. The major items for increasing sheet metal parts production are the NC router, NC profile punch press, debur machine, and translator digitizing system. The NC router and punch press will greatly facilitate the shaping of sheet metal parts, and the translator digitizing system will supply digitized data sets to the NC machines. The debur machine will greatly reduce the flow time and labor to brake and debur parts.

2. Since hydroform parts are more labor intensive although fewer in count, hydroform presses will require updating prior to making improvements in the brake press process. The new hydraulic press with a trapped rubber head and two feed tables should be put into operation, and then the 500-ton hydraulic press should be refurbished with a trapped rubber head and two feed tables added. This improvement will considerably increase the press's hydroforming capabilities, thus allowing it to handle the expected increase in part count. This will contribute significantly to the reduction of handwork man-hours.

3. The brake form capability will be improved with one 12-feet NC brake press, one 6-feet NC brake press, and one 4-feet NC brake press. In addition, unitized punching

tools for pilot holes are required. The addition of this equipment will allow the brake form to handle the required increased part count but will require the addition of a new NC shear to cut raw material to flat pattern sizes.

The following new equipment has been identified to increase the shops' capability to produce sheet metal parts which are not presently being fabricated at SA-ALC but will be required for future modification work on both present- and new-generation aircrafts:

1. NC Extrusion Stretch Press.
2. NC Skin Stretch Press.
3. Hot Form Press.
4. Fluid Cell Press.

To support the new NC machines, the organization responsible for the layout of flat patterns and other tooling will require a Computer Aided Design/Computer Aided Manufacturing (CAD/CAM) terminal. This terminal should interface with the proposed digitized system which converts hardcopy drawings to digitized data sets. The CAD/CAM terminal will be typical of those now in use for NC mills and lathes and will allow tapes to be organized for the NC router and punch press. The terminal should be equipped with: (1) software programs to make data sets for routing flat patterns for both airframe and commercial air conditioning ducts, and (2) software that will interface with the

NC machines and also the plotters. The CAD/CAM system will not be a primary system but will be utilized as a backup system to preclude work stoppage for lack of data sets or other digitized data.

6.3 New and Modified Machines

The new and modified machines recommended for use in the modernization plan are listed in Appendix B, Tables B-13 through B-15. Data provided included:

1. Rough Order of Magnitude (ROM) Cost (FOB Supplier).
2. Expected Delivery Time Frame.
3. Consumables.
4. Electrical Power Requirements.

New equipment data contained in the matrices are based on teleconference inquiries with equipment suppliers during the last quarter of 1985. Prices are subject to change without notice.

The retained and modified equipment recommended for use in the modernization plan is based on data from historical maintenance records (Tables B-1 through B-12 and Figures B-1 through B-5), cost estimations from refurbishment firms, machine replacement values, and engineering judgement from visual observations.

One copy of layouts, calculations, and original vendor data used in preparation of this report will be catalogued and furnished at the time of submittal of the final report.

7.0 SUPPORT ORGANIZATION INTERFACES

7.1 Conclusions

The following observations, derived from the technical team survey and the foregoing technical discussion, are offered to further the process of modernization of the sheet metal shop. Installation of NC equipment (brake and punch presses) and trapped rubber heads for new or existing equipment will greatly increase the capability to fabricate sheet metal parts and will meet or exceed the 21 percent growth estimate. Large quantities of data and material will be required to support the proposed new sheet metal facility. The support organizations that will be impacted the most by the new equipment are as follows:

ENGINEERING - Increase capability to allow part programming, develop digitized data, and design tooling (special tools, form blocks, etc.).

PLANNING - With the increase in sheet metal parts production and use of high-technology machines, the primary concern is the requirement for a master schedule based on part need date. Job planning should include specification of materials, designation of form blocks, machines, processes, and process sequence.

SCHEDULING - The job planning data should provide the basis for preparing and maintaining a master schedule for parts flow through the shops. Automatic Data Processing (ADP) will simplify integrating new tasks and coordinating tool availability, material, and manpower.

MATERIAL - ADP planning will enable accurate record keeping and assist in projection of material usage so that proper inventories can be established and maintained.

SHOP SUPERVISION - Select key people for training at factory schools and then cross-train backup personnel.

FACILITIES/ MAINTENANCE - Establish maintenance schedules for new machines and train key personnel to new high-technology requirements. Provide maintenance data for integration with hardware production scheduling.

DATA PROCESSING - Update/develop standard automated planning system to work with master schedule. Develop retention and retrieval system for digitized data converted from engineering drawings.

TRAINING/ CERTIFICATION - Training on new high-technology equipment should be part of the purchase agreement. At present, no certification requirements are needed. For new NC machines, trained operators are required and their proficiency must be maintained and documented.

7.2 Recommendations

The following recommendations are derived from technical team surveys, the modernization layout of Figure 2, and the foregoing technical discussion. Specific recommendations are as follows:

Engineering - SA-ALC engineering makes parts for many different types of aircraft, each with a different drawing system (e.g., Boeing (B52), Lockheed (C5A and C130), etc.). With the introduction of data sets it becomes a major task to convert this diversified data to a machine compatible language. A layout specialist group will be required to translate these company drawings to usable language data for the machine. This group will provide the data necessary to define a flat pattern from hardcopy for routing on the NC router or profile punch press. This group will also arrange the parts on sheet stock to control scrap and provide the data to the operators through tape or computer storage for NC operation. All tapes for the NC router will be prepared by this group. They will also be responsible for storage of the electronic data and to build a data base for future use.

Layout specialists can also support other organizations such as tooling, by scribing or routing headers for a master model to be used in drop hammer or fiberglass fabrication. Also, layout specialists can provide building maintenance with data sets of air conditioning transitions, plenums, etc., or provide full size mylar copies of data to be used for making drill tools, hand routers, and assembly fixtures. A specialist is needed who understands design requirements for appropriate tools to work with the new generation NC equipment.

Planning - A master schedule based on part need date should be developed. Detailed planning for each part which includes material, tool, machines, processes, process sequence, and part flow through the shop should be formulated for consistency. Each part should be assigned a code number, i.e., a series of numbers or letters for automatic data processing. The number should indicate such parameters as designated machine, processes, surface finishes, material shape, chemistry, dimensions, tolerances, lot size, etc. This information provides the foundation for a data base which has broad applications. Since SA-ALC makes parts for the B-52, C5, and C-130 aircraft, each with different types of drawing systems, the data base can be used to group parts by common characteristics, which in turn, makes it possible to eliminate unnecessary planning. Such a system has been demonstrated to reduce the time required for planning by as much as 80 percent.

The survey team reviewed planning and scheduling systems during the remote site surveys. Standardization is the key. The systems surveyed were based on repeating the same functions over and over and doing it the same way every time. BCAC standardized each activity. Individual methodologies were discarded. This system was then converted to usable software and sheet metal planning became standard and automated.

With the new machines at SA-ALC a similar system should be employed. The changes need to be internally reviewed and made an integral part of the modernized sheet metal operations.

Scheduling - Scheduling must control parts flow through the shops, i.e., when parts will be at specific locations, how long they are to be in that location, and what the "hold up" is if they fail to move. With this system "bottle necks" and "work stoppages" occurring from lack of data, material, or manpower become highly visible.

Material - With automated planning and scheduling in place, the materials function must also become automated. Part count, quantity, material, etc., are easily assessable allowing identification of trends. Once these trends are identified, quantitative analysis can be made which will assist in projection of material usage so that proper inventories can be established and maintained.

Shop Supervision - Training of personnel to be specialists and assuring backup personnel availability is crucial to a schedule-sensitive system. New technology requires greater knowledge with regard to utilization and training of personnel.

Facilities Maintenance - With NC machines as primary drivers for scheduled production it becomes vital to assure the machines operate at optimum levels. Scheduled preventative maintenance is the key to long runs with minimum down time. Maintenance should become a part of master scheduling.

Data Processing - This system will automatically be revised as other organizations automate or apply electronic systems. The main concern of this operation is to assure standardization. This means that each organization's data processing will interface with the others. An individual from engineering, planning, or scheduling should be responsible for maintaining uniformity and standardization for the data system.

Training/Certification - Training will be divided into two sections for the new electronic systems. Both operators and maintenance personnel should be factory trained by the equipment manufacturer and will then become instructors for others. Maintenance personnel, requiring factory training, will be used to keep machines in service, to train other maintenance personnel, and establish the milestones for preventative maintenance on the master schedule.

APPENDIX A

INDUSTRIAL SITE SURVEY TECHNOLOGY ASSESSMENT REPORT

DW-10051-1

INDUSTRIAL SITE SURVEY

TECHNOLOGY ASSESSMENT REPORT

SEPTEMBER 3-24, 1985

The industrial site survey assessments, reported in this document, were requested by the SA-ALC/MAB, Kelly AFB, San Antonio, Texas 78208, under Government Contract Number F41800-85-R7366; however, it does not necessarily bear the endorsement of the requesting agency.

ABSTRACT

The industrial site surveys were conducted by a BAO team to evaluate their sheet metal fabrication methods, procedures, data processing, and equipment; and to ascertain if portions of their technology, technique, operations, and facilities could be applied to update the SA-ALC sheet metal operations.

1.0 INTRODUCTION

The primary objective of the site surveys was to familiarize team members with the sheet metal fabrication methods and data processing at SA-ALC and then survey the industrial sites in the areas of process equipment, workload, work flow, organization and organizational interfaces. BAO will evaluate their methods of operations to ascertain if portions of their technology and techniques can be applied to SA-ALC operations.

2.0 SITE SURVEYS

2.1 Boeing Commercial Airplane Company (BCAC) Survey

BCAC is the largest commercial aircraft manufacturer in the world. Their sheet metal operations are set up to support delivery of new aircraft. They produce a very large volume of sheet metal parts; however, most job orders processed through the shop are for 10 to 20 parts/part number. The sheet metal fabrication facilities are located in Plant II, Seattle, Washington.

The procedures used to identify and control flow of sheet metal through the system were presented by the Industrial Engineering Office. The concept is based on a master schedule with each organization providing their service in a timely manner to produce parts on schedule. Pressure is placed on the schedule when one or more groups increase their capability and, therefore, put forth a requirement for the interfacing group's improvement. This system has forced planning to join the high-technology environment.

Past planning methods were explained. The only uniformity was that Boeing processes were used and some standard tools were available. The requirement for increased efficiency changed this method of operation to a standardized system. Research was implemented and a system devised which made all sheet metal planning uniform. Tools were catalogued and, where possible, defined as a standard. A methodology was developed for sequencing the part through the shops and allowed planning to reduce the flow time through the shop by 80 percent. The overall effect on the part production improvement curve is still being assessed. It is, however, known that besides reduced planning time, gains were made in:

1. Estimating need for tools and their cost.
2. More legible shop paper (machine typed versus handwritten).
3. Standardization of tools by families.
4. Reduced errors in Routing, Labor Standards.
5. Repeatable for follow-on lot orders.

These changes were dramatic in changing the format and output of production planning, but the organizational manpower remained constant. Experienced personnel were used to compile data, while others were retrained to use the high-technology machines and equipment.

ADVANTAGES

This system is simple and has many features that could be implemented at SA-ALC. It will require realigning interfaces and organizational responsibilities. Some items which should be considered for incorporation into the SA-ALC sheet metal operations include:

1. Standardization in design, planning, processes, and parts manufacturing.
2. The planner must plan each job from start to finish, which includes specifying materials and dedicating specific machine tools (existing/new), form blocks, machines, processes, and the manufacturing of parts to a predetermined schedule.
3. Each part should be assigned a classification number or code number, a series of numbers or letters which can be handled by a computer. For example, it would include machine operations, surface finishes, material shape, chemistry, dimensions, tolerances, lot size, etc. This information provides the foundation for a data base which has broad applications. Since SA-ALC makes parts for the B-52, C5, and C-130 aircraft each with different types of drawing systems, the parts can be grouped by common characteristics, which in turn, makes it possible to eliminate unnecessary planning duplication. This has been demonstrated to reduce the time for planning by as much as 80 percent.

