

AD 740916

SEVENTH ANNUAL REPORT OF THE
MACHINABILITY DATA CENTER

1970 - 1971

ROBERT E. SNIDER
Metcut Research Associates Inc.

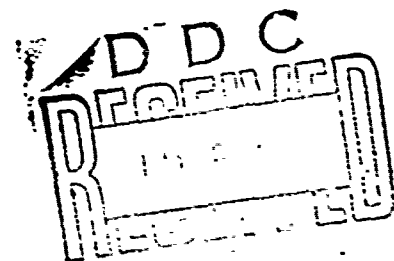
TECHNICAL REPORT AFML-TR-72-55

APRIL 1972

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AIR FORCE MATERIALS LABORATORY
AIR FORCE SYSTEMS COMMAND
WRIGHT-PATTERSON AIR FORCE BASE, OHIO



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13. ABSTRACT This report covers the seventh year of operation of the Machinability Data Center from October 1, 1970 through September 30, 1971 (Contract F33615-71-C-1112). During this contracting period 4,246 documents were processed from which 11,316 cards were keypunched. Currently, there are 121,459 supporting records on punched cards which permit computer searches to be conducted for citation to 43,574 specific machining situations coded on MDC's documents. During this reporting period, 807 specific inquiries were answered for 398 different organizations representing 517 individuals. Since the Center's operation began in October 1964 a total of 6,546 specific inquiries have been processed. The average number of inquiries was 67 per month at an average processing cost of \$48.23 per inquiry. Statistics are presented for estimated cost savings of MDC users. Through September 30, 1971 it has been very conservatively estimated that these savings amounted to more than \$55,000,000. Also in this report are tables and information reflecting MDC activity in other areas related to data publications, Government activity, types of inquiries, etc.			

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**AIR FORCE MATERIALS LABORATORY
AIR FORCE SYSTEMS COMMAND
WRIGHT-PATTERSON AIR FORCE BASE, OHIO**

FOREWORD

The Seventh Annual Report of the Machinability Data Center (MDC) covers work performed under Contract F33615-71-C-1112 from October 1, 1970, through September 30, 1971. The work described in this report covers that accomplished under project No. 8975, Materials Information Analysis Centers, Task No. 897506, Machinability Data Center. It also cites some statistics covering the 6-3/4 years that MDC has been in operation. This Center is operated for the Air Force Materials Laboratory, by Metcut Research Associates Inc., 3980 Rosslyn Drive, Cincinnati, Ohio 45209. The manuscript was released by the author, Robert E. Snider, Director of MDC, in October 1971 for publication as an MDC Report.

The work was administered under the direction of the Air Force Materials Laboratory, Wright-Patterson Air Force Base, with Mr. E. L. Horne (LAM) AFML Program Monitor.

For a complete analysis of the progress made by the Center from its early inception to the present, the following seven references should be reviewed:

"Final Report on the Design of a System for Collecting, Evaluating and Disseminating Machinability Data for Aerospace Materials", Technical Documentary Report Nr. ASD-TDR-63-572, July 1963, AD-416743.

"First Annual Report of the Air Force Machinability Data Center", AFMDC 65-2, February 1966, AD-482278.

"Second Annual Report of the Air Force Machinability Data Center", AFMDC 66-4, February 1967, AD-813037.

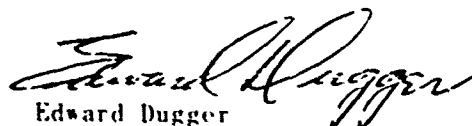
"Third Annual Report of the Air Force Machinability Data Center", AFMDC 67-8, February 1968, AD-829879.

"Fourth Annual Report of the Air Force Machinability Data Center", AFMDC 68-6, October 1968, AD-844920.

"Fifth Annual Report of the Air Force Machinability Data Center", AFMDC 69-6, October 1969, AD-697794.

"Sixth Annual Report of the Air Force Machinability Data Center", AFMDC 70-5, October 1970, AD-722478.

This technical report has been reviewed and is approved.



Edward Dugger
Chief, Materials Information Branch
Materials Support Division
Air Force Materials Laboratory

ABSTRACT

This report covers the seventh year of operation of the Machinability Data Center from October 1, 1970 through September 30, 1971 (Contract F33615-71-C-1112). During this contracting period 4,246 documents were processed from which 11,316 cards were keypunched. Currently, there are 121,459 supporting records on punched cards which permit computer searches to be conducted for citation to 43,574 specific machining situations coded on MDC's documents.

During this reporting period, 807 specific inquiries were answered for 398 different organizations representing 517 individuals. Since the Center's operation began in October 1964 a total of 6,546 specific inquiries have been processed. The average number of inquiries was 67 per month at an average processing cost of \$48.23 per inquiry.

Statistics are presented for estimated cost savings of MDC users. Through September 30, 1971 it has been very conservatively estimated that these savings amounted to more than \$55,000,000.

Also in this report are tables and information reflecting MDC activity in other areas related to data publications, Government activity, types of inquiries, etc.

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INTRODUCTION

The Machinability Data Center has been operated continuously since October 1, 1964, by Metcut Research Associates Inc. From October 1, 1964, through October 1, 1968, the Center operated under contracts from the Manufacturing Technology Division of the Air Force Materials Laboratory. On October 1, 1968, government administration of the Center was changed to the Materials Information Branch of the Air Force Materials Laboratory. Another change of administration took place during this contract period on August 1, 1971. The Defense Supply Agency assumed contract responsibility with the Materials Information Branch of the Air Force Materials Laboratory at Wright-Patterson Air Force Base continuing technical monitoring of the Center's activity.

This Seventh Annual Report of the Machinability Data Center presents accomplishments and progress during the period from October 1, 1970, through September 30, 1971.

Contained herein are charts reflecting data input activities and the scope of services provided industry and government in answering technical inquiries and the dissemination of data through the sale of data publications.

DESCRIPTION OF MDC

MACHINABILITY DATA CENTER, 3980 ROSSLYN DRIVE, CINCINNATI, OHIO 45209. Operated for the Department of Defense, Defense Supply Agency, with technical aspects being monitored by the Air Force Materials Laboratory, Materials Support Division, under Contract F33615-71-C-1112, by Metcut Research Associates Inc.

SCOPE

The Machinability Data Center (MDC) collects, evaluates, stores, and disseminates material removal information including specific and detailed machining data for the benefit of industry and government. Strong emphasis is given to engineering evaluation for the purpose of developing material removal parameters, such as speeds, feeds, depths of cut, tool material and geometry, cutting fluids and other significant variables. Data are being processed for all types of materials and for all kinds of material removal operations such as turning, milling, drilling, tapping, grinding, electrical discharge machining, electrochemical machining, etc.

COLLECTION

MDC has a data file of over thirty-two thousand selected documents pertaining to material removal technology. This data file is supported by a retrieval system which is controlled by an IBM 1130 computer installation. Information retrieval is based upon the specific material (with definite chemical, physical, and mechanical properties) and the specific material removal operation being used. Computerized search techniques are employed utilizing a combination of search parameters to produce source data. Information retrieval can be refined to the extent necessary to satisfy the requirements of a specific inquiry by controlling the input search parameters.

INFORMATION SERVICES PROVIDED BY MDC

MDC maintains an intensive effort to serve as a communication link for both government and industry by providing services related to the field of material removal. MDC's output consists of providing analyzed data in response to technical inquiries, compilation and marketing of data publications on subjects of current interest to the manufacturing industry. MDC also maintains a selected mailing list for providing notification of the availability of new information and services from the Center.

TO REQUEST MACHINING INFORMATION.....

Telephone: 513-271-9510
TWX: 910-461-2840 or
Write: Machinability Data Center
3980 Rosslyn Drive
Cincinnati, Ohio 45209

.....

NOTE: Association of the names of companies and individuals with specific requests is kept confidential. However, data developed remain the property of MDC for dissemination as required for answering similar inquiries and for developing data publications.

