REPORT DDC-TR-70-2

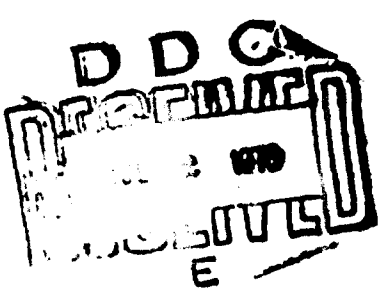
AD-708 600

AN INTERIM PROGRESS REPORT OF COMPUTER-OUTPUT-MICROFILM ACTIVITIES AND EXPERIENCES AT THE DEFENSE DOCUMENTATION CENTER

SAMUEL E. BLUMBERG
DIRECTORATE OF DEVELOPMENT

JULY 1970

DEFENSE DOCUMENTATION CENTER
Defense Supply Agency
Cameron Station
Alexandria, Virginia 22314



DEFENSE SUPPLY AGENCY
DEFENSE DOCUMENTATION CENTER
CAMERON STATION
ALEXANDRIA, VIRGINIA 22314

PREFACE

The Defense Documentation Center (DDC) is presently experimenting with Computer-Output-Microfilm (COM) equipment.

This interim progress report was issued primarily for the information of DDC and Defense Supply Agency (DSA) personnel. It has been released because of the widespread interest in COM experiences.

The statistics given in the report (costs, times, wages, etc.) are for DDC only. They may vary for other COM installations. The equipment recommendations are for the particular needs of DDC. It should not be inferred that DDC is recommending acquisition of any one manufacturer's equipment for other COM installations. Such recommendation should be made only after careful study of installation needs.

PREPARED BY:

Samuel E. Blumberg

SAMUEL E. BLUMBERG
Directorate of Development

APPROVED BY:

Paul A. Roley, Jr.

for HERMAN W. MILES
Director, Directorate of Development

TABLE OF CONTENTS

TABLE OF CONTENTS - APPENDICES

COM REPORT

I. INTRODUCTION

With the advent of third generation computers, we can produce more information in less time than was formerly possible.

High speed printers, based upon technology from the previous decade, cannot process information as quickly as it is received from the computer. Delaysof hours or even of days are commonplace. The amount of paper generated is often enough to create storage problems. Retrieval of specific data can be cumbersome when it requires searching through reams of paper.

One increasingly popular method of circumventing these problems is to use film instead of paper for computer reports. Digital information is transferred directly from computer tape to film. The process, computer-output-microfilm (COM), achieves computer speed by photographing data, rather than by impact printing with its inherent limitations. Microfilm requires less storage space than paper and, with proper equipment and a satisfactory indexing scheme, makes possible faster retrieval of data.

II. BACKGROUND

In March 1969 a study was made to determine the potential value of COM equipment to the Defense Documentation Center (DDC). The study indicated that COM might be of major benefit to DDC in several ways: easier information handling and storage, reduced file space requirements, faster "throughput" time for computer generated information, and substantial cost reduction when compared to the cost of information in conventional hard copy form.

On the basis of this study, DDC was authorized to acquire COM equipment for experimentation until the end of FY 70. DDC obtained a Stromberg-Datagraphix 4360 micromation printer in 2nd quarter, FY 70, and has been experimenting with COM since then. As originally conceived, the scope of the COM experiment was limited to DDC reference products already being produced in hard copy. While the experiment was being conducted, its scope evolved into a broader based effort. Instead of being restricted to existing reference products, the scope of the experiment now includes powerful reference products heretofore unavailable. Instead of being restricted to conventional uses of COM equipment (microfilm and microfiche), the scope of the experiment now includes investigation of other uses such as production of hard copy and varying size copy. Instead of being restricted to DDC in-house, the scope of the experiment now permits us to include DDC users in future COM investigations.

III. EQUIPMENT

Stromberg-Datagraphix is the largest manufacturer of COM equipment in the industry and has had years of practical COM experience.

One particular requirement for a DDC COM unit is the capability of producing microfiche as well as roll film. Microfiche is a 4" x 6" sheet of film which contains 80 frames (pages) of information. Stromberg-Datagraphix was (and still is, 15 May 1970) the only leading manufacturer offering a single COM unit for both microfiche and roll film.