4. Parts of the BCAC system, when integrated with the SA-ALC system, could provide the needed improvement to support change and could possibly be software programmed into existing equipment. The standardization and uniformity alone would reduce misinterpretation by interfacing organizations and provide a smoother, quicker transmission of data. The system is geared to accept "surge loads" and, in most cases, without premium time being allocated.
5. BCAC's primary driver "Production Schedule" was evident in the warehousing of material, movement to the machines, and the routing of tools to machines.

2.2 Boeing Military Airplane Company (BMAC) Survey

BMAC is primarily a large aircraft modification center for military aircraft and large commercial airplanes. Their flight line appears to be an international airport with all types, sizes and vintages of aircraft represented. In some cases, parts and aircraft were being repaired to foreign flight regulations. They also build the cabin sections for the 737, 757, and 767 airplanes for BCAC.

The primary concern at BMAC was utilization of machines and facilities when the quantity of parts might be one or two and the schedule on the planning card was ASAP-AOG.

BMAC is a smaller, more diverse sheet metal fabricator than BCAC. Diverse machines such as: NC Laser routers, Linemill Tracer Water Cutter routers, special designed routers to profile extensions, and shop controlled digitizer systems were used. These allow efficient utilization of material and the placement of AOG parts into the flow without jeopardizing planned schedules. When the shop or workload capability is calculated, the allotted time is so close to actual time that any break in the system creates large backlogs. This has made it necessary to develop a comprehensive preventative maintenance system and machine replacement program which allows the sheet metal shop to support the high volume quantities their programs require.

Computer Numerical Control (CNC) machines and Numerical Control (NC) machines require large amounts of data and large quantities of material. Digitized systems are controlled by and dedicated to support the sheet metal shop in fabrication of spare parts for all types of military and commercial aircraft, both U.S. and foreign. Boeing maintains approximately a 3-month supply of material based on the current use rate. Material availability status is basically computer controlled and is monitored very closely. Boeing usually contracts with a vendor to supply their material for a specific period of time. The vendor monitors the use rate and keeps the material at a specified level.

Boeing has standardized all their Engineering, Planning, and Manufacturing operations which allows BMAC and BCAC to have the same data processing operation. BMAC is geared to make small

quantities of parts with minimum tooling and yet maintain a large product support capability for BCAC.

ADVANTAGE

1. Same as BCAC.
2. Note: The digitizing system at SA-ALC to inout data to the new NC machines should be dedicated to or controlled by the sheet metal operation. Any interruption of data flow to the machines will result in a large backlog of orders very quickly. A disruption of material supply can also result in increased backlog.

2.3 Sacramento Air Logistics Center (SM-ALC) Survey

This survey was an opportunity to study a companion Air Force Logistics Center operation using the same regulations as SA-ALC and ascertain if innovations were being used which could be applied at SA-ALC operations.

This logistic command supports the A10, F111, and B-52 aircraft. Their operation parallels SA-ALC but innovations have been implemented to efficiently use their machines.

Scheduling and routing is in the process of implementing a change to a "Kit" method. This system routes all orders and material to the "Kit" area, the orders and materials are then released to the work area on a schedule need requirement not on an "earned-hour" value or some other priority.

Template layout requirements are also provided by a template layout group. These draftsmen prepare all templates for the brake presses, router, headers in master models, and locate features for assembly tools. They also design tools, prepare tapes for NC punch presses, develop flat patterns, and define material quantities for production runs.

The NC punch press was the leading item in the sheet metal fabrication area. The addition of a trapped rubber head to an old hydraulic press and automatic loading devices, along with a "follow a line" battery-powered mule, are examples of innovative improvement.

SM-ALC personnel were very inquisitive about other operations in other places, and talked briefly of developing an Air Force Logistics Center (AFLC) quarterly meeting to exchange ideas.

ADVANTAGE

1. Planning provides the sheet metal craftsmen with the data, material, and tools, if required, so their time can be devoted to making parts.
2. Planning is scheduling the work to a master parts schedule.
3. Their digitizing system is dedicated to sheet metal operation. This works very well for SM-ALC with no problems reported.

2.4 United Airlines Survey

United Airlines is a large commercial airline company. Their primary task is scheduled maintenance of commercial airplanes to maintain a passenger movement schedule.

This survey was short but informative. Most maintenance is on major engine components, landing gears, brakes, control surfaces, etc. They have major spares and change out of flaps, gear doors, entry doors, cargo doors, etc. Their priority concerns are record keeping and engineering planning for timely identification of requirements and fabrication of repair parts. They have standardized their sheet metal processing procedures and manufacture sheet metal parts to one standard regardless of aircraft type used: i.e., Boeing, Lockheed, McDonald Douglas, Air Bus, etc. They have coordinated with the major aircraft manufacturers to assure their processes and procedures meet or exceed their requirement. The main sheet metal schedule potential problem is a single failed item caused by ground handling, cargo loading, or other small quick fix items. To handle these problems, a communication system is set up through Engineering and requirements are prepared. Working in parallel, Purchasing is procuring material and the shop is gathering, designing, or fabricating assist tooling. When Engineering is ready each organization has standardized methods to process sheet metal in their area, allowing a short response time.

ADVANTAGE

1. Standardized sheet metal processing procedures and parts manufacturing.
2. The quick response time between Engineering, Planning, Material, and the sheet metal shops to handle fixes.

2.3 Summary

Each of these facilities have unique application of sheet metal fabrication. Machines and facilities, at each site surveyed, were reviewed and evaluated. Machine types and craftsmen of all sites were basically the same. The differences in productivity are significant and the methodology used to achieve the end item productivity is equally diversified. Each site has applied new technology to their facility, each in a different manner.

One specific question asked at each site surveyed was, "What is the best way to increase productivity in your shop"? They all gave one basic answer. Give the shop craftsmen complete planned jobs with the required tools (special tools, form blocks, etc.) and materials at his workstation so he can keep his machine busy making parts. The second answer was give him the best equipment possible to work with.

APPENDIX B

TABLES AND FIGURES FOR MACHINE MATRIX AND MAINTENANCE DATA ON MACHINES

TABLE B-1 SA-ALC SHEET METAL FORMING EQUIPMENT

ITEM	NOMENCLATURE	SIZE & IDENTIFICATION	MANUFACTURER	YEAR OF DELIVERY	SPARE PARTS AVAILABILITY	CANDIDATE ATTACHMENTS	RECOMMENDATION
1 D	HYDROFORM PRESS HYDRAULIC FLEXIBLE DIE	2,750 TON 25" BLANK CATALOG NO. 70-300F- 006-1	CINCINNATI MILLING MACHINE COMPANY	1972	VERSON ALL STEEL PRESS CO. CHICAGO, ILLINOIS 312-734-8200 (NO ONE PLANT SERVICES MECHANIC FAMILIAR WITH TOTAL MACHINE)	NONE	MAINTAIN
2 D	PRESS HYDRAULIC	250 TON SERIAL NO. C-2018	WILLIAM WHITE & CO. 700 THIRD AVE. MOLINE, ILLINOIS 61265 309-797-7650	1944	SAME AS ORIGINAL. GARLOCK PACKING AVAILABLE ON SHELF FABRICATE WELDMENTS IN LIEU OF CASTINGS. THREE MONTHS DELIVERY. CONTACT DAVE THOMAS.	TRAPPED RUBBER HEAD. USE RUBBER WEAR PAD FROM MOSITES RUBBER CO.	MAINTAIN. TEMPORARY REPAIR OF CRACKED CASTINGS. INSTALL NEW WELDMENTS BEFORE USING TRAPPED RUBBER HEAD.
3 D	PRESS HYDRAULIC	220 TON SERIAL NO. 1496	LAKE ERIE ENGINEERING BUFFALO, N.Y.	1939	B-H PRESS CORP. 4865 STENTON AVE. PHILADELPHIA, PA. 19144 215-843-3434 PARTS MANUAL AVAILABLE $225 APPROXIMATELY CONTACT BILL PULLAR	SAME AS ABOVE.	MAINTAIN FOR OPTION 1 ONLY. SALVAGE OTHERWISE.
4 D	PRESS	500 TON CONTRACT F09603-72-C- 4836 CATALOG NO. C-4037 MODEL 500T	WILLIAM WHITE & CO. 700 THIRD AVE. MOLINE, ILLINOIS 61265 309-797-7650	1973	SAME AS ORIGINAL. NEW POSITION TRANSDUCER AVAILABLE 12-14 WEEK DELIVERY.	SAME AS ABOVE.	MAINTAIN.
5 D	PRESS BRAKE	150 TON 12 FOOT 3" STROKE CATALOG NO. 12 FM 150 SERIAL NO. 72292	WISCONSIN MACHINE CORP. MEDFORD, WISCONSIN	1972	ORIGINAL MANUFACTURER NO LONGER IN BUSINESS. NO SUPPLIER OR SPARE PARTS IDENTIFIED. MAY BE MAINTAINED BY CONTRACTOR CAPABLE OF FABRICATING CUSTOM COMPONENTS.	CUSTOM BUILT PRESS PLATES TO PUNCH HOLES IN LONG NARROW HOLE PATTERN.	SALVAGE
6 D	PRESS BRAKE	50 TON 6 FOOT THROAT 3" STROKE CATALOG NO. 6 PM 75 SERIAL NO. 74507 3441-00-812-5217	WISCONSIN MACHINE CORP. MEDFORD, WISCONSIN	1940	SAME AS ABOVE.	NONE	MAINTAIN

D = MAINTENANCE DATA SUPPLIED

TABLE B-1
SA-ALC SHEET METAL POWER EQUIPMENT

ITEM	NOMENCLATURE	SIZE & IDENTIFICATION	MANUFACTURER	YEAR OF DELIVERY	SPARE PARTS AVAILABILITY	CANDIDATE ATTACHMENTS	RECOMMENDATION
7 D	PRESS BRAKE	360 TON 12 FOOT THROAT CONTRACT NO. 3441-82 3441-00-277-2105 U.S.A.F. 805668	CINCINNATI SHAPER CO.	1942	PARTS AVAILABLE FROM CINCINNATI INC. CONTACT MIKE BORSCH 513-367-7100. NEEDS SERIAL NO. METAL STAMPED FRONT VERTICAL FACE OF BED RIGHT HAND SIDE. NUMBERS 5/8" TO 3/4" HIGH 4 OR 5 DIGITS.	NONE	MAINTAIN
8 D	SHEAR	12 FOOT 3/8" MILD STEEL 24" THROAT DEPTH CONTRACT NUMBER F09603-72-C-4452 CATALOG NO. S-0612 SERIAL NO. 40941	LODGE AND SHIPLEY CO.	1972	HERR-VOSS CORP. MAIN STREET CALARY, PA. 16024 MANUAL AVAILABLE $20 APPROXIMATELY GREEN LIGHT DISCONTINUED. GREEN LIGHT COULD BE RENOVATED BY OUTSIDE CONTRACTOR.	NONE	MAINTAIN
9 D	SHEAR	12 FOOT 3/8" MILD STEEL 3445-00-262-4243 CATALOG NO. 0612 SERIAL NO. M-175-9 U.S.A.F. 805676	COLUMBIA MACHINERY & ENGINEERING CORP. HAMILTON, OHIO	1950	NO SUPPLIER IDENTIFIED. MAY BE MAINTAINED BY CONTRACTOR CAPABLE OF FABRICATING CUSTOM COMPONENTS.	NONE	SALVAGE
10	PUNCH PRESS	CONTRACT NO. 3443-6 3443-00-490-9118 U.S.A.F. 805689	ROPER WHITNEY METAL TOOLS ROCKFORD, ILLINOIS	OLD	NO SUPPLIER IDENTIFIED.	NONE	SALVAGE.
11	PUNCH PRESS	55 TON SERIAL NO. UPPER LEFT HAND BY GIBS. GOLD TAG. 3143-LO-24975-2153	WALSH PRESS & DIE CO. CHICAGO, ILLINOIS DIVISION OF AMERICAN GAGE AND MACHINE CO. 1222 SOUTH HANNAH FOREST PARK, ILL. 60130 312-378-6700	OLD	MANUAL AND PARTS ARE AVAILABLE FROM ORIGINAL SUPPLIER. NEED SERIAL NO. TO ORDER PARTS.	NONE	MAINTAIN.