SUMMARY OF MAJOR ACTIVITY

Contract Change

During July, 1971, the Center's Contract No. F33615-71-C-1112 was modified to reflect the change in DoD funding from the United States Air Force to the Defense Supply Agency with technical monitoring to remain under the Air Force Materials Laboratory, Materials Support Division.

On August 1, 1971, the name of the Center was changed from Air Force Machinability Data Center to Machinability Data Center (MDC). Plans and work were started in order to implement the directive in the new "Statement of Work" requiring the institution of a service charge system for the Center's publications and services.

The new "Statement of Work" offered two options for implementing the service charge system designed to achieve the Department of Defense objectives. The first option, a Net Billing Procedure would allow MDC to market, provide services and publications directly to industry and collect charges that would be used to increase the quality and quantity of services provided MDC users. The other option entailed negotiating a contract with The National Technical Information Service (NTIS) for dissemination of selected MDC publications and collection of service charges. Presently, MDC is planning to initiate the system of service charges under the Net Billing Procedure.

Machining Data Handbook

Preparation of the rough draft of the revised edition of the Machining Data Handbook was completed during this reporting period. Copies were reviewed and approved by Rock Island Arsenal and the Materials Support Division, Air Force Materials Laboratory, Wright-Patterson Air Force Base. The Second Edition was expanded to contain recommendations for 48 conventional machining and grinding operations, and five new sections of engineering information were added. It is estimated that final engineering review, composition and printing will be completed by early Spring of 1972.

Computerized User-Inquirer File

During this reporting period a major modification was completed to merge the Center's Inquiry, SIC (Standard Industrial Classification) and User File into one computerized system. The new system eliminated two separate card files and a metal plate Addressograph mailing system. Computer programs were written that will print mailing labels from the User-Inquiry File, maintain and print statistics on MDC's activities for reporting purposes and provide a more efficient and frequent method of updating the files.

MDC OPERATIONAL AREAS

At MDC, personnel work in ten functional areas of operation. These are indicated below along with the numbers used for time coding purposes:

1	Administration	Administration of technical and general activities of MDC
2	Engineering Supervision	Technical activities including all mechanized handling of data and processing of inquiries
3	Systems Analysis	Design of the machinability data system, particularly processing
4	Machining Data Analysis	Technical evaluation of machinability data and information including Preliminary Screening
5	Data Processing	Operation of a mechanized system including a computer
6	Data Control	Superimposition and use of controls to guarantee proper operation of data processing system
7	Document Acquisition and Document Storage	Acquisition of all types of data and information for processing. Storage of documents including those which have received Final Technical Evaluation and those in process
8	Data Dissemination	Dissemination including duplication and printing
9	Machining Data Verification - Experimental Machining	Laboratory and shop work necessary for resolving highly significant and controversial data situations
0	Secretarial and Clerical	Development and execution of all procedures relating to typing and filing

DISTRIBUTION OF MDC USER FILE

Names are added to the User File as a result of: 1) inquirers, 2) visitors, 3) additional names submitted by current Users, 4) requests resulting from dissemination of data publications, and 5) technical articles published in periodicals and announcements pertaining to the Center.

GENERAL CONCENTRATION OF USERS BY NUMBERS

STATES	ORGANIZATIONS	TOTAL NO. ORGANIZATIONS	STATES*	INDIVIDUAL	TOTAL INDIVIDUAL USERS
7	0	0	7	0	0
15	1-10	89	14	1-25	195
16	11-25	291	12	26-50	438
6	26-50	217	11	51-125	818
2	51-100	134	6	126-300	1,425
9	OVER-100	<u>1,810</u>	5	OVER-300	<u>3,246</u>
	TOTAL	2,541		TOTAL	6,122

AREA CONCENTRATION OF ORGANIZATIONS

West Coast (3 states)-	302 companies
Midwest (5 states) -	924 companies
North Central (3 states) -	518 companies
New England (6 states)-	272 companies

The total User File (6,122 individuals and 2,541 plants), can be broken down as follows:

Company Users (Individuals)	5,299
Companies	2,304
 Educational Institutions (Individuals)	 718
Colleges	206
 Societies, Centers, etc. (Individuals)	 105
Societies, Centers, etc.	31

* Includes Washington, D.C.

SUMMARY OF SPECIFIC INQUIRIES BY TYPE OF INQUIRY

October 1, 1970 - September 30, 1971

NO. OF
INQUIRIES
10/1/70-9/30/71

1. RECOMMENDATIONS FOR A SPECIFIC MACHINING SITUATION. <i>Typical Example:</i> Requested recommendations for turning Waspaloy in the solution treated and aged condition.	128
2. STARTING RECOMMENDATIONS FOR AN EXTENSIVE GROUP OF MACHINING SITUATIONS. <i>Typical Example:</i> Requested machinability data on AM-350, S-816, HS-25, HS-31, Inconel X-750, Unitemp M-252 and Hastelloy R-235.	286
3. INFORMATION PERTAINING TO NEW MACHINING PROCESSES, EQUIPMENT AND TOOLS. <i>Typical Example:</i> Requested information on the manufacturer of equipment called "Liquid Lathe".	45
4. COORDINATION AND POTENTIAL USE OF AFMDC. <i>Typical Example:</i> Requested detailed information on services available from AFMDC.	30
5. REQUESTS FOR SPECIFIC DOCUMENTS, REPORTS, BOOKS, PAPERS, ETC. <i>Typical Example:</i> Requested a list of reports available for machining of titanium. Also wanted cost of each report.	54
6. GENERAL INFORMATION SUCH AS SAFETY PRACTICES, NAMES OF FIRMS HAVING CERTAIN MACHINING CAPABILITIES, TOOL MATERIAL PROPERTIES, ETC. <i>Typical Example:</i> Requested the names of people to contact in the fields of metal removal such as EDM, ECM, ECG, EDC, USM, CHM, LBM, Abrasive Machining and Hot Machining.	25
7. REQUESTS FOR BIBLIOGRAPHIES AND ABSTRACTS. <i>Typical Example:</i> Request for bibliographies with abstracts covering use of ceramic tools and abrasives in machining various materials.	4
8. STATE-OF-THE-ART INFORMATION AND REPORTS <i>Typical Example:</i> Suggestions for important manufacturing programs for the next five years in the field of material removal. Supply problem, approach and approximate funds.	39

SUMMARY OF SPECIFIC INQUIRIES BY TYPE OF INQUIRY (cont.)

October 1, 1970 - September 30, 1971

NO. OF
INQUIRIES
10/1/69-9/30/70

9. SPECIAL INQUIRIES AND REPORTS FOR U.S. AIR FORCE, MANUFACTURING TECHNOLOGY DIVISION.
Typical Example: Requested a report on the progress during the last five years in machining of titanium and hard to machine materials - state of the art. 2

10. EVALUATION, TRANSLATION AND REVIEW OF REPORTS, BOOKS, PAPERS.
Typical Example: Requested an evaluation of a report published in Electro-Technology, October 1964, concerning adaptive control possibilities. 1

11. REQUESTS FOR INFORMATION ON METAL REMOVAL RATES.
Typical Example: Requested information on maximum metal removal rates in turning and drilling of leaded steels. 4

12. COMPARISON OF ONE PROCESS OR MATERIAL WITH ANOTHER.
Typical Example: Requested a comparison of the machining of Inconel W with Inconel X in both solution treated and solution treated and aged conditions, primarily in turning out also drilling and milling if possible. 44

13. INFORMATION PERTAINING TO CUTTING FLUIDS.
Typical Example: Requested cutting fluid recommendations for titanium and a wide variety of high temperature alloys and stainless steels. 17

14. INFORMATION ON MACHINABILITY RESEARCH.
Typical Example: Requested machining information on the effect of work diameter on tool life, mathematical correlations of the various machining processes and the means of predicting the surface quality in milling. 114

15. INFORMATION PERTAINING TO ESTIMATING COST, SETTING TIME STANDARDS, AND PRODUCTION RATES IN MACHINING.
Typical Example: Requested information including formulas that could be used to predict production rates and costs. 34

TOTAL 807

*This total does not include requests for published data publications such as AFMDC reports.