Upon consideration of the above facts, the decision was made to order the following Stromberg-Datagraphix COM equipment:

Datagraphix 4360 Micromation Printer	$1924/month
F200 Reread (7 time reread)	78
Universal Camera	300
TOTAL	$2302/month

In addition an IBM 729 II tape unit was obtained from another government agency at no cost to DDC.

Equipment is also available to develop and to duplicate film produced by the micromation printer. However, it was not ordered because DDC already had developing capability in its photographic section.

IV. EQUIPMENT EXPERIENCES

In our overall experience the COM unit has been reliable, and the few instances of "down" time due to hardware malfunctions have not been a problem. Two early hardware malfunctions were caused by the inexperience of DDC personnel in handling the equipment. Other malfunctions occurred during the normal "shake out" procedure which is part of any new installation.

Certain other equipment problems did arise, however. The tape unit arrived with defective cables. New cables had to be ordered from IBM, which delayed operational status of the COM installation for three weeks. Future investigation should consider the advantages of a single vendor installation, weighed against the additional cost involved.

There was also a character set problem. The seven-track tape unit limits the number of available characters to sixty-four. Two character sets are generally available, either a business set or a scientific set. DDC's requirements are such that neither character set is wholly satisfactory. The manufacturer resolved the problem by customizing a character set for DDC.

A third equipment problem is the universality of the universal camera. The optional universal camera was ordered to provide the capability of using 16mm, 35mm, or 105mm (fiche) film. Our experimentation was limited to the 16mm and 105mm sizes, however, because the 35mm capability was not available. It has been promised by 1 July 1970.

V. COMPATIBILITY PROBLEMS (COM FICHE-COSATI FICHE)

The most common type of microfiche in use today is COSATI fiche, which contain sixty frames (pages) arranged in 12 columns by 5 rows. The top row (not including the 5 rows of data) is dedicated to header information. The reduction ratio cannot exceed 20X, the fiche are negative, and frames are arranged from left to right across each row.

COM fiche contain eighty frames arranged in 10 columns by 8 rows. No row is dedicated to header information, however header information can be placed in any frames through programming. The reduction ratio is 24X, the fiche are positive, and frames are arranged from top to bottom down each column.

Since 1965 DDC has distributed COSATI fiche to all users requesting fiche. The majority of all fiche users, including DDC users of fiche, are accustomed to COSATI fiche. Their fiche reading equipment is designed for COSATI fiche. Other fiche handling equipment such as the Houston-Fearless Compact Automatic Retrieval Display (CARD) unit require COSATI fiche.

There is an industrywide review of the different kinds of fiche being produced. This includes COSATI fiche, COM fiche, and National Microfilm Association (NMA) fiche. There may emerge a single standard for all fiche of this type. Until such a standard becomes reality, however, DDC is committed to COSATI fiche.

Both Datagraphix and DDC are working toward production of a COSATI-like fiche from the COM unit. The result will be a fiche which will not meet all of the COSATI standards but which will be close enough to satisfy most users.

VI. SUMMARY OF THE EXPERIMENT

As stated in the background the primary purpose for obtaining COM equipment was experimentation. The object of the experimentation has been threefold: to verify the conclusions reached in the March 1969 study cited above, to gain practical experience with conventional COM products (microfilm and microfiche), and to investigate other uses for COM equipment.

In order to verify the conclusions reached in the study a number of DDC reference products were put on film in a simulated production environment. These included such applications as printed bibliographies, Technical Abstract Bulletin (TAB) Indexes, Request Processing User History File, and others. Production data do verify the conclusions reached in the study. For example, the cost to produce a report on 16mm film is 35% less than the cost to produce the same report on the high speed printer.

In order to gain practical experience with conventional COM products we are producing TABs and their indexes for the ten-year period 1961-1969 on 16mm film. These reference tools will be used in-house and will also be offered to DDC users.

We have also investigated other ways of producing information. For example, we have produced hard copy reports from COM film via Xerox Copyflo. Another use is to change the size of a page of information. The standard page of computer printout is about 11" x 14". A more convenient size is the conventional 8½" x 11". By using COM equipment

and the Xerox Copyflo we can vary the height and width of each page to produce this or other desired sizes. This technique results in a product with which users are more familiar, and for which they have a preference. It enables them to store computer reports in legal size or letter size file cabinets, something they could not do with high speed printer output.

These two examples illustrate the experimental mode inherent in much of our COM effort. This experimentation is an important part of the overall program.