D = MAINTENANCE DATA SUPPLIED

TABLE B-1

SA-ALC SHEET METAL POWER EQUIPMENT

ITEM	NOMENCLATURE	SIZE & IDENTIFICATION	MANUFACTURER	YEAR OF DELIVERY	SPARE PARTS AVAILABILITY	CANDIDATE ATTACHMENTS	RECOMMENDATION
12	PUNCH PRESS	SIZE NOT AVAILABLE U.S.A.F. 302833 SERIAL NO. STAMPED LEFT OR RIGHT SIDE OPPOSITE CONTROLS TYPICAL NO. MP-XXXXX-YR M-XXXXX-YR	E. W. BLISS CO.	OLD	ORIGINAL SUPPLIER CUSTOMER SERVICE 616-948-3369 MANUALS AND SPARE PARTS AVAILABLE.	NONE	MAINTAIN.
13	PUNCH PRESS	150 TON 30" STROKE 4" ADJUST 24" SHUT HEIGHT 10 STROKE/MINUTE CATALOG NO. F1150-4 U.S.A.F. 805044	CLEARING MACHINE CO. 6499 W. 66TH ST. CHICAGO, ILL. 60638	OLD	ORIGINAL SUPPLIER FIELD SERVICE 312-767-8700 MANUALS 3-6 WEEKS $200 TO $600 STOCK CLUTCH AND BRAKE PARTS. FABRICATE STRUCTURAL PARTS. NEED SERIAL NO. YR-XXXX (1930) YR-XXXXX (1944)	NONE	MAINTAIN.
14 D	PUNCH PRESS	23½ x 15 TON SERIAL NO. 31274	NIAGARA MACHINE & TOOL WORKS, NORTHLAND & LONGVIEW AVES., BUFFALO, N.Y. 14211 716-893-4070	1935	ORIGINAL SUPPLIER	NONE	MAINTAIN.
15	PUNCH PRESS	71 TON 4" STROKE 15.75" SHUT HEIGHT 3" ADJUSTMENT 42 STROKES/MINUTE CATALOG NO. A4-1/2 SERIAL NO. 31996	NIAGARA MACHINE & TOOL WORKS, NORTHLAND & LONGVIEW AVES. BUFFALO, N.Y. 14211 716-893-4070 NESSENDORF, HELMS & CO. HOUSTON, TEXAS	OLD	ORIGINAL SUPPLIER (NIAGARA) REPAIR PARTS AND MANUALS AVAILABLE. STRUCTURAL PARTS NOT AVAILABLE FROM SUPPLIER. 1 TO 8 WEEKS DELIVERY STRUCTURE MAY BE MAINTAINED BY CONTRACTOR CAPABLE OF FABRICATING CUSTOM COMPONENTS.	NONE	MAINTAIN.

D = MAINTENANCE DATA SUPPLIED

TABLE B-1
SA-ALC SHEET METAL POWER EQUIPMENT

ITEM	NOMENCLATURE	SIZE & IDENTIFICATION	MANUFACTURER	YEAR OF DELIVERY	SPARE PARTS AVAILABILITY	CANDIDATE ATTACHMENTS	RECOMMENDATION
16	PUNCH PRESS	ROTEX CATALOG NO. 20 CND 15 TON 26" THROAT 27/32" HOLE IN MILD STEEL 3405-312-5212	ROTEX PUNCH COMPANY, INC. 2360-B ALVARDO ST. SAN LEANDRO, CA. 94577 415-357-3600	1974	ORIGINAL SUPPLIER SERVICE REP. JOHN SHIVER PARTS, MANUALS AND SERVICE AVAILABLE.	NONE	REPLACE ITEMS 16 AND 17 WITH NEW NC PROFILE FABRICATOR PUNCH PRESS. KEEP ITEMS 16 AND 17 AS BACKUP DURING LEARNING PROCESS OF USING NEW NC MACHINE
17 D	PUNCH PRESS	STRIPPIT 18 TON 18" THROAT .25" MAX. THICK MATERIAL CATALOG NO. 18/30 SONIC 76001 SER. NO. 47663072 CONTRACT NUMBER F09603-72-C-4606	STRIPPIT NORDAILLE AKRON, N.Y.	1972	ORIGINAL SUPPLIER CALIFORNIA SERVICE CENTER 716-542-4511 PARTS - PETER FELTS PARTS SHIPPED FROM AKRON, N.Y. FIELD SERVICE EVALUATION JOHN POTERA EXT. 281	STOCK TOOLS FROM STRIPPIT	
18	BAND SAW	DO ALL 36" THROAT 234" BLADE 1290 FEET/MINUTE 3405-00-528-0609 SERIAL NO. 31-52981	DO-ALL ATLANTA, GA. 404-688-4114	1982	DO-ALL 12122 RADIUM ST. SAN ANTONIO, TEXAS 78216 SERVICE REP. BOB GREGG 512-349-0740 WELD SHOP AVAILABLE. REPAIR PARTS AVAILABLE.	NONE	MAINTAIN.
19	BAND SAW	DO ALL 36" THROAT 234" BLADE 1290 FEET/MINUTE CONTRACT NO. F09603-82-C-6072 SERIAL NO. 399-83491	DO-ALL ATLANTA, GA. 404-688-4114	1982	SAME AS ABOVE.	NONE	MAINTAIN.
20	DROP HAMMER						MAINTAIN.

D = MAINTENANCE DATA SUPPLIED

ITEM 1

MACHINE TOOL AND EQUIPMENT HISTORICAL RECORD

EQUIPMENT NUMBER: 02654

PART I — DESCRIPTION OF EQUIPMENT

1. NOMENCLATURE			2. MANUFACTURER	
HydroForm PRESS			[illegible]	
3. MODEL NUMBER	4. SERIAL NUMBER	5. SIZE/CAPACITY	6. COST	7. DATE PURCHASED
2M	70-309F005-1	2750 TONS	$254,230	1971
8. FSN				
3442 1463668				

PART II — LOCATION

WORK CENTER	BLDG NUMBER	ZONE CODE	COLUMN	REFERENCE TO COLUMN	DATE INSTALLED
MBPSC	375			SHT METAL MFG	
			(G-77)		

PART III — MAINTENANCE COSTS AND REPAIRS

DATE	TYPE MAINTENANCE	WORK ORDER NUMBER	COST: MATERIAL	COST: LABOR	COST: ACCUM TOTAL	DOWN TIME PRODUCTION HOURS
20 APR 78	[illegible]	R08223	—	96.25	96.25	1
7 APR 81	MECH	R09765	Hyd Leak	93.95	190.20	[illegible]
4 MAY 81	"	R11214	" "	58.75	249.[illegible]	[illegible]
4 MAY 81	"	R11834	" "	82.15	331.[illegible]	[illegible]
26 MAY 81	MECH	R13873	Hyd Leak	47.84	379.[illegible]	[illegible]
24 July 81	MECH	R20223	-	67.63	446.[illegible]	
24 MAY 82	[illegible]	R[illegible]	[illegible]	[illegible]	910.[illegible]	[illegible]
4 JUNE 82		K15441	—	192.00	1,102.36	[illegible]
[illegible]	[illegible]	[illegible]				

TABLE B-2 MAINTENANCE DATA - PRESS, HYDROFORM (EQUIP. NO. 02654)

AFLC FORM JUN 71 388 REPLACES AFLC FORM 30, WHICH IS OBSOLETE. AFLC-WPAFB-JAN 73 40M

DH-10031-1

1,256 44 65611 PKH (. #2

MACHINE TOOL AND EQUIPMENT HISTORICAL RECORD

EQUIPMENT NUMBER 02622

PART I — DESCRIPTION OF EQUIPMENT

1. NOMENCLATURE	2. MANUFACTURER	
PRESS BUSHING HYDRAULIC	William J. White & Co.	Code 65871

3. MODEL NUMBER	4. SERIAL NUMBER	5. SIZE/CAPACITY	6. COST	7. DATE PURCHASED
4433	C-2018	250 TON	11218	1944

8. FSN 4940640 3749

PART II — LOCATION

WORK CENTER	BLDG NUMBER	ZONE CODE	COLUMN	REFERENCE TO COLUMN	DATE INSTALLED
MAESC (293AM)	375	—	C 32	36' [illegible]	—

PART III — MAINTENANCE COSTS AND REPAIRS

DATE	TYPE MAINTENANCE	WORK ORDER NUMBER	COST			DOWN TIME PRODUCTION HOURS
			MATERIAL	LABOR	ACCUM TOTAL	
07-23-78	[illegible]	R06735	—	288.36	288.36	1
2 MAY 79	[illegible]	R09517A	—	484.62	773.36	2
10 MAY 79	[illegible]	R09517	—	145.44	919.22	3
17 JUNE 80	[illegible]	R 14225	—	556.63	1476.85	4
5 Dec-82	MECH & MECH	R30941	[illegible]	331.96	1807.81	5
15 JUNE 82	ELECTRICAL	R14529	—	36.00	1843.81	6
27 [illegible] 82	[illegible]	R20039	N/P	115.28	1958.84	1.5
21 Oct 82	MECH	R29033	Clutch Tool	68.24	2027.08	8
7 Nov 82	ELEC & MECH	R29932	-0-	86.18	2113.26	9
[illegible]	[illegible]	[illegible]	—	[illegible]	2126.26	12

TABLE B-3 MAINTENANCE DATA - PRESS, BUSHING HYDRAULIC
(EQUIP. NO. 02622)

0441

(3)

MACHINE TOOL AND EQUIPMENT HISTORICAL RECORD

EQUIPMENT NUMBER 02142

PART I — DESCRIPTION OF EQUIPMENT

1. NOMENCLATURE	2. MANUFACTURER				
Press H&O	Lake Erie Engr. Corp.				
3. MODEL NUMBER	4. SERIAL NUMBER	5. SIZE/CAPACITY	6. COST	7. DATE PURCHASED	
	1495	220 Tons	12150.00	4/17/39	
8. ID					
3448-194-0562	AF# 805680				

PART II — LOCATION

WORK CENTER	BLDG NUMBER	ZONE CODE	COLUMN	REFERENCE TO COLUMN	DATE INSTALLED
MG PSC	325		L 2.5	SAC Hdqtrs MFG	
2 ACDM					

PART III — MAINTENANCE COSTS AND REPAIRS

DATE	TYPE MAINTENANCE	WORK ORDER NUMBER	COST			DOWN TIME PRODUCTION HOURS
			MATERIAL	LABOR	ACCUM TOTAL	
21 MAR 78	Correction	R14410	—	20.88	20.88	
4-20-78		R19643		41.76	62.64	
	Mech			33.52	96.16	
18 SEP 79	Elec.	R32515	—	46.60	142.76	
8 NOV 79	"	R31849	—	29.35	172.11	
4 DEC 79	"	R31326	—	65.16	237.27	
21 [illegible] 81	Elec. Prev.	12.9874	—	44.92	282.19	
22 [illegible] 81	Oper. Mech.	R16746	—	49.13	331.32	
[illegible] 82	Mech. [illegible]	[illegible]	—	[illegible]	[illegible]	
[illegible] 82	"	[illegible]	[illegible]	—	[illegible]	