ANALYSIS OF INQUIRIES BY STATE

October 1, 1970 - September 30, 1971

10 STATES LEADING INQUIRIES			
STATES	COMPANIES	INDIVIDUALS	NO. OF INQUIRIES
CALIFORNIA	28	38	56
CONNECTICUT	12	14	24
ILLINOIS	22	28	40
INDIANA	13	14	21
MASSACHUSETTS	16	17	25
MICHIGAN	27	36	58
MISSOURI	5	10	31
NEW YORK	20	24	31
OHIO	108	170	265
PENNSYLVANIA	39	46	63
TOTAL	290	397	514
OTHER STATES SUBMITTING INQUIRIES			
ALABAMA	2	3	5
ARIZONA	2	2	2
ARKANSAS	2	2	2
COLORADO	5	6	13
DISTRICT OF COLUMBIA	5	5	5
DELAWARE	4	4	7
FLORIDA	3	3	8
GEORGIA	2	2	3
IOWA	1	1	1
KANSAS	2	2	2
KENTUCKY	4	4	7
LOUISIANA	1	1	1
MAINE	1	1	1
MARYLAND	4	4	4
MINNESOTA	6	7	8
MISSISSIPPI	1	1	2
NEW JERSEY	10	10	12
NEW MEXICO	21	2	3
NORTH CAROLINA	3	3	10
OKLAHOMA	3	4	13
OREGON	1	1	4
RHODE ISLAND	5	6	7
SOUTH CAROLINA	1	1	1
TENNESSEE	5	6	14
TEXAS	11	14	18
VERMONT	5	5	15
VIRGINIA	5	6	6
WEST VIRGINIA	1	1	1
WASHINGTON	2	2	2
WISCONSIN	10	11	16
TOTAL	108	120	193
TOTAL FOR ALL STATES	398	517	807

ANALYSIS OF INQUIRIES BY MATERIAL GROUP

October 1, 1970 - September 30, 1971

MATERIAL GROUP	INQUIRIES
PLAIN CARBON & LOW ALLOY STEELS	99
ULTRA HIGH STRENGTH & TOOL STEELS	49
CARBIDES	5
CAST IRON	39
CAST STEELS	6
STAINLESS STEELS	40
NICKEL ALLOYS	4
MARAGING STEELS	19
HIGH TEMPERATURE ALLOYS	110
TITANIUM ALLOYS	50
REFRACTORY ALLOYS	21
BERYLLIUM ALLOYS	5
ZIRCONIUM ALLOYS	5
ALUMINIUM, MAGNESIUM, ZINC, LEAD, COPPER & TIN ALLOYS	57
PRECIOUS & RARE METALS	6
POWDER METALS	9
FOAMY METALS	0
NONMETALLICS INCLUDING CERAMICS, PLASTICS, GRAPHITE & COMPOSITES	48
MULTIPLE GROUP	91
UNITERM TYPE (NO GROUP)	247

ANALYSIS OF INQUIRIES BY TYPE OF MACHINING OPERATION

October 1, 1970 - September 30, 1971

OPERATION	INQUIRIES
<u>CONVENTIONAL CHIP REMOVAL</u>	
TURNING	19
BORING	19
MILLING (GENERAL)	4
FACE MILLING	18
END MILL SLOTTING	13
PERIPHERAL END MILLING	10
SLAB MILLING	2
ALL OTHER TYPES OF MILLING	11
DRILLING	14
GUN DRILLING	5
REAMING	9
TAPPING	19
GEAR CUTTING	4
BROACHING	3
ROUTING	0
BANDSAWING	4
TOTAL	340
<u>CONVENTIONAL GRINDING</u>	
GENERAL GRINDING	27
SURFACE GRINDING	17
CYLINDRICAL GRINDING	13
INTERNAL GRINDING	3
CENTERLESS GRINDING	2
ABRASIVE MACHINING	2
ABRASIVE BELT GRINDING	3
ABRASIVE CUTOFF	3
HONING	7
TOTAL	72
<u>ALTERNATE MACH'NING METHODS</u>	
ELECTRICAL DISCHARGE MACHINING	26
ELECTROCHEMICAL MACHINING	11
ELECTROCHEMICAL GRINDING	6
CHEMICAL MACHINING	7
PHOTOCHEMICAL MACHINING	3
ULTRASONIC MACHINING	2
LASER MACHINING	6
ABRASIVE JET MACHINING	0
SUB-ZERO MACHINING	3
HOT MACHINING	4
THREAD ROLLING	2
TOTAL	70
<u>MISCELLANEOUS</u>	
BURNISHING	9
POLISHING	2
UNITERM DESCRIPTIVE OPERATIONS	328
MULTIPLE OPERATIONS	169
MISCELLANEOUS CONVENTIONAL OPERATIONS	40
TOTAL	548

SUMMARY OF INQUIRIES PROCESSED BY MDC FOR STSP* & SBA**

October 1, 1970 - September 30, 1971

NUMBER OF INQUIRIES FOR STSP*	
<u>STATE</u>	<u>NO. OF INQUIRIES</u>
MAINE	1
MICHIGAN	1
VERMONT	8
TOTAL	10

NUMBER OF INQUIRIES FOR SBA**	
<u>STATE</u>	<u>NO. OF INQUIRIES</u>
CALIFORNIA	1
COLORADO	3
MISSISSIPPI	2
MINNESOTA	2
OHIO	1
PENNSYLVANIA	4
TEXAS	2
TOTAL	15

STSP* - STATE TECHNICAL SERVICES PROGRAMS

SBA** - SMALL BUSINESS ADMINISTRATION TECHNOLOGY
UTILIZATION PROGRAMS

MACHINABILITY DATA CENTER

SUMMARY OF SPECIFIC INQUIRIES BY SIC* NUMBER

OCTOBER 1, 1970 - SEPTEMBER 30, 1971

SIC MAJOR GROUP NO.	SIC INDUSTRY NO.		NUMBER OF INQUIRIES		
			BY SIC INDUSTRY NO.	BY SIC MAJOR GROUP NO.	% OF TOTAL
91		FEDERAL GOVERNMENT		64	7.9
	9100	DEFENSE SUPPLY AGENCY	2		
	9100	U.S. DEPT. OF JUSTICE, WASHINGTON, D.C.	1		
	9100	U.S. MARINE CORPS	1		
	9100	U.S. DEPT. OF THE NAVY	3		
	9100	U.S. DEPT. OF THE AIR FORCE	14		
	9100	U.S. DEPT. OF THE ARMY	9		
	9100	U.S. ATOMIC ENERGY COMMISSION	1		
	9100	NATIONAL AERONAUTICS & SPACE ADMINISTRATION	8		
	**9191	STATE TECHNICAL SERVICE PROGRAMS	10		
	9192	SMALL BUSINESS ADMINISTRATION	15		
19		ORDNANCE AND ACCESSORIES		16	2.0
27		PRINTING, PUBLISHING, AND ALLIED INDUSTRIES		19	2.4
28		CHEMICALS AND ALLIED PRODUCTS		1	0.1
29		PETROLEUM REFINING AND RELATED INDUSTRIES		8	1.0
32		STONE, CLAY, GLASS, AND CONCRETE PRODUCTS		8	1.0
33		PRIMARY METAL INDUSTRIES		42	5.2
34		FABRICATED METAL PRODUCTS, EXCEPT ORDNANCE, MACHINERY, AND TRANSPORTATION EQUIPMENT		37	4.6
35		MACHINERY, EXCEPT ELECTRICAL		246	30.5
36		ELECTRICAL MACHINERY, EQUIPMENT AND SUPPLIES		74	9.2

* Standard Industrial Classification Manual (SIC). Executive Office of the President, Bureau of the Budget, 1967

** This SIC Number Was Assigned Because of the Special Significance of the State Technical Service Program

SUMMARY OF SPECIFIC INQUIRIES BY SIC* NUMBER (cont.)