VII. CONVENTIONAL APPLICATIONS (MICROFILM AND MICROFICHE)

The way in which an output product will be used determines whether or not it is good for COM. Reports which are infrequently used and seldom updated are good applications. Reports which are produced for archival purposes are particularly suited to COM. Reports which are referenced for specific items rather than read in their entirety should be considered for COM. Personnel who must carry reference information with them when visiting users should find microfilm and a portable reader more convenient than bulky hard copy reports.

Conversely, reports which are used a number of times each day and which require frequent updating are not ideal for COM. Reports which must be annotated or which require notations right at the data cannot be used in film format.

The following applications were selected for COM testing and were produced on 16mm film:

1. Bibliographies
2. Indexes
3. Request Processing User History File
4. Dissemination Authority List (DAL)
5. Military DAL
6. Index by keyword and performing organisation
7. Alpha term list

These applications are representative of the reference products produced by DDC. The film is of acceptable quality. Readability in a film reader, i.e., legibility, contrast, and sharpness of characters is good. These products are available for inspection.

A cassette contains 100 feet of film, which is about 2000 frames (pages), and costs $8.15 to produce (Appendix A).

The cost to produce 2000 pages on the high speed printer is $12.60 (Appendix B). The COM cost includes cost of the film, exposing the film, developing, cost of a film cassette, and labor to place the film in the cassette. Not included is rental of the COM equipment or cost of film reading equipment. Hard copy cost includes cost of paper and operator cost. It considers multi-programming capability of the UNIVAC 418, which makes it possible to drive three printers concurrently. Not included are certain ancillary operations such as decollating, bursting, and distributing the report. Not included is depreciation of equipment. DDC now owns the UNIVAC 1108 system so there is no monthly rental. COM costs represent a 35% saving over hard copy costs.

The following table indicates comparative costs for the seven applications listed above. In each case $1.50 was added for set up time (1/3 hour).

	COM	Hard Copy
Printed Bibs (200 pages)	$2.32	$2.76
Indexes (800 pages as typical)	4.76	6.54
Request Processing User History File (2200 pages)	10.47	15.36
Dissemination Authority List (1200 pages)	6.39	9.06
Military DAL (160 pages)	2.15	2.50
Index by Keyword and Performing Organization (5000 pages)	21.88	33.00
Alpha Term List (6700 pages)	28.80	43.71

Those costs are for an original set only. They do not represent publication costs for multiple copies. Publication cost for multiple copies is $12 per 2000 pages. Cost for each duplicate copy of 2000 frames of film (100 feet), including exposure, developing, labor costs, and a cassette is $3.81 (Appendix F). This is a savings of 68% for duplicate sets produced on film rather than hard copy.

In addition to cost savings the COM unit prints this data 14 times faster than the high speed printer. Thus delays due to printer backlogs are eliminated

We are using the microfiche capability (105mm film) of the COM unit to produce COSATI-like fiche for the Houston Fearless Compact Automatic Retrieval Display (CARD) system. The entire Work Unit Data Bank is contained on 750 fiche which are housed in the CARI unit. Any one of 45,000 records can be retrieved and displayed within 4 seconds.

The cost to produce a set of fiche for the CARI system using conventional methods is $1000 (Appendix C). The cost to produce a set of fiche for the CARD system using COM equipment is $135 (Appendix D). This represents a cost saving of 87%. In addition 100 hours of computer printer time is saved, as well as the time required to photograph 750 fiche.

VIII. OTHER USES OF COM (HARD COPY FROM COM)

At least once each week the Work Unit Section (DDC-TST-2) receives a Contributor Summary List (CSL) for distribution to DDC Work Unit Data Bank contributors. This report contains about 13,000 pages. It requires 26 hours of printer time to print and costs $82.

Because of its frequency and size this report added considerably to the workload of the high speed printer. The hard copy could not be eliminated in favor of film or fiche because it is separated into many smaller parts for distribution. Thus an alternate method of producing a hard copy CSL report was sought.

The method adopted involves COM equipment and a Xerox Copyflo unit. The COM equipment produces the complete report on 16mm film. Instead of being fragmented and placed in cassettes for distribution, however, the film is used in a Xerox Copyflo unit to produce the report on continuous rolls of paper. The paper is cut to pages and sent to the Work Unit Section for distribution.