TABLE B-4 MAINTENANCE DATA - PRESS, HYDRAULIC (EQUIP. NO. 02142)

DW-10051-1

MACHINE TOOL AND EQUIPMENT HISTORICAL RECORD

EQUIPMENT NUMBER: 00717

PART I — DESCRIPTION OF EQUIPMENT

1. NOMENCLATURE	2. MANUFACTURER
PRESS ARBOR	WILLIAMS-WHITE MOLINE

3. MODEL NUMBER	4. SERIAL NUMBER	5. SIZE/CAPACITY	6. COST	7. DATE PURCHASED
	C4037	500 Tons	$7790	1979

8. FSN		9. EAM/PMS
3442200188	AF TAG 736587	3461-5-26-7

PART II — LOCATION

WORK CENTER	BLDG NUMBER	ZONE CODE	COLUMN	REFERENCE TO COLUMN	DATE INSTALLED
MBPHE	375		~~R6 RW6 N~~	3HP Metal Mfg	
			~~G 22 G 20~~		
			G 22		

PART III — MAINTENANCE COSTS AND REPAIRS

DATE	TYPE MAINTENANCE	WORK ORDER NUMBER	COST			DOWN TIME PRODUCTION HOURS
			MATERIAL	LABOR	ACCUM TOTAL	
6 Aug 76	Mechanic	R21758	N/A	8 22	8 22	
11 Sept 78	elect	R23424	—	82 34	90 56	
3 Nov 78	MECH	R29622	—	86.88	177.32	2
16 Nov 78	"	R31218	—	43 44	220.76	
29 Nov 78	ELECT	R33112	—	43 28	264.04	3
11-28-78	MECH	R31327	—	175 62	439 66	
7 Mar 79	"	R04545	—	111.20	550 86	6
15 MAR 79	MECH	R02647	—	400 36	950 22	
9 Mar 79	"	D09425	—	78.12	1028.90	
7 Jun 79	"	R15851	—	66.24	1095 14	5
24 Jul 79	ELECT	R20510	—	44.84	1139 98	4.5
4 SEP 79	"	R 11345	—	33 64	1173 62	
12 SEP 79	MECH	R25620	—	11.65	1184.87	0
12 DEC 79	"	R33415	—	273.84	1458.71	
25 JAN 80	"	R01617	—	118 00	1576 71	
1 JUN 80	Mech	R 10763	—	139 20	1715.91	7
10 JUN 80	ELECT	R 15254	—	111 00	1831 91	
24 OCT 80	MECH	R 29733	—	22 34	1854 25	
12 FEB 81	"	R04305	oil leak	23 60	1878 85	
11 MAR 81	ELEC	R06539	Grind	70 64	1948 49	6 3
27 JULY 81	MECH	R09301	—	45 03	1993 52	5
19 NOV 81	Electrical	R 31733	Check Valve	72.24	2,065.81	5
16 MAY 82	ELEC	R00605	INDUCTIVE	76.35	2,142.16	9
5 NOV 82	"	R20318	—	55.32	2197 48	5
7 Nov 83	MECH	R 29733	—	110.16	2307 64	9
7 MAY 84	ELEC	R 10731	Stream Transducer Cable	54.96	2363.08	12 12

TABLE B-5 MAINTENANCE DATA - PRESS, ARBOR (EQUIP. NO. 00717)

(#5)

MACHINE TOOL AND EQUIPMENT HISTORICAL RECORD

EQUIPMENT NUMBER: 00101

PART I — DESCRIPTION OF EQUIPMENT

1. NOMENCLATURE	2. MANUFACTURER
MACHINE, BRAKE	WISCONSIN (50875)

3. MODEL NUMBER	4. SERIAL NUMBER	5. SIZE/CAPACITY	6. COST	7. DATE PURCHASED
	72292	12'	30,765	1972

8. FSN: 3441 00 277 2105

PART II — LOCATION

WORK CENTER	BLDG NUMBER	ZONE CODE	COLUMN	REFERENCE TO COLUMN	DATE INSTALLED
MBPSC	375	~~[illegible]~~			
(288UM)		124			

PART III — MAINTENANCE COSTS AND REPAIRS

DATE	TYPE MAINTENANCE	WORK ORDER NUMBER	COST: MATERIAL	COST: LABOR	COST: ACCUM TOTAL	DOWN TIME PRODUCTION HOURS
05 JAN 79	MECH	R00342	—	109.53	109.53	
9 MAY 79	ELECT.	R12813	—	43.96	153.46	
14 MAY 79	"	R13026	—	66.24	219.70	
11 Jun 79	ELECT	R15919	—	44.16	263.86	
		~~[illegible]~~	~~[illegible]~~			
6 Jul 79	MECH & ELECT	R18624	—	33.63	287.49	
[illegible] OCT 79	MECH	R27133	—	780.[illegible]	1067.[illegible]	
[illegible] DEC 79	"	R31042	—	205.[illegible]	1272.[illegible]	
3 APR 80	"	R07136	[illegible]	66.[illegible]	1339.[illegible]	
2 DEC 80	"	R37774	-	45.60	1385.[illegible]	
1 Jun 81	Elec	R12527	Repair Power Rack	47.32	1432.64	-
15 Feb 83	Mech.	R23936	Ball screw & nut [illegible]	393.60	2639.07	[illegible]
6 March 83	"	R06217	—	157.44	2796.51	[illegible]
8 APR 83	MECH	R09723	Jamming mechanism	214.72	3,011.23	[illegible]
16 MAY 83	MECH	R11751	ADJUSTMENT FOR [illegible] JAMMER	647.22	3,658.45	[illegible]
[illegible]	Mech	R12416	-	[illegible]	[illegible]	7
[illegible]	[illegible]	R21[illegible]	—	[illegible]	[illegible]	3
[illegible]	Mech	[illegible]	—	[illegible]	[illegible]	9
29 Jan 85	MECH/ELEC	R26327	[illegible]	219.36	4,318.93	12

TABLE B-6 MAINTENANCE DATA - MACHINE, BRAKE (EQUIP. NO. 00101)

MACHINE TOOL AND EQUIPMENT HISTORICAL RECORD

EQUIPMENT NUMBER: 02647

PART I — DESCRIPTION OF EQUIPMENT

1. NOMENCLATURE	2. MANUFACTURER
MACHINE, BRAKE POWER	WISCONSIN

3. MODEL NUMBER	4. SERIAL NUMBER	5. SIZE/CAPACITY	6. COST	7. DATE PURCHASED
	6121	50 TON	7250.00	1940

8. FSN: 3441 00 609 8765 — AFTAC 805683

PART II — LOCATION

WORK CENTER	BLDG NUMBER	ZONE CODE	COLUMN	REFERENCE TO COLUMN	DATE INSTALLED
MBPSC	375		L23		

PART III — MAINTENANCE COSTS AND REPAIRS

DATE	TYPE MAINTENANCE	WORK ORDER NUMBER	COST: MATERIAL	COST: LABOR	COST: ACCUM TOTAL	DOWN TIME PRODUCTION HOURS
01-13-76	Mech Repr	R33523	NA	65.00	65.52	
26-01-77	" "	R34234	NA	147.20	213.20	
16 FEB 78	Brkdown	R04607	—	218.16	431.36	
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	
26 Jul 79	Brkdwn	R20512	—	32.42	463.88	1 ~~2.0~~
31 Jul 79	"	R20733	—	179.36	628.24	~~4.0~~
20 AUG 80	MECH	R23307	—	22.54	665.78	[illegible]
1 DEC 80	"	R32619	—	22.00	688.57	
11 MAY 81	"	R12817	—	35.73	724.01	[illegible]
26 aug 81	Mech	R23666	—	46.12	770.13	
17 Nov 82	MECH.	R30709	Fitting 1.50	206.08	977.71	[illegible]
8 FEB 83	PIPEFITTER	R03863	Misc .75	39.36	1017.82	
24 Feb 83	Pipe + Mech	R05426	—	52.48	1070.30	[illegible]
26 MAR 83	MECH	R08107	Ruptured Air line	241.21	1,311.51	
25 Apr 83	MECH	R11204	INOPERATIVE	161.04	1472.55	[illegible]
16 Apr 83	"	R09441	[illegible] 12.42	161.04	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
28 Nov 83	"	R33927	—	[illegible].96	1976.37	
[illegible]	[illegible]	[illegible]	—	[illegible]	[illegible]	5
17 April 84	Mech.	R08330	Clutch Tmp.	114.40	2255.65	
2 May 84	Elec.	R12312	Fuses #1.00	28.60	2285.25	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	57.20	[illegible]	
25 Oct 84		R28610	Receptacle/1.50	[illegible]	2416.75	10

TABLE B-7 MAINTENANCE DATA - MACHINE, BRAKE (EQUIP. NO. 02647)

AFLC FORM JUN 71 388 — REPLACES AFLC FORM 30, WHICH IS OBSOLETE. — AFLC-WPAFB-JAN 73 42M

DW-10051-1

M483 Lathe (#7)

MACHINE TOOL AND EQUIPMENT HISTORICAL RECORD

EQUIPMENT NUMBER 02007

PART I — DESCRIPTION OF EQUIPMENT

1. NOMENCLATURE	2. MANUFACTURER				
BRAKE MACHINE	MF Code 12374 Cincinnati Shaper Co.				
3. MODEL NUMBER	4. SERIAL NUMBER	5. SIZE/CAPACITY	6. COST	7. DATE PURCHASED	
	—	12ET	21,195.00	1942	
8. PEN					
3441277105	NF 805668				

PART II — LOCATION

WORK CENTER	BLDG NUMBER	ZONE CODE	COLUMN	REFERENCE TO COLUMN	DATE INSTALLED
MCFSC	375		~~F-23~~	SHEET METAL	
288NM			F-23	MANUFACTURING	

PART III — MAINTENANCE COSTS AND REPAIRS

DATE	TYPE MAINTENANCE	WORK ORDER NUMBER	COST			DOWN TIME PRODUCTION HOUR
			MATERIAL	LABOR	ACCUM TOTAL	
30-11-76	Repair	R33516	10.50	32.50	43.00	4.0 hrs
21 Dec 76	Mech. Repair	R35300P	N/A	41.00	84.39	44.30
9-23-76		R25556		541.12	125.47	
20 JUN 79	MECH	R17019	—	66.24	191.66	
4 MAR 80	"	R06027	—	22.50	214.56	
14 JAN 81	"	R00644	—	58.50	272.75	
15 MAY 81	"	R17270	adj. blade alum.	23.50	296.38	
10 SEP 81	mech	R17225	adj. brake shoes	47.55	343.93	
[illegible]	[illegible]	[illegible]	—	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	—	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	—	[illegible]	[illegible]	
1 JAN 84	mech.	R03126	—	53.42	1004.30	
18 APR 84	MECH.	R10313	CLUTCH SHOE	114.40	1118.70	

TABLE B-8 MAINTENANCE DATA - MACHINE, BRAKE (EQUIP. NO. 02007)