SIC MAJOR GROUP NO.	SIC INDUSTRY NO.		NUMBER OF INQUIRIES		
			BY SIC INDUSTRY NO.	BY SIC MAJOR GROUP NO.	% OF TOTAL
37		TRANSPORTATION EQUIPMENT		160	19.8
	3721	AIRCRAFT AND MISSILES	48		
	3722	AIRCRAFT ENGINES & ENGINES PARTS - MISSILE ENGINES	73		
	3729	AIRCRAFT PARTS & AUXILIARY EQUIPMENT - MISSILE PARTS	72		
		OTHERS	17		
38		PROFESSIONAL, SCIENTIFIC, AND CONTROLLING INSTRUMENTS: PHOTOGRAPHIC AND OPTICAL GOODS: WATCHES AND CLOCKS		6	0.7
39		JEWELRY, PRECIOUS METALS		2	0.2
40		RAILROADS, LINE-HAUL OPERATING		1	0.1
50		WHOLESALE TRADE		17	2.1
73		MISCELLANEOUS BUSINESS SERVICES		9	1.0
82		EDUCATIONAL SERVICES		63	7.8
86		NONPROFIT MEMBERSHIP ORGANIZATIONS		3	0.4
89		MISCELLANEOUS SERVICES		32	4.0
TOTALS				807	100.0%

* Standard Industrial Classification Manual (SIC), Executive Office of the President,
Bureau of the Budget, 1967

OCTOBER 1, 1970 TO SEPTEMBER 30, 1971

• INDICATES NEW INQUIRERS

- A R INDUSTRIES
ABBOTT LABORATORIES
• ABRASIVE ENGINEERING
AERO RESEARCH APPLIC CTR
AEROSJET GENERAL CORP
DEPT OF THE AIR FORCE
DEPT OF THE AIR FORCE
AIR FORCE MATERIALS LAB
AIR FORCE MATERIALS LAB
AIR FORCE MATERIALS LAB
AIR FORCE MATERIALS LAB
AIRCO
ALLIED SCREW PRODUCT INC
• ALL'S-CHALMERS MFG CO
ALLIS-CHALMERS WFG CO
ALLOY STEELS . NC
AMERICAN COMPLTER SERVICE
AMERICAN HELLER CORP
• AMERICAN MICRO PRODUCTS
• AMERICA SOC ABRASTHND
AMERICAN SOC FOR METALS
AMERICAN STANDARD INC
AMERICAN TOOL WORKS
ANNUATION PROCUR & SUPL
• AN CORP
ANDERSON INC
ANGEL ENGINEERING CO
ARMCO STEEL CORP
• DEPT OF THE ARMY
DEPT OF THE ARMY
DEPT OF THE ARMY
DEPT OF THE ARMY
DEPT OF THE ARMY
ATAKA AMERICA INC
ATCO ENGRAVING
U S ATOMIC ENERGY COMMN
• AVCO CORPORATION
AVCO CORPORATION
AVCO CORPORATION
AVCO CORPORATION
BABCOK & WILCOX CO
• BABCOK & WILCOX CO
• BATTELLE DEVELOPMNT CORP
BATTELLE MEMORIAL INST
BECKMAN INSTRUMENT CO
• BEECH AIRCRAFT CORP
BELL & HOWELL CO
BELL AEROSPACE CORP
• BELL HELICOPTER CO
THE BENDIX LAB
THE BENDIX CORP
THE BENDIX CORP
THE BENDIX CORP
BERGHAUSEN CONSULTANT
• BETHLEHEM STEEL CORP
BINNS MACHINERY PROD
BLUE ASM TOOL & DIE CO
THE BOEING CO
THE BOEING CO
BOSTON UNIVERSITY
BRADEN INDUSTRIES INC
BRANSON INSTRUMENTS INC
• BROWN & SHARP MFG CO
BRUBAKER TOOL CORP
• THE BUDD COMPANY
THE BUDD COMPANY
BUENLER CORP
BUSINESS WEEK MAGAZINE
C & C PRODUCTS INC
C F L
CABOT CORPORATION
CALIFORNIA GENERAL INC
CAMERON IRON WORKS
THE CARBORUNDUM CO
CARNEY COMPANY
CARNEGIE-MELLON UNIV
CASE WESTERN RES UNIV
CATERPILLAR TRACTOR CO
CESSNA AIRCRAFT CO
• CHAMPION SPARK PLUG CO
CHANDLER EVANS INC
CHRYSLER CORP
UNIV OF CINCINNATI
CINCINNATI INC
• CINCINNATI MILACRON CHEM
CINCINNATI MILACRON INC
CINCINNATI MILACRON INC
CINCINNATI MILACRON INC
CINCINNATI MILACRON INC
CLEVELAND AUTO MACH TOOL
CLIMCO PRODUCTS INC
• U S DEPT OF COMMERCE
- CINCINNATI, OH
N CHICAGO, IL
WHEATON, IL
BLOOMINGTON, IN
DOWNEY, CA
WRT-PTRSN AFB, OH
WRT-PTRSN AFB, OH
WRT-PTRSN AFB, OH
WRT-PTRSN AFB, OH
WRT-PTRSN AFB, OH
WRT-PTRSN AFB, OH
BERKLEY, CA
MISHAWAKA, IN
MATTESSON, IL
MILWAUKEE, WI
CINCINNATI, OH
CINCINNATI, OH
DETROIT, MI
CINCINNATI, OH
DETROIT, MI
METALS PARK, OH
CINCINNATI, OH
CINCINNATI, OH
JOLIET, IL
CINCINNATI, OH
CHICAGO, IL
ELY GROVE VLG, IL
MIDDLETOWN, OH
CHARLOTTESVILLE, VA
PHILADELPHIA, PA
ROCK ISLAND, IL
ROCK ISLAND, IL
ST LOUIS, MO
WARREN, MI
NEW YORK, NY
CINCINNATI, OH
WASHINGTON, DC
EVERETT, WA
LOWELL, MA
RICHMOND, IN
STRATFORD, CT
ALLIANCE, OH
BEAVER FALLS, PA
COLUMBUS, OH
COLUMBUS, OH
FULLERTON, CA
BOULDER, CO
CHICAGO, IL
BUFFALO, NY
FORT WORTH, TX
ALLENTOWN, PA
GREENFIELD, MA
KANSAS CITY, MO
SOUTHFIELD, MI
CINCINNATI, OH
BALTIMORE, MD
CINCINNATI, OH
CINCINNATI, OH
PHILADELPHIA, PA
SEATTLE, WA
BOSTON, MA
BROKEN ARROW, OK
COOKVILLE, TN
ESMOND, RI
MILLERSBURG, PA
FT WASHINGTON, PA
PHILADELPHIA, PA
INDIANAPOLIS, IN
PITTSBURGH, PA
CLEVELAND, OH
CINCINNATI, OH
KOKOMO, IN
CHULA VISTA, CA
HOUSTON, TX
NIAGARA FALLS, NY
MADISON HTS, MI
PITTSBURGH, PA
CLEVELAND, OH
E PORIA, IL
WICHITA, KS
TOLEDO, OH
WEST HARTFORD, CT
NEW ORLEANS, LA
CINCINNATI, OH
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CINCINNATI, OH
BATAVIA, OH
CINCINNATI, OH
CINCINNATI, OH
CINCINNATI, OH
CINCINNATI, OH
CINCINNATI, OH
CINCINNATI, OH
WASHINGTON, DC
- CURTISS-WRIGHT CORP
CURTISS-WRIGHT CORP
DANA CORP
UNIVERSITY OF DAYTON
DAYTON MALLEABLE IRON CO
• DE MOFF CORP
DEFENSE METALS INFO CTR
• DEFENSE RESEARCH BOARD
• DEFENSE SUPPLY AGENCY
• DEFENSE SUPPLY AGENCY
• DENMPSEY-HALEY INDUSTRIES
• THE DENTISTS SUPPLY CO
UNIVERSITY OF DENVER
UNIVERSITY OF DETROIT
DEUTSCH CO
COL J NICHOLAS DICK
• DIE COMP INC
DOVER CORP
DOVER CORP
THE DON CHEN CO
DUNCAN MFG CO
E I DUPONT DENEMOURS CO
E I DUPONT DENEMOURS CO
• E I DUPONT DENEMOURS CO
• E I DUPONT DENEMOURS CO
DYNA DUOINT INC
ECIVRES INC
• ELECTRON PROPERTY CTR
ELLIOT CO
• EMERSON ELECTRIC CO
• EMERSON ELECTRIC CO
• EVEREDE TOOL CO
EX-CELL-O CORP
• FISHER CONTROLS INC
UNIVERSITY OF FLORIDA
FORD MOTOR CO
FORD MOTOR CO
• FORD MOTOR COMPANY
FRANKLIN INSTITUTE RES
FRECON ENGINEERING
KENNETH J GALT CO
• GARNDER-DENVER
THE GARRETT CORP
GEBEL INDUSTRIES INC
GENERAL DYNAMICS CORP
GENERAL DYNAMICS CORP
GENERAL ELECTRIC CO
GENERAL ELECTRIC CO
GENERAL ELECTRIC CO
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GENERAL ELECTRIC CO
GENERAL ELECTRIC CO
GENERAL MOTORS CORP
GENERAL MOTORS CORP
GENERAL MOTORS CORP
GENERAL MOTORS CORP
GENERAL MOTORS CORP
GENERAL STEEL IND CO
• GIDDINGS & LEWIS MACH TL
GLEASON WORKS
GOODYEAR AEROSPACE CORP
• GOLD INC
W R GRACE CO
GRACO INC
GRAVELLY CORP
GRAVELLY CORP
GRAY & DUCTILE IRON SOC
G A GRAY CO
GREDE FOUNDRIES INC
GREEN ASSOC
GRUPMAN AEROSPACE CORP
H & H INDUSTRIES INC
HAMTILTON IND GRINDING
HAMMERLE INST & TOOL CO
• HEBERLEIN INC
HONEYWELL INC
HUGHES AIRCRAFT CO
HUGHES AIRCRAFT CO
• HY PRO TOOL CO
INTERNATIONAL BUSINS MACH
INTERNATIONAL BUSINS MACH
INTERNATIONAL HARVESTER
INTERNATIONAL NICKEL CO
- BUFFALO, NY
WOOD-RIDGE, NJ
YORYTCN, CT
DAYTON, OH
DAYTON, OH
CRANSTON, RI
COLUMBUS, OH
WASHINGTON, DC
DALLAS, TX
MEMPHIS, TN
DAYTON, OH
YORK, PA
DENVER, CO
DETROIT, MI
BANNING, CA
WASHINGTON, DC
PLAINFIELD, NJ
CINCINNATI, OH
CINCINNATI, OH
GOLDEN, CO
CINCINNATI, OH
WILMINGTON, DE
WILMINGTON, DE
WILMINGTON, DE
WILMINGTON, DE
COLUMBUS, OH
NORWOOD, OH
CULVER CITY, CA
JEANETTE, PA
MENARD, AR
MILFORD, CT
CHICAGO, IL
OAK PARK, MI
MARSHALLTOWN, IA
GAINESVILLE, FL
CINCINNATI, OH
DEARBORN, MI
DETROIT, MI
PHILADELPHIA, PA
CINCINNATI, OH
INDIANAPOLIS, IN
CINCINNATI, OH
PHOENIX, AZ
CINCINNATI, OH
FORT WORTH, TX
SAN DIEGO, CA
BLOOMINGTON, IL
BURLINGTON, VT
CINCINNATI, OH
CINCINNATI, OH
CINCINNATI, OH
CINCINNATI, OH
DETROIT, MI
GREENSVILLE, SC
LA JAMAICA, NY
PITTSFIELD, MA
SCHECTADY, NY
SCHECTADY, NY
SPRINGFIELD, MA
WORTHINGTON, OH
ANDERSON, IN
DAYTON, OH
FLINT, MI
INDIANAPOLIS, IN
SANDUSKY, OH
WARREN, MI
ST LOUIS, MO
FOND DU LAC, WI
ROCHESTER, NY
AKRON, OH
CLEVELAND, OH
CLARKSVILLE, MO
MINNEAPOLIS, MN
CLEMMONS, NC
DUMBAR, WV
CLEVELAND, OH
CINCINNATI, OH
MILWAUKEE, WI
NEW RICHHMD, OH
BETHPAGE, NY
DAYTON, OH
HAMILTON, OH
BROOKLYN, NY
NEW YORK, NY
HOPKINS, MN
CULVER CITY, CA
TUCSON, AZ
NEW BEDFORD, MA
AUSTIN, TX
OWEGO, NY
ROCHESTER, NH
SAN DIEGO, CA
NEW YORK, NY