The entire process takes about 12 hours and costs about $134 (Appendix E). This is a time saving of about 50%. The cost is higher (by about 63%) than the high speed printer cost. This is because it is necessary to produce paper and film, rather than just paper. However, the Work Unit Section now has a backup film file of the CSL report for reference purposes. The quality of the report is good and personnel who work with it prefer it to the high speed printer version because its smaller size page is more convenient to handle.

IX. CONCLUSIONS

We have arrived at the following conclusions based upon our experiences with COM during the preceding five months:

1. In all cases a significant time savings is realized when reports are produced by COM equipment rather than by the high speed printer.

2. The cost advantage of COM over the high speed printer varies according to the application. In the case of the Work Unit fiche it is an 87% saving. In the case of the hard copy from film it is more expensive than the high speed printer (by about 63%). In the most common case, that of 16mm film for viewing in a film reader, the saving is about 35%.

3. Film products require about 90% less space than their hard copy counterparts and are easier to handle.

4. There are intangible benefits to using COM equipment. For example, timeliness of information, alleviation of printer delays, and greater convenience of handling information are factors which cannot readily be quantified.

5. A major intangible benefit of COM equipment is the flexibility it affords. Products can take varying forms and sizes. COM equipment can be used simply as a stand alone printer, or as part of a complex remote inquiry information retrieval system using on-line computer capabilities. In this latter application a user would have a set of documents on film (the complete set of Work Unit Summaries, for example) at his own facility. By interrogating a central computer through a remote inquiry station, the user can determine the exact location, in his own collection, of any desired information. Retrieval of this information can be a separate operation, or it can be done automatically under control of the central computer.

6. The tangible and intangible benefits of COM have made it possible for DDC to offer its users information which was heretofore impractical to produce. In addition to TAB entry cumulations and indexes for 1960-1969, previously mentioned, DDC is putting the entire AD Direct File on film. Another project is creation of composite TAB files and composite indexes on film, with annual updatings.

7. The COM industry is expending considerable effort to develop more equipment and more sophisticated equipment. By next year we expect a wider choice of equipment satisfying our need for both film and fiche capability at a competitive price.

X. RECOMMENDATIONS

Based upon our conclusions from the COM experiment; based upon the present and developing state of the art in COM equipment and techniques, and in ADP equipment and techniques; based upon the projected needs of DDC and its users during the seventies, we make the following recommendations.

1. Continue our COM activities beyond 30 June 1970.

2. Extend the rental period for our present COM equipment beyond 30 June 1970.

3. Continue surveillance of the COM equipment market to know of the best available equipment at all times.

4. Continue preparing for the greater information handling needs of this new decade by committing ourselves to further experimentation with non-paper information storage mediums, such as film.

5. Adopt the following plans as broad guidelines to give direction to our COM efforts in the coming year:

A. Gather and evaluate data on user acceptance of COM products both at DDC and in the field.

B. Work more closely with DDC users in determining still more applications of COM which could be mutually beneficial.

C. Combine COM techniques with computer capabilities to produce a remote inquiry information retrieval system superior to what we have today.

D. Continue to investigate new techniques for producing information on COM equipment.

E. As user acceptance permits, change the emphasis of the COM effort from experimental to production, without ever completely discontinuing the experimental.

F. Investigate the advantages, both economically and systemswise, of obtaining COM developing and duplicating equipment instead of using the conventional developing and duplicating equipment we now use.

The COM project started out as a narrow effort with specific goals. As the work proceeded the entire philosophy of the effort changed. The COM project is now much broader, encompassing more uses and more users, as well as more powerful and far reaching techniques. We strongly believe that future development and evaluation of COM should be based upon this new and broader philosophy.

APPENDIX A

COST TO PRODUCE 2,000 FRAMES (100 FEET) OF 16mm COM FILM IN A CASSETTE IS $8.15

1.	Film Cost: $5.44/200 foot roll or $2.72/100 feet	$2.72
2.	Operator Cost (COM Unit): Rate of Unit - 2 frames/second 2000 frames - 1000 seconds - 5/18 hour 5/18 hour at $4.50/hour operator wages - $1.25	1.25
3.	Chemicals for Developing: 1¢/foot* 1¢/foot x 100 feet (2000 frames) - $1.00	1.00
4.	Operator Cost (Developing) Rate of Developing Equipment - 300 feet/hour* 100 feet of film requires 1/3 hour to develop 1/3 hour at $4.50/hour operator wages - $1.50	1.50
5.	Cost of one cassette	1.23
6.	Operator Cost to Place Film in Cassette Estimated Time Required - 1/10 hour/cassette 1/10 hour at $4.50/hour operator wages - $.45	.45
		$8.15