DW-10051-1

MACHINE TOOL AND EQUIPMENT HISTORICAL RECORD

EQUIPMENT NUMBER: 02446

PART I — DESCRIPTION OF EQUIPMENT

1. NOMENCLATURE	2. MANUFACTURER	3. MODEL NUMBER	4. SERIAL NUMBER	5. SIZE/CAPACITY	6. COST	7. DATE PURCHASED	8. FSN
SHEARING MACH.	Lodge & Shipley	S-0612	48941	3/8" X 12' mild Steel	$26409.	OCT. 72	3445/809/1974

PART II — LOCATION

WORK CENTER	BLDG NUMBER	ZONE CODE	COLUMN	REFERENCE TO COLUMN	DATE INSTALLED
MBPSB	375		J 22	[illegible]	

PART III — MAINTENANCE COSTS AND REPAIRS

DATE	TYPE MAINTENANCE	WORK ORDER NUMBER	COST: MATERIAL	COST: LABOR	COST: ACCUM TOTAL	DOWN TIME PRODUCTION HOURS
8 Mar 79	Mech	R09918	—	22.24	22.24	
15 MAY 79	"	R13537	—	43.96	66.20	
4 JUN 79	"	R10827	—	176.64	242.84	
26 Apr 79	ELECT	R11528	—	22.08	264.92	
13 AUG 79	Mech	R21579	—	134.96	399.88	
25 Oct 79	Elect	R29564	—	19.50	419.38	
27 Nov 79	"	R32529	—	33.84	453.22	
18 AUG 80	Mech	R32127	—	33.40	486.62	
11 Dec 80	"	R34518	—	23.64	510.26	
24 MAR 81	Mech	R07846	—	46.96	557.22	
23 SEPT 81	Mech	R08943	Adjust Blade	47.56	604.78	1
6 MAR 82	Electrical	R02343	8.55	31.84	644.37	2
24 Mar 82	Machinist	R14050	Adjust Blade	196.48	840.85	3
5 Sept 82	Mech/Mech	R20947	No Parts	$176.48	$1017.33	4
29 Dec 83	Mech	R34220	—	81.28	1098.61	5
25 Mar 84	Mech	R09527	—	219.84	$1318.65	6
7 MAY 84	Mech	R11710	Adjust Machine	114.40	1433.05	7
5 NOV 84	"	R20927	House Blocks	219.84	1652.89	8
14 AUG 84	"	R21301	Back Stop Screw	113.16	1766.05	9
23 DEC 84	Electrical	R21613	—	35.64	1801.69	10

Removed From SCBU
May 25-77

TABLE B-9 MAINTENANCE DATA - SHEARING MACHINE (EQUIP. NO. 02446)

DW-10051-1

50-80315-SKA #9

MACHINE TOOL AND EQUIPMENT HISTORICAL RECORD					EQUIPMENT NUMBER 02484
PART I	DESCRIPTION OF EQUIPMENT				
1. NOMENCLATURE: SHEAR MACHINE			2. MANUFACTURER: COLUMBIA MACHINE + ENG.		
3. MODEL NUMBER	4. SERIAL NUMBER: W-175-9	5. SIZE/CAPACITY	6. COST: 13572.00	7. DATE PURCHASED: 1950	
8. FSN: 3445 00 262 4243	AFTAG 805676				

PART II	LOCATION				
WORK CENTER	BLDG NUMBER	ZONE CODE	COLUMN	REFERENCE TO COLUMN	DATE INSTALLED
MBPSC	325		J22		

PART III — MAINTENANCE COSTS AND REPAIRS

DATE	TYPE MAINTENANCE	WORK ORDER NUMBER	COST: MATERIAL	COST: LABOR	COST: ACCUM TOTAL	DOWN TIME PRODUCTION HOURS
06-SEP-77	Repair clerk	R 21759	N/A	28.75	28.75	
01-02-77	mech Repair	R 05539	N/A	32.88	61.63	
05-03-77	Mydon Electric	R 08351	N/A	16.42	22.70	
17 MAY 78	Rebuilt	R 01228	—	122.50	200.50	
31 MAY 78	Correction	R 14409	—	20.44	220.95	
1 Nov 78	ELECTRICAL	R 26546	—	43.44	264.42	
11-30-78	MECH	R 31262		70.82	335.24	
04 JAN 79	"	R 00215	—	54.75	389.99	
5 OCT 79	"	R 27727	—	58.50	448.49	
10 JAN 80	CORRECTIVE	R 34113A	—	141.60	590.09	
17 JAN 80	Repair	R 34113	—	186.80	778.89	
13 MAR 80	MECH	R 15753	—	23.20	802.09	
10 APR 81	ELEC	R 09809	Repair Elect Motor	23.30	825.39	
29 JULY 81	ELECTRICIAN	R 10539	—	22.83	848.13	
31 AUG 81	mech	R 23310	Repair Welding	115.30	963.43	
10 NOV 81	MACH.	R 24257	—	96.32	1059.75	
7 DEC 81	ELEC	R 32714	Repair Motor Starter	72.24	1131.99	
2 MAR 82	MAINT-MECH	R 24733	Changed Clevis	159.64	1291.63	
15 Apr 82	MACHINIST	R 09037	Columbia Shear Mfg	44.12	1340.79	
22 Nov 82	DIE & MECH	R 29933	—	206.08	1546.83	2
						1
"	"		—			6
			—			2
5 DEC 83	MECH	R 32=04		101.42	1128.25	2
						1
14 MAR 84	"	R 11 03	300	29.50		3
30 MAY 84	"			114.10		6
31 OCT 84	MECH	R 36326	—		5368.73	10

TABLE B-10 MAINTENANCE DATA - SHEARING MACHINE (EQUIP. NO. 02484)

DW-10051-1

0437

(E14)

MACHINE TOOL AND EQUIPMENT HISTORICAL RECORD

EQUIPMENT NUMBER 02216

PART I — DESCRIPTION OF EQUIPMENT

1. NOMENCLATURE	2. MANUFACTURER			
PRESS Punch	NIAGARA			
3. MODEL NUMBER	4. SERIAL NUMBER	5. SIZE/CAPACITY	6. COST	7. DATE PURCHASED
MD A3	31274	23½ X 15	10,289.00	1935
8. FSN				
3443141814141		AF80503 8		

PART II — LOCATION

WORK CENTER	BLDG NUMBER	ZONE CODE	COLUMN	REFERENCE TO COLUMN	DATE INSTALLED
MBPSC	375		G 22	[illegible]	
2'99NM					

PART III — MAINTENANCE COSTS AND REPAIRS

DATE	TYPE MAINTENANCE	WORK ORDER NUMBER	COST			DOWN TIME PRODUCTION HOURS
			MATERIAL	LABOR	ACCUM TOTAL	
2 OCT 80	MECH	R 30223	—	22.11	22.11	
28 OCT 80	ELEC MAIN	R 14527	[illegible]	11.36	11.36	
9 MAR 84	G. [illegible]	R 96905	—	193.42	276.82	

TABLE B-11 MAINTENANCE DATA - PRESS PUNCH (EQUIP. NO. 02214)

DW-10051-1

3 72-58133 SKG #17

MACHINE TOOL AND EQUIPMENT HISTORICAL RECORD

EQUIPMENT NUMBER 02593

PART I — DESCRIPTION OF EQUIPMENT

1. NOMENCLATURE	2. MANUFACTURER	3. MODEL NUMBER	4. SERIAL NUMBER	5. SIZE/CAPACITY	6. COST	7. DATE PURCHASED
Hole Punching and Notching Machine	Strippit Division-Houdaille Industries EC-59155	76001	47553072	18" Max Hole Dia-3.5" in .089 M.S. Max Matl Thk-2"	$12,328	1972

8. FSN: 3445-00-879-1352

34C2-7-9-1,12,22

PART II — LOCATION

WORK CENTER	BLDG NUMBER	ZONE CODE	COLUMN	REFERENCE TO COLUMN	DATE INSTALLED
MOPSC 288 NM	375		G-24	WITET	

PART III — MAINTENANCE COSTS AND REPAIRS

DATE	TYPE MAINTENANCE	WORK ORDER NUMBER	COST			DOWN TIME PRODUCTION HOURS
			MATERIAL	LABOR	ACCUM TOTAL	
24 Jul 79	MECH	R20511	—	33.63	54.43	3.0
9 Aug 80	"	R21417	—	66.22	121.65	
12 Nov 80	"	R31777	—	22.80	143.93	

TABLE B-12 MAINTENANCE DATA - HOLE PUNCHING (EQUIP. NO. 02593)

* = REFURBISHMENT COST NOT DETERMINED
D = MAINTENANCE DATA SUPPLIED.

TABLE B-13
MACHINE MATRIX (EXISTING)

ITEM	NOMENCLATURE	SIZE AND IDENTIFICATION	MANUFACTURER	YEAR OF DELIVERY	ROM	RECOMMENDATIONS
1 D	HYDROFORM PRESS HYDRAULIC FLEXIBLE DIE	2,750 TON 25" BLANK CATALOG NO. 70-300F-005-1	CINCINNATI MILLING MACHINE COMPANY	1972	--- *	MAINTAIN OR REFURBISH
2 D	PRESS HYDRAULIC	250 TON SERIAL NO. C-2018	MILLIAM-WHITE 700 THIRD AVE. MOLINE, ILLINOIS 61265 309-797-7650	1944	---	SALVAGE COMPONENTS THAT COULD BE USED TO SUPPORT ITEM 4 AND SCRAP
3 D	PRESS HYDRAULIC	220 TON SERIAL NO. 1495	LAKE ERIE ENGR. BUFFALO, N.Y.	1939	---	SURPLUS OR SALVAGE COMPONENTS THAT COULD BE USED TO SUPPORT ITEM 4 AND SCRAP
4 D	PRESS	500 TON, CONTRACT NO. F09603-72-C-4836 CATALOG NO. C-4037 MODEL 500T	MILLIAM-WHITE 700 THIRD AVE. MOLINE, ILLINOIS 61265 309-797-7650	1973	* $30,000 AND 800 MANHOURS	REFURBISH ADD TWO EACH FEED TABLES AND TRAPPED RUBBER HEAD
5	PRESS BRAKE	150 TON, 12 FOOT 3" STROKE, CATALOG NO. 12 FN 150, SERIAL NO. 72292	WISCONSIN MACHINE CORP. MEDFORD, WISCONSIN	1972		SURPLUS OR SALVAGE COMPONENTS THAT COULD BE USED TO SUPPORT ITEM 6 AND THEN SCRAP
6 D	PRESS BRAKE	50 TON, 6 FOOT THROAT 3" STROKE, CATALOG NO. 6 FN 75, SERIAL NO. 74507, 3441-00-812-5217	WISCONSIN MACHINE CORP. MEDFORD, WISCONSIN	1940	MOVE COST	MAINTAIN
7 D	PRESS BRAKE	360 TON, 12 FOOT THROAT CONTRACT NO. 3441-82 3441-00-277-2105 U.S.A.F. 805668	CINCINNATI SHAPER CO.	1942	MOVE COST *	MAINTAIN UNTIL DELIVERY AND INSTALLATION OF 12' NC BRAKE PRESS, THEN REFURBISH BY REPLACING CRACKED STRUCTURE

TABLE B-13
MACHINE MATRIX (EXISTING)

B - MAINTENANCE DATA SUPPLIED.