JANITROL AERO
 JODEX CORP
 JONES & LAMSON
 U S DEPT OF JUSTICE
 KAISER AEROSPACE & ZEC
 KAMAN CORP
 KAREL INDUSTRIES INC
 KEARNEY & TRECKER CORP
 KENNAN MANUFACTURING CO
 KENNECOTT COPPER CORP
 EASTERN KENTUCKY UNIV
 KERNER TOOL & DIE CO
 KEYSTONE BOLT & NUT CORP
 JOE KIM
 MAX KRONENBERG
 LADISH CO
 LASERMATION
 LATROBE STEEL CO
 LAWSON MANUFACTURING CO
 LE BLOND INC
 LEMIGH UNIVERSITY
 LINCOLN ELECTRIC CO
 LING-TEMCO-VOUGHT INC
 LING-TEMCO-VOUGHT INC
 LING-TEMCO-VOUGHT INC
 LING-TEMCO-VOUGHT INC
 ARTHUR D LITTLE CO INC
 LOCKHEED AIRCRAFT CORP
 LOCKHEED AIRCRAFT CORP
 LOCKHEED AIRCRAFT CORP
 LOCKHEED AIRCRAFT CORP
 LODGE & SHIPLEY CO
 A M LORD CO
 W A MADDOX
 UNIVERSITY OF MAINE
 MALLAY TOOL SERVICE
 P R MALLORY
 MANKATO STATE COLLEGE
 U S MARINE CORPS
 MARK III INC
 MARTIN MARIETTA CORP
 MARTIN MARIETTA CORP
 MARTIN MARIETTA CORP
 MASTER CHEMICAL CORP
 MC DONNELL DOUGLAS CORP
 MC DONNELL DOUGLAS CORP
 MC DONNELL DOUGLAS CORP
 MECHANICAL PROP DATA CTR
 METAL IMPROVEMENT INC
 UNIVERSITY OF MICHIGAN
 EASTERN MICHIGAN UNIV
 MIDWEST CENTRAL SS WNDG
 NINE SAFETY APPLIANCES
 UNIVERSITY OF MISSOURI
 MODERN MACHINE SHOP
 MODERN PATTERNEPLASTICS
 MONARCH MACHINE TOOL CO
 NOOG INC
 MUELLER BRASS CO
 MUSKOGEE TOOL IND. INC
 NATIONAL AEROSPACE ADM
 NATIONAL AEROSPACE ADM
 NATIONAL AEROSPACE ADM
 NATIONAL AUTOMATIC TL CO
 NATIONAL ELECTROSTATICS
 NATIONAL JET SALES CORP
 NATIONAL LEAD CO OF OHIO
 DEPT OF THE NAVY
 DEPT OF THE NAVY
 DEPT OF THE NAVY
 NEW YORK STATE DEPT
 NILES PRECISION CO
 NORRIS INDUSTRIES
 NORTH AMERICAN ROCKWELL
 NORTH AMERICAN ROCKWELL
 NORTH AMERICAN ROCKWELL
 NORTH AMERICAN ROCKWELL
 NORTH CAROLINA ST UNIV
 NORWICH COMPANY
 NORWICH UNIVERSITY
 OAK ELECTRO-METICS CORP
 OLIVETTI NUMERICAL CONT
 OWENS-ILLINOIS INC
 PEARL EQUIPMENT CO
 PENN CENTRAL TRANS CO
 PENNSYLVANIA STATE UNIV
 PERKINS MACHINE CO
 PETERSON BUILDERS INC
 PFAUDLER COMPANY
 PHILCO-FORD CORP
 PHOTOLASTIC INC
 PHYSICAL SCIENCE INC
 PIONEER ASTRO INDUST INC
 UNIV OF PITTSBURGH
 PLANET PRODUCTS CORP
 PLASTILINE INC
 POLAROID CORPORATION
 POLYMET CORPORATION
 PORTER PRECISION PRODS
 PRATT & WHITNEY AIRCRAFT