*Figures supplied by Photographic Section

NOT included in this cost:

1. Rental of COM equipment
2. Overhead costs (light, heat, etc.)
3. Film reader costs

APPENDIX B

COST TO PRINT 2000 PAGES ON THE HIGH SPEED COMPUTER PRINTER IS $12.60

1. Paper Cost:
   $3.30/1000 sheets or $6.60/2000 sheets — $6.60

2. Operator Cost (High Speed Printer):
   Operator Wage - $4.50/hour
   Operator can operate three printers concurrently.
   Operator wage to operate one printer for one hour is 1/3 of $4.50 - $1.50
   Effective printer speed approximates 500 pages/hour
   Time required to print 2000 pages is 4 hours
   Four hours operator time at $1.50/hour - 6.00

TOTAL $12.60

NOT included in this cost:

1. Depreciation of equipment
2. Overhead costs (light, heat, etc.)

APPENDIX C

COST TO PRODUCE A SET (750) OF CONVENTIONAL FICHE FOR THE HOUSTON-FEARLESS CARD SYSTEM IS $1,000 ($997.50)

1. Paper Cost:
   $3.50/1000 sheets or
   45 times $3.50 - $157.50 for 45,000 sheets — $157.50

2. Operator Cost (High Speed Printer)
   Operator Wage - 1.50/hour (see Appendix B, Step 2)
   Effective printer speed approximates 500 pages/hour
   45,000 pages/500 pages per hour - 90 hours printing time
   Considering breaks, set-up time, restarts, etc., assume 100 hours printing time.
   100 hours printing time at $1.50/hour - $150. — 150.00

3. Cost of Conventional Fiche:
   Cost of one master fiche is 92¢.
   (Figure supplied by photographic section is complete, includes labor, material, overhead, etc.)
   Cost of 750 fiche is 750 times 92¢ - $690.00 — 690.00

TOTAL — $ 997.50

APPENDIX D

COST TO PRODUCE A SET (750) OF COM FICHE
FOR THE HOUSTON-FEARLESS CARD SYSTEM IS $130 ($133.56)

1. Film Cost: $15.18/100 feet (about 180 4" x 6" fiche/100 feet) About 450 feet of film required for 750 fiche. 4.5 times $15.18 - $68.31	$68.31
2. Operator Cost (COM Unit) 2 fiche/minute - 375 minutes (750 fiche) - 6.25 hours Considering breaks and set up time, assume 8 hours COM time 8 hours at $4.50/hour operator wage - $36.00	36.00
3. Chemicals for Developing 5¢/foot times 450 feet - $22.50 (figure of 5¢/foot supplied by photographic section)	22.50
4. Operator Cost (Developing) Rate of Developing Equipment - 300 feet/hour 450 feet of film requires 1 1/2 hours to develop 1 1/2 hours at $4.50/hour operator wages - $6.75	6.75
	$133.56

APPENDIX E

COST TO PRODUCE A CONTRIBUTOR SUMMARY LIST (ABOUT 13000 PAGES) USING COM EQUIPMENT AND A XEROX COPYFLO UNIT IS $134 ($134.46)

1.	Film Cost (COM): 13000 frames - 650 feet of film in seven cassettes. Total Cost - $53.62	$53.62
2.	Xerox Copyflo Paper Cost Each roll of 2000 feet (1800 feet usable) costs $4.89. Each of the 13000 pages is 10 inches in height. Six rolls of paper are needed. Six rolls at $4.89/roll - $29.34	29.34
3.	Operator Cost (Xerox Copyflo) Unit operates at about one roll of paper per hour. Six hours of operating time required. Operator wage is $4.50/hour Six hours times $4.50/hour - $27.00	27.00
4.	Operator Cost (Cutting to pages) Operator can cut about 2000 pages per hour. Cutting time requires about 7 hours at $3.50/hour Seven hours times $3.50/hour - $24.50	24.50
	TOTAL	$134.46