ITEM	NOMENCLATURE	SIZE AND IDENTIFICATION	MANUFACTURER	YEAR OF DELIVERY	ROM	RECOMMENDATIONS
8 B	SHEAR	12 FOOT, 3/8" MILD STEEL 24" THROAT DEPTH CONTRACT NO. F09603-72-C-4452, CATALOG NO. S-0612, SERIAL NO. 48941	LODGE AND SHIPLEY CO.	1972	MOVE COST DURING SHOP UPDATE	MAINTAIN
9 B	SHEAR	12 FOOT, 3/8" MILD STEEL 3445-00-262-4243 CATALOG NO. 0612 SERIAL NO. H-175-9 U.S.A.F. 805676	COLUMBIA MACHINERY AND ENGINEERING CORP. HAMILTON, OHIO	1950	DEMOLITION COST	SCRAP
10	PUNCH PRESS	CONTRACT NO. 3443-6 3443-00-490-9118 U.S.A.F. 805689	ROPER WHITNEY METAL TOOLS ROCKFORD, ILLINOIS	OLD	DEMOLITION COST	SCRAP
11	PUNCH PRESS	55 TON, SERIAL NO. UPPER LEFT, HAND BY GIBS GOLD TAG, 3143-LO-24975-2153	WALSH PRESS AND DIE CO. CHICAGO, ILLINOIS DIVISION OF AMERICAN GAGE AND MACHINE CO. 1222 SOUTH HANNAH FOREST PARK, ILL. 60130 312-378-6700	OLD	DEMOLITION COST	SCRAP
12	PUNCH PRESS	SIZE NOT AVAILABLE U.S.A.F. 302833 SERIAL NO. STAMPED LEFT OR RIGHT SIDE OPPOSITE CONTROLS TYPICAL NO. MP-XXXXX-YR, M-XXXXX-YR	E.W. BLISS CO.	OLD	MOVE COST	MAINTAIN

TABLE B-13
MACHINE MATRIX (EXISTING)

B = MAINTENANCE DATA SUPPLIED.

ITEM	NOMENCLATURE	SIZE AND IDENTIFICATION	MANUFACTURER	YEAR OF DELIVERY	ROM	RECOMMENDATIONS
13	PUNCH PRESS	150 TON, 30" STROKE 4" ADJUST, 24" SHUT HEIGHT, 10 STROKE/MINUTE CATALOG NO. F1150-4 U.S.A.F. 805044	CLEARING MACHINE CO. 6499 W. 65TH ST. CHICAGO, ILL. 60638	OLD	DEMOLITION COST	SCRAP
14 B	PUNCH PRESS	231 X 15 SERIAL NO. 31274	NIAGARA MACHINE & TOOL NORTHLAND & LONGVIEW AVES., BUFFALO, N.Y. 14211 716-893-4070	1935	MOVE COST	MAINTAIN
15	PUNCH PRESS	71 TON, 4" STROKE 15.75" SHUT HEIGHT 3" ADJUSTMENT, 42 STROKES/MINUTE CATALOG NO. A4-1/2 SERIAL NO. 31996	NIAGARA MACHINE & TOOL NORTHLAND & LONGVIEW AVES., BUFFALO, N.Y. 14211 716-893-4070 MESSENDORF, NELMS & CO. HOUSTON, TEXAS	OLD	MOVE COST	MAINTAIN
16	PUNCH PRESS	ROTEX, CATALOG NO. 20CHD 15 TON, 26" THROAT 27/32" HOLE IN MILD STEEL 3445-312-5212	ROTEX PUNCH COMPANY, INC. 2350-B ALVARDO ST. SAN LEANDRO, CA. 94577 415-357-3600	1974	MOVE COST	MAINTAIN UNTIL NUMERICALLY CONTROLLED PUNCH PRESS IS OPERATIONAL AND COMPANION DIGITAL GENERATION CAPABILITY IN HAND, THEN SCRAP
17	PUNCH PRESS	STRIPPIT, 18 TON 18" THROAT, .25" MAX. THICK, MATERIAL CATALOG NO. 18/30 SONIC 76001 SERIAL NO. 47553072 CONTRACT NO. F09603-72-C-4606	STRIPPIT HOUDAILLE AKRON, N.Y.	1972	MOVE COST	SAME AS FOR ITEM 16

TABLE B-13
MACHINE MATRIX (EXISTING)

B = MAINTENANCE DATA SUPPLIED.

ITEM	NOMENCLATURE	SIZE AND IDENTIFICATION	MANUFACTURER	YEAR OF DELIVERY	ROM	RECOMMENDATIONS
18	BAND SAW	DO ALL, 36" THROAT, 234" BLADE, 1290 FEET/ MINUTE, 3405-00-528-8689 SERIAL NO. 31-52981	DO ALL ATLANTA, GA. 404-688-4114	1982	MOVE COST	MAINTAIN
19	BAND SAW	DO ALL, 36" THROAT, 234" BLADE, 1290 FEET/ MINUTE, CONTRACT NO. F09603-82-C-6072 SERIAL NO. 399-83491	DO ALL ATLANTA, GA. 404-688-4114	1982	MOVE COST	MAINTAIN
20	DROP HAMMER					MAINTAIN
21	NUMERICALLY CONTROLLED ROUTER DRILLER	48" X 144" GANTRY 8" Z AXIS	EKSTROM CARLSON	1986	INSTALLA-TION COST	CONSUMABLES - ROUTER BITS, DRILL BITS, AND COOLANT. REQUIRES NUMERICAL CONTROL DATA SETS. RECOMMEND ADDING 3/4 TON AIR CONDITIONING TO COOL ELECTRONIC PACKAGE. (POWER REQUIRED TO RUN AIR CONDITIONER .56 KW.)

TABLE B-14
MACHINE MATRIX (NEW)

ITEM	NOMENCLATURE	SIZE AND IDENTIFICATION	DATA SOURCE	EXPECTED DELIVERY	ROM	CONSUMABLES
22	NUMERICALLY CONTROLLED PROFILE FABRICATOR PUNCH PRESS	48" X 48" TABLE W-3050 OR EQUAL	WIEDEMATIC OR STRIPPIT	26 WEEKS	$200,000	REQUIRES ONE TIME PURCHASE OF PUNCHES
23	DIGITIZING SYSTEM	TRANSLATOR	EKSTROM CARLSON	26 WEEKS	$28,000	PLOTTER PAPER, PRINTER PAPER, PLOTTER PENS
24	TAPE PUNCH		DATE SYSTEMS	OFF THE SHELF	$5,000	TAPE, MYLAR OR PAPER
25	SHEET METAL MAIN FRAME COMPUTER	2,000K	HEWLETT PACKARD, OR IBM, OR AT&T, OR ZENITH	OFF THE SHELF	$3,300	
26	NESTING SOFTWARE FOR MASTER LAYOUT TO BE USED WITH ITEM 23	MINIMIZES SCRAPE WHEN LAYING OUT SHEETS FOR ITEM 22	EKSTROM CARLSON	OFF THE SHELF	$60,000	MAGNETIC MEDIA TO STORE BACK UP COPY OF SOFTWARE
27	ROLL PLOTTER	48" WIDE X 144" LONG FULL SIZE SHEET LAYOUT AND VERIFICATION	HEWLETT PACKARD, OR EKSTROM CARLSON, OR CALCOMP	26 WEEKS	$17,000	ROLL PAPER, ROLL MYLAR AND SHEETS, PENS
28	CRT DISPLAY JOBS IN	15" DIAGONAL AND CARD RACK	SAME AS ITEM 25	OFF THE SHELF	$1,000	PUNCH CARDS
29	CRT DISPLAY JOBS OUT	15" DIAGONAL AND CARD RACK	SAME AS ITEM 25	OFF THE SHELF	$1,000	PUNCH CARDS

TABLE B-14
MACHINE MATRIX (NEW)

ITEM	NOMENCLATURE	SIZE AND IDENTIFICATION	DATA SOURCE	EXPECTED DELIVERY	ROM	CONSUMABLES
30	COMPATIBILITY SOFTWARE TO LINK NC ROUTER AND NC PUNCH PRESS	N/A	EKSTROM CARLSON	26 WEEKS	$25,000	NONE
31	NUMERICALLY CONTROLLED SHEAR	12 FT. LENGTH	STRIPPIT	26 WEEKS	$24,300	REQUIRES ONE TIME PURCHASE OF SHEAR BLADES
32	HYDRAULIC PRESS 150 TON WITH TWO EACH FEED TABLES, DAKE	48" X 48" WORKING AREA RUBBER TRAPPED RUBBER HEAD	DAKE	26 WEEKS	$105,000 PLUS TRAPPED RUBBER HEAD	HYDRAULIC FLUID, MISC. LUBRICANTS, RUBBER FOR TRAPPED RUBBER HEAD, NOSITE RUBBER WEAR PADS
33	SKIN STRETCH PRESS, NUMERICALLY CONTROLLED	96" X 260", 200 TON	CYRIL BATH COMPANY	26 WEEKS	$1,350,000	HYDRAULIC FLUID, NC TAPES, MISC. LUBRICANTS
34	EXTRUSION STRETCH PRESS	6" X 144"	CYRIL BATH COMPANY	26 WEEKS	$265,000	HYDRAULIC FLUID, NC TAPES, MISC. LUBRICANTS
35	NUMERICALLY CONTROLLED PRESS BRAKE	12 FEET	STRIPPIT	26 WEEKS	$46,000	REQUIRES ONE TIME PURCHASE OF BRAKE FORM TOOLS
36	NUMERICALLY CONTROLLED PRESS BRAKE	6 FEET	STRIPPIT	26 WEEKS	$31,800	REQUIRES ONE TIME PURCHASE OF BRAKE FORM TOOLS
37	NUMERICALLY CONTROLLED PRESS BRAKE	4 FEET	STRIPPIT	26 WEEKS	$26,000	REQUIRES ONE TIME PURCHASE OF BRAKE FORM TOOLS

TABLE B-14
MACHINE MATRIX (NEW)

ITEM	NOMENCLATURE	SIZE AND IDENTIFICATION	DATA SOURCE	EXPECTED DELIVERY	ROM	CONSUMABLES
38	HOT FORM PRESS	48 X 48 C PRESS 1800°F	MURDOCK	26 WEEKS	$700,000	ELECTRICAL HEATING ELEMENTS, HYDRAULIC FLUID, MISC. LUBRICANTS
39	FASTENER LINE STRIPPIT PUNCH TOOLING SET (USED WITH ITEMS 35, 36, AND 37)	6 FEET LONG ON 2 INCH CENTER PILOT PUNCHES	STRIPPIT	6 WEEKS	$10,000	REQUIRES ABRASIVES FOR TOOLS AND FIXTURES UNIT TO RESHARPEN PUNCHES
40	FLUID CELL PRESS	QCF 400-100	ASEA	78 WEEKS	$2,500,000	HYDRAULIC FLUID, WEAR PADS, BLADDER, MISC. LUBRICANTS
41	CAD/CAM TERMINAL		SAME AS EXISTING SA-ALC CAD/CAM TERMINAL	26 WEEKS	$48,000	USES CONSUMABLES LISTED IN ITEMS 23 AND 27