COLUMBUS, OH
 CINCINNATI, OH
 SPRINGFIELD, VT
 WASHINGTON, DC
 GLENDALE, CA
 BLOOMFIELD, CT
 DELHAM MAYOR, NY
 MILWAUKEE, WI
 SEATTLE, WA
 LEXINGTON, MA
 RICHMOND, KY
 ERIE, PA
 CHALFONT, PA
 CEDAR GROVE, NJ
 CINCINNATI, OH
 CUDAHY, WI
 PHILADELPHIA, PA
 LATROBE, PA
 PEABODY, MA
 CINCINNATI, OH
 BETHLEHEM, PA
 CLEVELAND, OH
 DALLAS, TX
 DALLAS, TX
 WARREN, MI
 WARREN, MI
 CAMBRIDGE, MA
 BURBANK, CA
 MARIETTA, GA
 PALO ALTO, CA
 REDLANDS, CA
 CINCINNATI, OH
 HUDSON, OH
 CINCINNATI, OH
 BANGOR, ME
 HOUSTON, TX
 INDIANAPOLIS, IN
 MANKATO, MN
 QUANTICO, VA
 PROVIDENCE, RI
 BALTIMORE, MD
 DENVER, CO
 ORLANDO, FL
 PERRYBURGH, OH
 LONG BEACH, CA
 SANTA MONICA, CA
 ST LOUIS, MO
 TRAVERSE CITY, MI
 CINCINNATI, OH
 ANN ARBOR, MI
 YPSILANTI, MI
 CINCINNATI, OH
 EVANS CITY, PA
 COLUMBIA, MO
 CINCINNATI, OH
 TOLEDO, OH
 SIDNEY, OH
 BUFFALO, NY
 PORT HURON, MI
 MUSKOGEE, MI
 CLEVELAND, OH
 HAMPTON, VA
 HUNTSVILLE, AL
 RICHMOND, IN
 MIDDLETON, WI
 LA VALE, MO
 CINCINNATI, OH
 NEWPORT, RI
 SAN DIEGO, CA
 WARMINSTER, PA
 ALBANY, NY
 NILES, MI
 NEWARK, NJ
 CANOGA PARK, CA
 EL SEGUNDO, CA
 LOS ANGELES, CA
 MCGREGOR, TX
 TULSA, OK
 RALEIGH, NC
 WORCESTER, MA
 NORTHFIELD, VT
 CRYSTAL LAKE, IL
 ELMHURST, NY
 TOLEDO, OH
 NASHVILLE, TN
 ALTOONA, PA
 UNIVERSITY PK, PA
 WARREN, MA
 STURGEON BAY, WI
 ELYRIA, OH
 NEWPORT BEACH, CA
 MALVERN, PA
 WACON, GA
 CHICAGO, IL
 PITTSBURGH, PA
 CINCINNATI, OH
 POMPANO BEACH, FL
 CAMBRIDGE, MA
 CINCINNATI, OH
 CINCINNATI, OH
 EAST HARTFORD, CT

PRODUCTO MACHINE CO
 PROMEX COMPANY INC
 PURDUE UNIVERSITY
 R S C ASSOCIATES
 RADIATION INTERNATIONAL
 RADIO CORPORATION OF AM
 RAYCON CORP
 GILBERT REITER
 REMINGTON ARMS CO INC
 RESEARCH COTTRELL INC
 RESIMOID ENGRG CORP
 REX CHAINBELT INC
 REYNOLDS METALS CO
 REYNOLDS METALS CO
 R J REYNOLDS TOBACCO CO
 RHODE ISLAND UNIVERSITY
 ROHR CORPORATION
 ROOTS-CONNERSVILLE
 C F RUSSELL CO
 S K F INDUSTRIES
 S P C MACHINERY INC
 SAGINAW STEERING GEAR
 SAN JOSE CITY COLLEGE
 SANDIA CORPORATION
 SCHNEIDER INSTRUMENT CO
 SEIPREAT-ELSTAD MACH CO
 SERVICEMASTER IND SYS CO
 SIGHODE CORP
 THE SINGER COMPANY
 SINGERS GENERAL PRECISION
 SMALL BUSINESS ADMIN
 SMALL BUSINESS ADMIN
 SMALL BUSINESS ADMIN
 SMALL BUSINESS ADMIN
 SMALL BUSINESS ADMIN
 SMALL BUSINESS ADMIN
 A O SMITH CORP
 SOUTHERN AUTOMATICS INC
 SOUTHERN RESEARCH INST
 SPECTRA-MAT INC
 SQUARE D CO
 THE STANDARD OIL CO
 STANDARD PRESSED STEEL
 STANFORD RESEARCH INST
 STRUCTURAL DYNAMICS RES
 SUNDRAND CORP
 SUPERMET COMPANY
 SYLVANIA ELEC PROD INC
 TECH ETCH INC
 TELEDYNE INDUSTRIES INC
 TELEX COMPUTER PRODUCTS
 UNIVERSITY OF TENNESSEE
 TIMKEN COMPANY
 TIPP MACHINE & TOOL CO
 TOOL STEEL GEAR & PIN, OH
 TORIN CORP
 TORRINGTON CORP
 TRW INC
 TRW INC
 CHARLES TURPIN & CO
 TWIN CITY TOOL COMPANY
 THE U S BAIRD CORP
 U S STEEL CORPORATION
 U S STEEL CORPORATION
 UNION CARBIDE CORP
 UNITED AIRCRAFT PRODUCTS
 UNIVERSAL PRECISION
 VALERON CORP
 VALLEY ENGRG & MFG CORP
 VALLEY TODECO INC
 VASCO
 UNIVERSITY OF VERMONT
 UNIVERSITY OF VERMONT
 VERMONT AMERICAN CORP
 VR WESSON CO
 WALKER MACHINERY CO
 WALLACE-MURRAY CORP
 WALLOU TOOL & DIE CO
 THE WALMET CORP
 CLAIRE WALSH
 WAUKESHA CUTTING TOOLS
 WENDT-SOMIS CO
 WEST MILTON PREC TOOL CO
 WESTERN ELECTRIC CO INC
 WESTERN ELECTRIC CO INC
 WESTINGHOUSE ELECTRIC
 WESTINGHOUSE ELECTRIC
 WESTINGHOUSE ELECTRIC
 WESTINGHOUSE ELECTRIC
 WHEELLOCK LOVEJOY & CO
 WHIRLPOOL CORP
 WILLEYS CARBIDE TOOL CO
 THE WING CO
 W C WINSTANDLEY & ASSOC
 UNIVERSITY OF WISCONSIN
 WOODWARD GOVERNOR CO
 WORD INC
 YARWAY CORP