APPENDIX F

COST TO PRODUCE A DUPLICATE SET OF 2,000 FRAMES (100 FEET) OF 16mm FILM IN A CASSETTE IS $3.81

1.	Film Cost 1600 Feet/$10 or 63¢/100 feet	$ .63
2.	Operator Cost (Developing, Includes exposure) 300 feet/hour or 1/3 Hour for 100 feet 1/3 hour times $4.50/hour operator wage - $1.50	1.50
3.	Cost of one Cassette - $1.23	1.23
4.	Operator cost (Load Film into Cassette) Estimates Time to Load One Cassette - 6 minutes (1/10 Hour). Operator Wage - $4.50/Hour 1/10 times $4.50/Hour - 45¢	.45
	TOTAL	$3.81

APPENDIX C

COST TO PRODUCE A DUPLICATE SET (750)
OF WORK UNIT FICHE IS $82.53

1.	Film Cost 16.8¢/100 feet (about 180 4" x 6" fiche) 4.5 rolls needed 4.5 rolls times $16.8¢/roll - $75.78	$75.78
2.	Operator Cost (Developing, Including Exposure) Unit operates at 300 feet per hour. 450 feet require 1.5 hours Operator wage is $4.50/hour. 1.5 hours times $4.50/hour - $6.75	6.75
	TOTAL	$82.53

APPENDIX H
SOME TIMING FACTORS AND COST FIGURES USED THROUGHOUT THE REPORT

1. COM Unit - 16mm film.....2 Frames/Second
2. COM Unit - 105mm film (fiche).....2 Fiche/Minute
3. High Speed Printer.....500 Pages/Hour
4. Xerox Copyflo.....46 Feet (46 Pages)/Minute
5. COM Film - 16mm.....$5.44/200 Feet
6. COM Film - 105mm (fiche).....$15.10/100 Feet
7. Duplicating Film - 16mm.....$10/1600 Feet
8. Duplicating Film - 105mm (fiche).....$16.84/100 Feet
9. Film Developing Speed.....300 Feet/Hour
10. Cutting Speed - Xerox Copyflo Pages.....2000 Feet/Hour
11. Operator Wages.....$4.50/Hour
    COM, High Speed Printer, Film Developer, Xerox Copyflo
12. Operator Wages.....$3.50/Hour
    Cutting Xerox Copyflo Paper into Pages

Unclassified
Security Classification

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author)
Defense Documentation Center
Cameron Station
Alexandria, Virginia 22314

2a. REPORT SECURITY CLASSIFICATION
Unclassified

2b. GROUP

3. REPORT TITLE
An Interim Progress Report of Computer-Output-Microfilm (COM) Activities and Experiences at the Defense Documentation Center

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)
Interim Progress Report, November 1969 - May 1970

5. AUTHOR(S) (First name, middle initial, last name)
Samuel E. Sherberg

6. REPORT DATE
July 1970

7a. TOTAL NO. OF PAGES
24

7b. NO. OF REFS
One

8a. CONTRACT OR GRANT NO.

b. PROJECT NO. 3.2A11

c.

d.

9a. ORIGINATOR'S REPORT NUMBER(S)

9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)

10. DISTRIBUTION STATEMENT
Distribution of this document is unlimited.

11. SUPPLEMENTARY NOTES

12. SPONSORING MILITARY ACTIVITY

13. ABSTRACT

Since November 1969 the Defense Documentation Center (DDC) has been experimenting with Computer-Output-Microfilm (COM) equipment and techniques. Stromberg-Datagraphix equipment was selected primarily for two reasons: the reputation and practical experience of this manufacturer and the capability of producing roll film or microfiche with a single unit.

Our findings indicate there are significant benefits to DDC from using COM equipment. Depending upon the type of application, the cost savings could be as high as 87%. COM also provides greater flexibility in the format of the output product. Reports could be in roll film, fiche, or hard copy produced from COM film. The size of the hard copy can be varied to accommodate differing needs and preferences.

Greater speed and reduced storage requirements make it practical to produce reference products which could not previously be considered. For example, complete sets, on 16mm film, of Technical Abstract Bulletin entries in numeric order by AD number, and indexes to them, for the ten-year period 1960-1969.

From a systems standpoint there are a number of uses for COM equipment: as a stand alone printer; in conjunction with other film handling equipment; and to produce film for a remote inquiry information retrieval system.

Based upon these findings we recommend extension of the rental agreement with Stromberg-Datagraphix and continuation of our experimentation with COM equipment.

DD FORM 1 NOV 1473

Unclassified
Security Classification

KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Computer-Output-Microform Computer-Output-Microfilm COM Microfilm Microform Microfiche						