TABLE 3-15
ELECTRICAL POWER REQUIREMENTS

NEW EQUIPMENT

ITEM	NOMENCLATURE	VOLTAGE/HZ	PHASE	LINE CURRENT/AMPS P.F. = 0.9	POWER/KW	DATA SOURCE
22	NUMERICALLY CONTROLLED PROFILE FABRICATOR FUNCTIONS	230/160 ± 10% 60HZ 115 VOLT 60HZ	3	118/59 MINIMUM 140/70 PEAK	MINIMUM 42 PEAK 50 .55	WIEDEMATIC W 3050 PEAK .3 SECOND WITHOUT CAUSING 10% DROP IN LINE VOLTAGE. RECOMMEND TRANSIENT SUPPRESSION ON CONTROL SYSTEM. RECOMMEND ADDING 3/4 TON AIR CONDITIONING TO COOL ELECTRONIC PACKAGE (.55KW)
23	DIGITIZING SYSTEM TRANSLATOR II	115 60HZ	1	7.6	.89	RECOMMEND TRANSIENT SUPPRESSION EXSTROM, CARLSON, AND COMPANY ROCKFORD, ILLINOIS
24	TAPE PUNCH	115/230 60/50HZ	1	1.6/.8	.15	± 2HZ, OPTION J 100/200 VAC, ± 10% SELECTABLE, RECOMMEND TRANSIENT SUPPRESSION DATA SPECIALITIES; NORTHBROOK, ILLINOIS
25	SHEET METAL PART TIME COMPUTER	115 60HZ	1		.42 ESTIMATE	RECOMMEND TRANSIENT SUPPRESSION
26	PLOTTER SOFTWARE FOR PLOTTER LAYOUT TO BE USED WITH ITEM 23					NOT APPLICABLE
27	ROLL PLOTTER	115 60 HZ	1		.12	RECOMMEND TRANSIENT SUPPRESSION. 10-40GT CAL COMP.
28	CRT DISPLAY JOBS IN	115 60HZ	1		.12	ESTIMATED

TABLE B-15
ELECTRICAL POWER REQUIREMENTS

NEW EQUIPMENT

ITEM	NOMENCLATURE	VOLTAGE/HZ	PHASE	LINE CURRENT/AMPS P.F. = 0.9	POWER/KW	DATA SOURCE
29	CRT DISPLAY JOBS OUT	115 60HZ	1		.12	ESTIMATED
30	COMPATIBILITY SOFTWARE TO LINK NC ROUTER AND N.C. PUNCH PRESS					NOT APPLICABLE
31	NUMERICALLY CONTROLLED SHEAR	230/460 60HZ	3	15.62/7.81	5.60	STRIPPIT 7.5 HP. MOTOR
32	HYDRAULIC PRESS 150 TON	230/460	3	52.02/26.01	18.65	DAKE 25 H.P. MOTOR
33	SKIN STRETCH PRESS	220/440 60HZ	3	369.80/184.90	126.82	400 TON CYRIL BATH VT400 2 EACH 60 H.P. & 1 EACH 50 H.P. MOTORS CAN START INDIVIDUALLY
34	EXTRUSION STRETCH PRESS	220/240 60HZ	3	117.49/58.75	40.29	30 TON CYRIL BATH V30 50 H.P. & 2 EACH 2 H.P. MOTORS CAN BE STARTED INDIVIDUALLY
35	12' NUMERICALLY CONTROLLED PRESS BRAKE	220/240	3	32.63/16.32	11.19	STRIPPIT 15 HORSE POWER MOTOR
36	6' NUMERICALLY CONTROLLED PRESS BRAKE	220/240	3	11.99/5.99	4.11	STRIPPIT 5.5 HORSE POWER MOTOR

TABLE B-15
ELECTRICAL POWER REQUIREMENTS

NEW EQUIPMENT

ITEM	NOMENCLATURE	VOLTAGE/HZ	PHASE	LINE CURRENT/AMPS P.F. = 0.9	POWER/KW	DATA SOURCE
37	4' NUMERICALLY CONTROLLED PRESS BRAKE	220/240 60HZ	3	11.99/5.99	4.11	STRIPPIT 5.5 HORSE POWER MOTOR
38	HOT FORM PRESS	480 ± 5%	3	320.75	240	100 TON 48 x 48 PLATEN 1800°F MURDOCK COMPTON, CALIFORNIA
39	FASTNER LINE PUNCH TOOLING SET					NOT APPLICABLE
40	FLUID CELL PRESS	460 60HZ	3	460.21	330	ASEA 110 SECOND CYCLE TIME ASEA WHITE PLAINS, NEW YORK
41	CAD/CAM TERMINAL	115 60HZ	1		.14	RECOMMEND TRANSIENT SUPPRESSION AT&T
					832.74	TOTAL