BRIDGEPORT, CT
 CHERRY HILL, NJ
 W LAFAYETTE, IN
 CLINTON, NY
 PORTLAND, OR
 LANCASTER, PA
 ANN ARBOR, MI
 STRATFORD, CT
 BRIDGEPORT, CT
 BOUND BROOK, NJ
 SKOKIE, IL
 DOWNERS GROVE, IL
 RICHMOND, VA
 RICHMOND, VA
 WINSTON SALEM, NC
 KINGSTON, RI
 CHULA VISTA, CA
 CONNERSVILLE, IN
 DAY SHORE, NY
 KING OF PRUSS, PA
 ROCHESTER, NY
 SAGINAW, MI
 SAN JOSE, CA
 ALBUQUERQUE, NM
 CINCINNATI, OH
 DAYTON, OH
 ROCKFORD, IL
 FLORENCE, KY
 SOMERVILLE, NJ
 LITTLE FALLS, NJ
 BALA CYNWYD, PA
 CLEVELAND, OH
 DALLAS, TX
 DENVER, CO
 JACKSON, MS
 LOS ANGELES, CA
 MINNEAPOLIS, MN
 MT STERLING, KY
 CINCINNATI, OH
 BIRMINGHAM, AL
 WATSONVILLE, CA
 CLEVELAND, OH
 CLEVELAND, OH
 SANTA ANA, CA
 MELO PARK, CA
 CINCINNATI, OH
 ROCKFORD, IL
 TROTWOOD, OH
 TOWANDA, PA
 WINGHAM, MA
 MILWAUKEE, WI
 TULSA, OK
 KNOXVILLE, TN
 CINCINNATI, OH
 TIPP CITY, OH
 CINCINNATI, OH
 TORRINGTON, CT
 TORRINGTON, CT
 CLEVELAND, OH
 DANVILLE, PA
 HARRISBURG, PA
 MAYLAND, MA
 OLATHE, KS
 STRATFORD, CT
 GARLAND, TX
 PITTSBURGH, PA
 OAK RIDGE, TN
 DAYTON, OH
 LAKE FOREST, IL
 ALLISON PARK, PA
 WILKES BARRE, PA
 SYLMAR, CA
 LATROBE, PA
 BURLINGTON, VT
 BURLINGTON, VT
 LOUISVILLE, KY
 WAUKESHA, IL
 CINCINNATI, OH
 LOCKPORT, NY
 CINCINNATI, OH
 PLEASANT RIDGE, MI
 CINCINNATI, OH
 WAUKESHA, WI
 ROGERS, AR
 VANDALIA, OH
 ALLENTOWN, PA
 KEARNY, NJ
 PHILADELPHIA, PA
 PITTSBURGH, PA
 PITTSBURGH, PA
 SUMMITVALE, CA
 WEST MIFFLIN, PA
 CINCINNATI, OH
 BENTON HARBOR, MI
 DEARBORN, MI
 LINDEN, NJ
 CENTERVILLE, OH
 MADISON, WI
 ROCKFORD, IL
 CINCINNATI, OH
 BLUE BELL, PA

POTENTIAL FOR MDC SERVICES TO INDUSTRY

STATISTICAL SUMMARY OF METALWORKING PLANTS PARTIAL LIST FROM DUN & BRADSTREET METALWORKING, DIRECTORY 1971			MDC SUMMARY OF INQUIRIES FOR 7 SIC GROUPS OCTOBER 1, 1970 - SEPTEMBER 30, 1971		
STANDARD INDUSTRIAL CLASSIFICATION (SIC)-NUMBER & INDUSTRY CLASSIFICATION	MAJOR PRODUCT MANUFACTURED NO. OF COMPANIES*	NO. OF INDIVIDUALS	NUMBER OF MDC COMPANIES	NUMBER OF MDC INQUIRERS	TOTAL INQUIRIES
MAJOR GROUP 37 - TRANSPORTATION EQUIPMENT SIC INDUSTRY NO.					
3721 - AIRCRAFT & MISSILES	82	268,947	21	33	48
3722 - AIRCRAFT ENGINES & PARTS	142	164,322	17	44	73
3729 - AIRCRAFT PARTS & AUXILIARY EQUIPMENT	542	139,838	11	15	22
MAJOR GROUP 33 - PRIMARY METAL INDUSTRIES	4,223	1,310,993	22	28	42
MAJOR GROUP 34 - FABRICATED METAL PRODUCTS, EXCEPT ORDNANCE, MACHINERY & TRANSPORTATION EQUIPMENT	11,818	1,359,472	21	24	37
MAJOR GROUP 35 - MACHINERY, EXCEPT ELECTRICAL	12,419	1,993,477	116	150	246
MAJOR GROUP 36 - ELECTRICAL MACHINERY, EQUIPMENT & SUPPLIES	9,267	1,914,426	34	45	74
	35,493	7,151,475	242	339	542

* 30 or more employees

DESCRIPTION OF MDC DATA PUBLICATIONS

October 1, 1970 - September 30, 1971

DESCRIPTION & CONTENT	NO. OF COPIES DISSEMINATED	SALES INCOME
AFMDC 65-1, MACHINING DATA FOR TITANIUM ALLOYS, AUGUST 1965 Turning, Face Milling, End Mill Slotting, Peripheral End Milling, Drilling, Reaming, Tapping, Broaching, and Surface Grinding for Commercially Pure Titanium, Alpha & Alpha-Beta, and Beta Alloys.	75	\$ 112.50
AFMDC 66-1, MACHINING DATA FOR NUMERICAL CONTROL, DECEMBER 1966 Contains all the data originally printed in the 7 individual reports, AFMDC 66-1.1 through 66-1.7	82	410.00
AFMDC 66-2, GRINDING RATIOS FOR AEROSPACE ALLOYS, JUNE 1966 Surface Grinding of Alloy Steels, Ultra-High Strength Steels, Tool Steels, Stainless Steels, Titanium Alloys, High Temperature Alloys, Refractory Alloys, and Nonmetals.	37	37.00
AFMDC 66-3, MACHINING DATA FOR BERYLLIUM METAL, JUNE 1966 This booklet covers problems involved in machining beryllium, in addition to specific data for 10 conventional operations and 4 alternate machining methods.	98	98.00
AFMDC 68-1, DETERMINATION AND ANALYSIS OF MACHINING COSTS AND PRODUCTION RATES USING COMPUTER TECHNIQUES, AUGUST 1968 This data publication describes a practical approach to the problem of obtaining machining costs and production rates. It includes equations, numerous computer calculations, and computer source program listings.	77	269.50
AFMDC 68-2, 1960 SUPPLEMENT TO MACHINING DATA FOR NUMERICAL CONTROL, AUGUST 1968 This supplement is a companion volume to Machining Data for Numerical Control (AFMDC 66-1). Machining data are presented for the newer aerospace materials.	58	174.00
AFMDC 70-1, MACHINING OF HIGH STRENGTH STEELS WITH EMPHASIS ON SURFACE INTEGRITY, JUNE 1970 This book was prepared from data collected on various high temperature alloys and both conventional and nonconventional machining operations. The emphasis is in the presentation of machining data and information is on providing guidelines for maintenance of high surface quality and in particular high surface integrity.	129	1,935.00
USAF MACHINABILITY REPORTS, VOL. 1 thru 4	69	919.00
TOTAL	625	\$3,955.00

MDC OPERATING COSTS

OCTOBER 1, 1970 - SEPTEMBER 30, 1971

INPUT COSTS		
TECHNICAL EVALUATION		\$ 26,056.49
DATA PROCESSING		23,144.30
DOCUMENT ACQUISITION & REPRODUCTION		<u>4,702.60</u>
		53,903.09
EQUIPMENT, SUPPLIES & SERVICES		<u>11,049.56</u>
	TOTAL	64,943.55
OUTPUT COSTS		
<u>INQUIRIES</u>		
TECHNICAL EVALUATION		32,974.21
DATA PROCESSING & RETRIEVAL		2,842.40
DATA ACQUISITION & REPRODUCTION		<u>3,102.00</u>
GOVERNMENT AGENCIES	1,933.00	38,918.61
(NOT INCLUDING SBA & STSP)		
ALL OTHER ORGANIZATIONS	<u>29,985.61</u>	
	SUBTOTAL	38,918.61
<u>DATA PUBLICATIONS</u>		
DATA PUBLICATIONS COMPLETED & IN PROCESS*		35,100.93
EQUIPMENT, SUPPLIES & SERVICES		<u>6,675.69</u>
		41,776.62
	TOTAL	80,695.23
GENERAL DISSEMINATION -		
GENERAL DISSEMINATION OF MACHINABILITY DATA & CENTER INFORMATION		14,087.13
EQUIPMENT, SUPPLIES & SERVICES		<u>1,540.54</u>
	TOTAL	15,627.67
REPORTS		
<u>MDC SYSTEMS REPORTS</u>		
MDC, MSD AND INFORMATION BRANCH MEETINGS AND SPECIAL MSD REPORTS		9,623.56
EQUIPMENT, SUPPLIES & SERVICES		<u>4,621.63</u>
	TOTAL	14,245.19
SYSTEMS ANALYSIS, MODIFICATION & CONTROL		
TECHNICAL EVALUATION		1,701.74
DATA PROCESSING - IBM 1130		
TECHNICAL & SYSTEMS ASPECTS		22,382.72
OPERATIONS MANUAL & CODE BOOK REVISIONS & ADDITIONS		<u>86.40</u>
		24,170.86
EQUIPMENT, SUPPLIES & SERVICES		<u>1,797.30</u>
	TOTAL	25,968.16
TOTAL ACTUAL COSTS NOT INCLUDING FIXED FEE		\$ 201,479.90

*INCLUDES FINAL PREPARATION OF MACHINING DATA HANDBOOK

ESTIMATED COST SAVINGS RESULTING FROM MDC'S OPERATION

OCTOBER 1, 1964 - SEPTEMBER 30, 1971

COST SAVINGS RESULTING FROM MDC'S

RESPONSE TO SPECIFIC INQUIRIES

Total Number of Specific Inquiries 6,546

Estimated Total Number of Machining Situations Included in the 6,546
Inquiries - 32,730

Estimated Savings per Machining Situation Response - \$800.00

Estimated Total Savings Resulting from Specific Inquiries - 32,730
Machining Situations x \$800.00 = \$26,184,000.00

COST SAVINGS RESULTING FROM MDC'S 14 DATA PUBLICATIONS

Total Number of Data Publications Copies Distributed - 19,294

Estimated Number of Machining Situations Utilized per Data Publications
Copy - 5

Estimated Total Number of Machining Situations - 19,294 Data Publication
Copies x 5 - 96,470

Estimated Savings per Machining Situation - \$300.00

Estimated Total Savings Resulting from Data Publications - 96,470 Machining
Situations x \$300.00 = \$28,941,000.00

TOTAL ESTIMATED COST SAVINGS RESULTING FROM MDC'S OPERATION

\$55,125,000.00

ECONOMIC ENVIRONMENT FOR MDC OPERATIONS

(ANNUAL COSTS)

Labor and Overhead Costs for Operating Metal Cutting Machine Tools in the United States

Total number of metal cutting machine tools in the metalworking industries	=	2,500,000*
Average labor cost + overhead	=	\$8.00 per hour
Average working day	=	8 hours
Number of working days per year	=	250
Average number of direct labor personnel per machine	=	1
Total cost of labor + Overhead: $2,500,000 \times \$8.00 \times 8 \times 250 \times 1$	=	\$40,000,000,000

\$40,000,000,000

*Based on American Machinist Tenth Inventory (1968)

Total Shipments Including Exports of Metal Cutting Type Metalworking Machinery

\$1,097,718,000

Source: U.S. Department of Commerce (1970)

Machine Tool Accessories Industry

Small cutting tools for machine tools and metalworking
machinery in the amount of \$670,000,000, includes
\$45,500,000 for tool holders.

Source: U.S. Department of Commerce (1970)

MDC INPUT & OUTPUT SUMMARY

SYSTEM INPUT

October 1, 1964 - September 30, 1971

Document and Card Totals

Documents Entered into the System (including Specific Inquiries)

Oct. 1, 1964 - Jan. 31, 1967	17,576
Feb. 1, 1967 - Jan. 31, 1968	3,695
Feb. 1, 1968 - Sept. 30, 1968	2,341
Oct. 1, 1968 - July 31, 1969	3,316
Aug. 1, 1969 - Sept. 30, 1970	5,638
Oct. 1, 1970 - Sept. 30, 1971	<u>3,408</u>
Total	35,974

Evaluated Documents (including Specific Inquiries)

Oct. 1, 1964 - Jan. 31, 1967	9,367
Feb. 1, 1967 - Jan. 31, 1968	3,734
Feb. 1, 1968 - Sept. 30, 1968	2,840
Oct. 1, 1968 - July 31, 1969	3,780
Aug. 1, 1969 - Sept. 30, 1970	7,522
Oct. 1, 1970 - Sept. 30, 1971	<u>2,649</u>
Total	29,892

Total Cards Punched

Oct. 1, 1964 - Jan. 31, 1967	75,173
Feb. 1, 1967 - Jan. 31, 1968	27,077
Feb. 1, 1968 - Sept. 30, 1968	13,833
Oct. 1, 1968 - July 31, 1969	33,868
Aug. 1, 1969 - Sept. 30, 1970	27,054
Oct. 1, 1970 - Sept. 30, 1971	<u>11,316</u>
Total	188,321

SYSTEM OUTPUT

Data Publications

Copies Distributed

AFMDC 65-1, Machining Data for Titanium Alloys	6,276
AFMDC 66-1, Machining Data for Numerical Control	1,327
AFMDC 66-2, Grinding Ratios for Aerospace Alloys	1,121
AFMDC 66-3, Machining Data for Beryllium Metal	1,476
AFMDC 68-1, Determination & Analysis of Machining Cost & Production Rates Using Computer Techniques	1,086
AFMDC 68-2, 1968 Supplement to Machining Data for Numerical Control	847
AFMDC 70-1, Machining of High Strength Steels with Emphasis on Surface Integrity	514
USAF Machinability Reports, Vol. 1 thru 4	69

Unit Costs

Average Cost Per Inquiry (807) - Oct. 1, 1970 - Sept. 30, 1971	\$ 48.23
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**MDC VISITS FOR ACQUISITION AND
DISSEMINATION OF MACHINABILITY INFORMATION**

October 1, 1970 - September 30, 1971

AMERICAN SOCIETY FOR INFORMATION SCIENCE 33RD ANNUAL MEETING (Attended)
Philadelphia, Pennsylvania
October 11-15, 1970

VISITED TO SOLVE PROBLEM OF BROACHING STACKED SILICON STEEL LAMINATIONS
Mt. Sterling, Kentucky
November 16, 1970

CONFERENCE ON MACHINING COSTS AND PRODUCTION RATES (Participated)
Delta College, Bay City, Michigan
December 9, 1970

PROGRAM FOR THE EAST/CENTRAL ENGINEERING CONFERENCE AND TOOL EXPOSITION (Participated)
Sponsored by the Society of Manufacturing Engineers
Cincinnati Convention Center, Cincinnati, Ohio
January 19, 20 & 21, 1971

1971 INTERNATIONAL TOOL EXPOSITION AND ENGINEERING CONFERENCE (Attended)
Sponsored by the Society of Manufacturing Engineers
Dearborn, Michigan
April 28 & 29, 1971

4TH ANNUAL INDUSTRIAL SEMINAR (Participated)
Sponsored by the Society of Manufacturing Engineers and Purdue University
Indiana University-Purdue University at Indianapolis
May 8, 1971

FORUM ON THE MANAGEMENT OF INFORMATION ANALYSIS CENTERS (Participated)
Sponsored by the COSATI Panel on Information Analysis Centers
National Bureau of Standards, Gaithersburg, Maryland
May 17, 18 & 19, 1971

SOCIETY OF MANUFACTURING ENGINEERS (Presentation on MDC)
Knoxville-Oak Ridge, Tennessee
June 3, 1971

ATTENDED INTERNATIONAL MACHINABILITY DATA CONFERENCE IN EUROPE (AACHEN, FRANKFURT) TO OBTAIN
INFORMATION ON EUROPEAN AND JAPANESE STATUS OF MACHINABILITY DATA BANKS
Dr. Max Kronenberg
June 1971

OHIO VALLEY CHAPTER - NUMERICAL CONTROL SOCIETY MEETING (Participated)
Cincinnati, Ohio
September 28, 1971

THE MACHINING CONFERENCE (Participated)
The Cleveland State University - Division of Continuing Education
Cleveland, Ohio
November 2, 1971