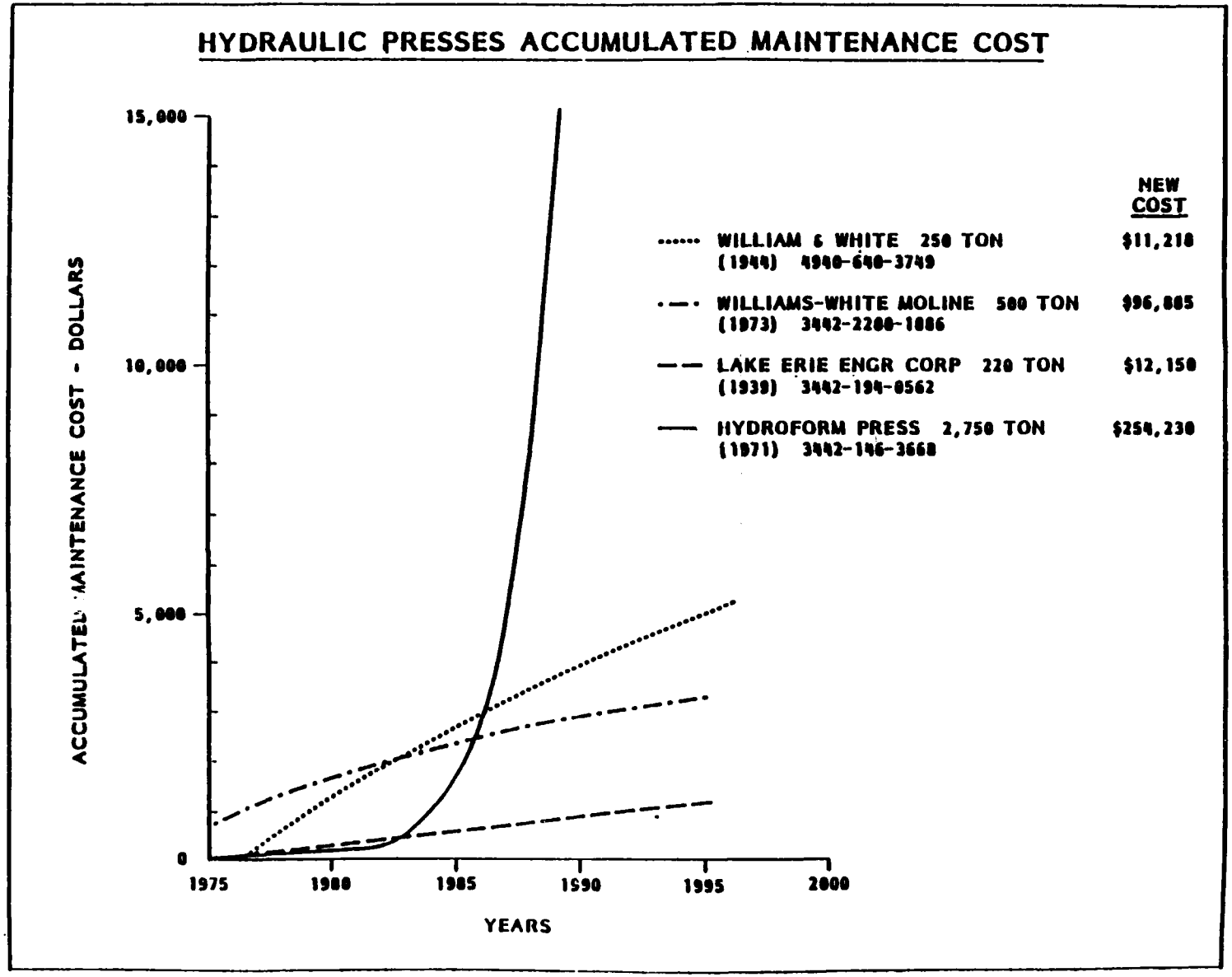

FIGURE B-1 MAINTENANCE DATA - PRESSES

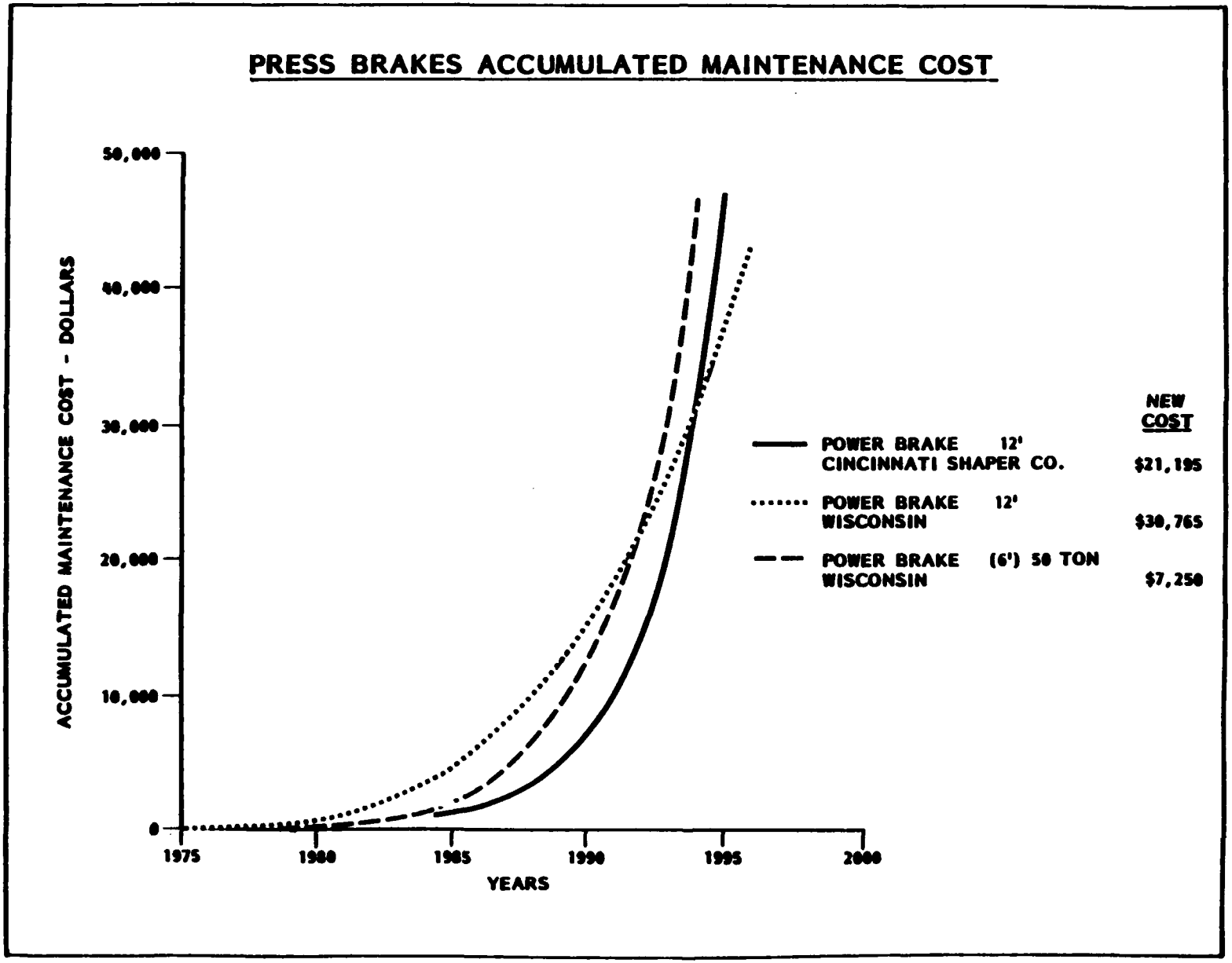

FIGURE B-2 MAINTENANCE DATA - BRAKES

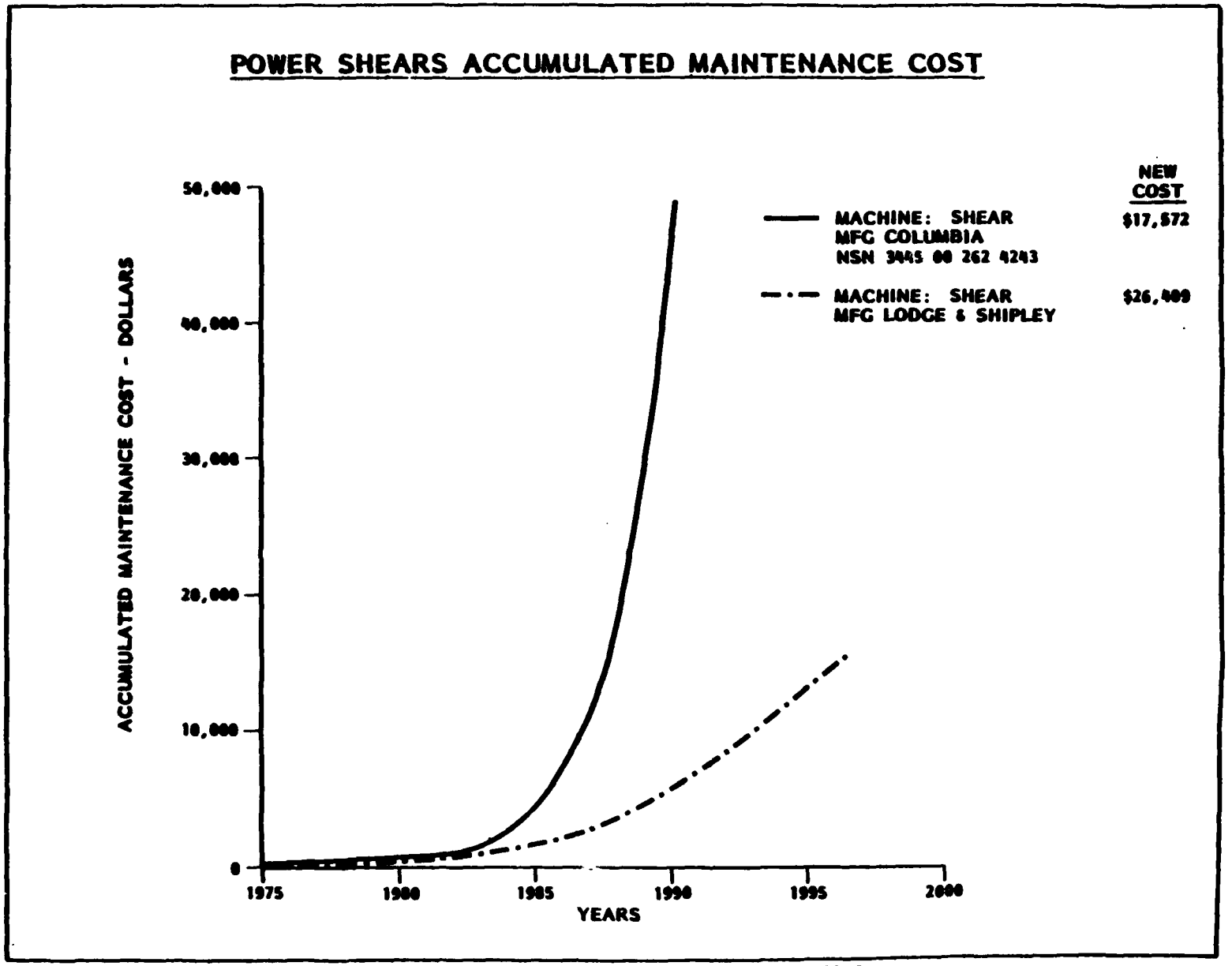

FIGURE B-3 MAINTENANCE DATA - SHEARS

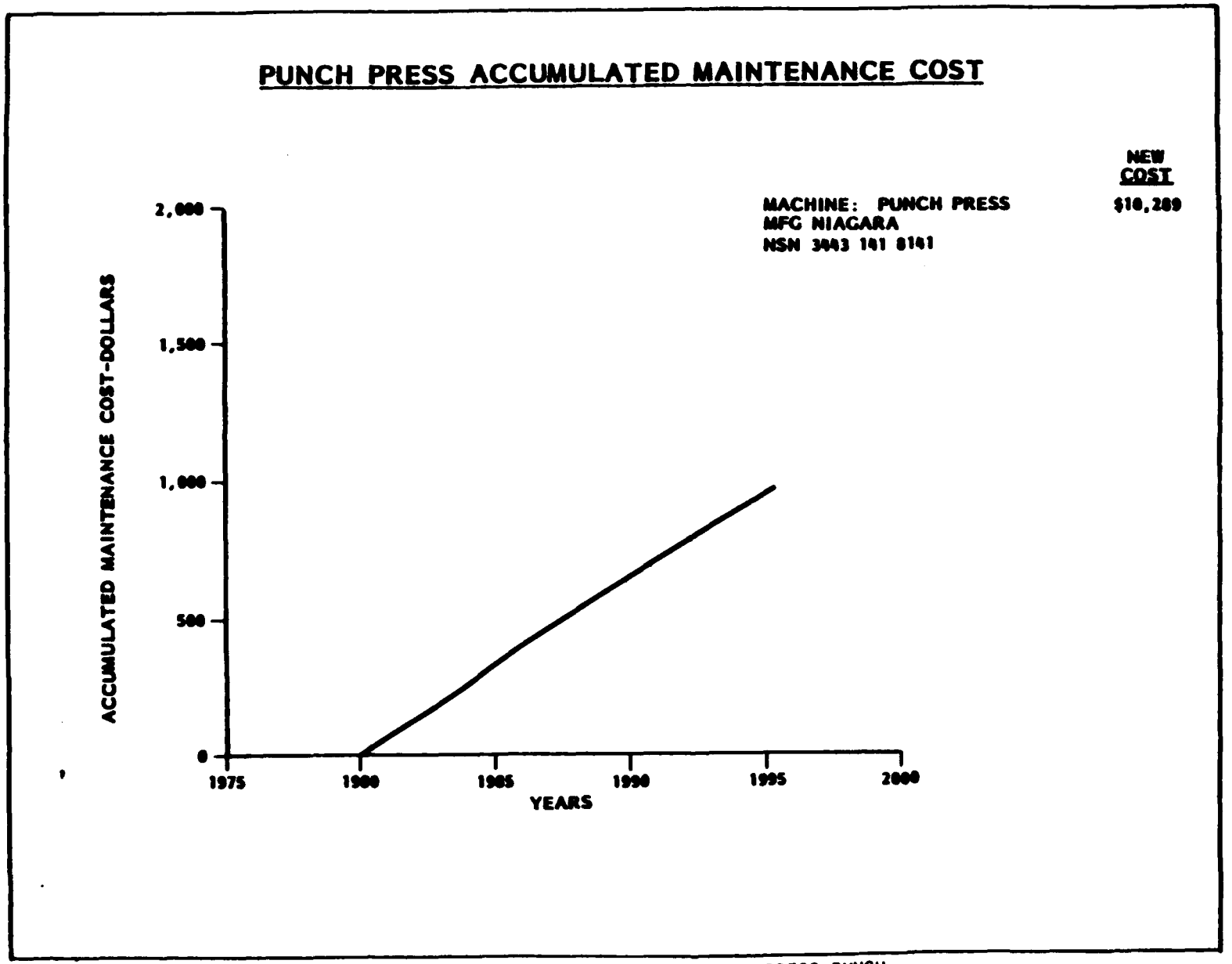

FIGURE B-4 MAINTENANCE DATA - PRESS PUNCH

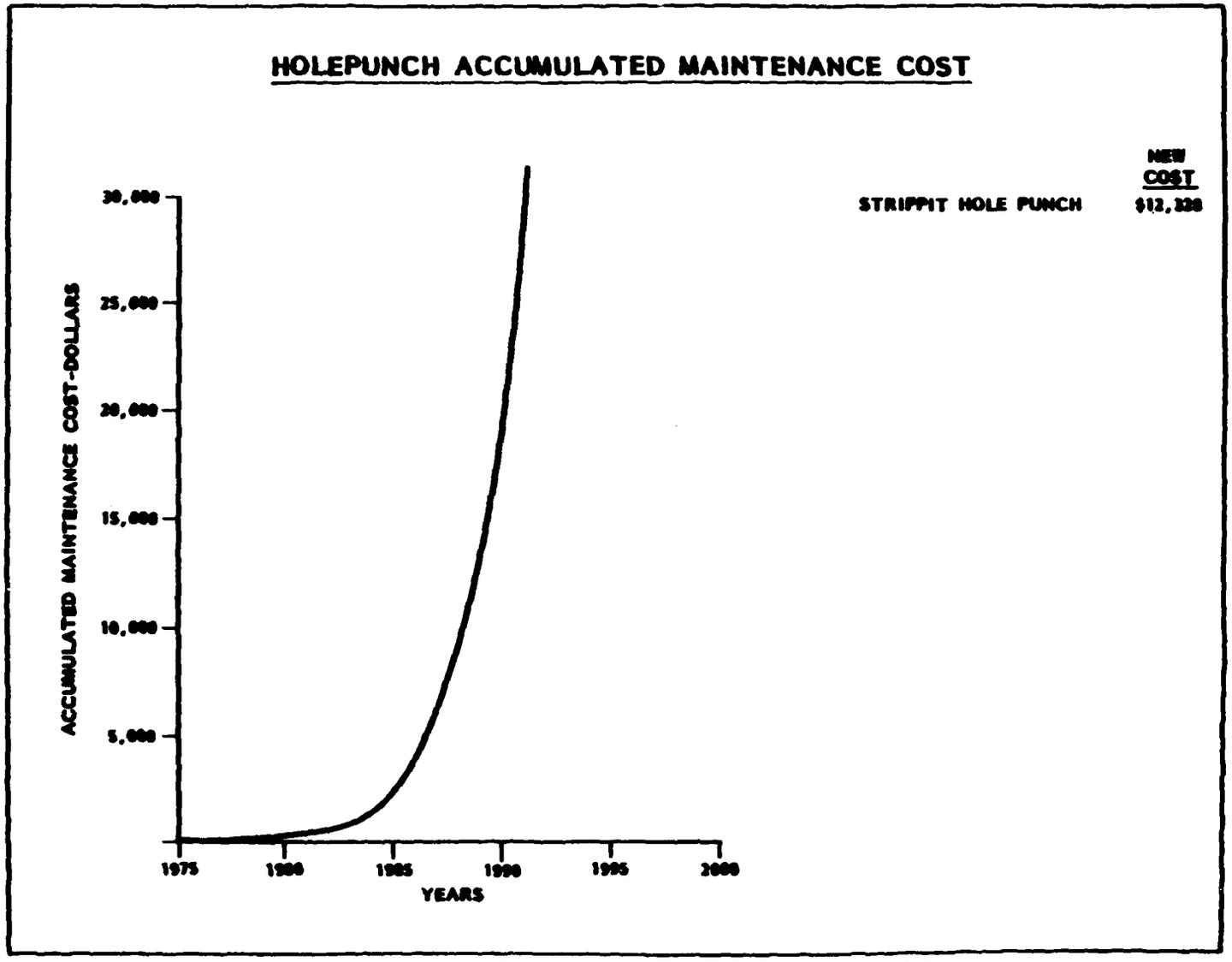

FIGURE B-5 .MAINTENANCE DATA - HOLE PUNCH

ITEM
1 B
2 B
3 B
4 B
5
6 B
7 B