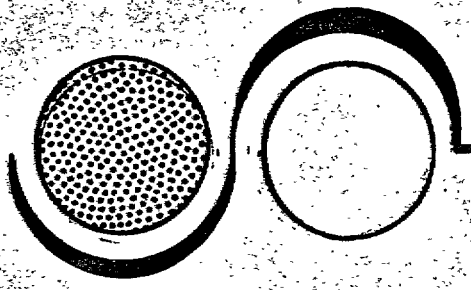

REPORT ON AN EXPERIMENTAL COMPUTER OUTPUT MICROFILM SERVICE CENTER

An experimental Computer Output Microfilm (COM) Service Center was operated in Norfolk, Virginia, for 18 months. High potential for savings through the use of COM was demonstrated, and the experiment itself yielded significant improvements in user operations and savings to the Government.

FEBRUARY 1976

THE JOINT GAO, DOD, GSA, AND NBS
STEERING COMMITTEE

OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE
WASHINGTON, D.C. 20301

COMPTROLLER

TO THE READER:

This report is the product of the Joint Steering Committee on Computer Output Microfilm (COM). Participating organizations were:

Department of Defense (DoD)

General Services Administration (GSA)

General Accounting Office (GAO)

National Bureau of Standards (NBS)

The first three monitored, and herewith report on, an experimental COM service center operated by the Navy. NBS has developed a draft standard for COM which is included as Appendix I.

This report is the final act of the Steering Committee which was dissolved on December 12, 1975. Further action on COM is the normal management responsibility of individual agencies.

Additional copies of this report may be obtained from the National Technical Information Service (NTIS) or the Defense Documentation Center (DDC).

William W. Higgins
Colonel, USA
Director for Data Automation

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ABBREVIATIONS

COM	Computer Output Microfilm
DOD	Department of Defense
ADP	Automatic Data Processing
FCDSSA	Fleet Combat Directional System Support Activity
GAO	General Accounting Office
GSA	General Services Administration
NBS	National Bureau of Standards
NESC	Naval Electronics Systems Command
NIH	National Institutes of Health
NMA	National Microfilm Association
NSC	Naval Supply Center, Norfolk
NNSY	Norfolk Naval Shipyard
NPPS	Navy Publication and Printing Service
NPPSO	Navy Publication and Printing Service Office, Norfolk
NRFC	Navy Regional Finance Center, Norfolk
OMB	Office of Management and Budget
PAMILANT	Personnel Accounting Machine Installation, Atlantic
TAC	Tactical Air Command, Langley Air Force Base

CHAPTER 1

INTRODUCTION

This is a report on the operation of an experimental Computer Output Microfilm (COM) Service Center. The service center was sponsored by a joint COM Steering Committee composed of representatives from the Office of Management and Budget (OMB), the Department of Defense (DOD), the General Services Administration (GSA), and the General Accounting Office (GAO). It was operated by the Navy Publication and Printing Service Office (NPPSO) at the Naval Supply Center (NSC), Norfolk, Virginia. Operations began in November 1973 and ended in June 1975.

The center was established as a result of GAO studies concerning the Federal Government's use of COM. The Steering Committee monitored the operations of the test center and reported quarterly.

This report is intended to give GSA and individual agencies the Steering Committee's findings on the use of COM. Tentative conclusions drawn herein are those of the Committee and not necessarily of the agencies represented on it. Also, the mention of specific products used for this experiment does not constitute endorsement.

WHAT COMPUTER OUTPUT MICROFILM IS

COM is a method of printing computer output on microfilm. Technological advances permit computers to process in terms of billionths of a second. But computer output is limited by the speed at which it can be produced in usable form. With the proliferation of computer applications, large amounts of paper reports have been produced, which are often difficult to store, distribute, and use. Researchers and records management specialists sought to develop an alternative to paper--one which would enable output to keep pace with computer processing speed (reduce the bottleneck at the output point), reduce storage space, and aid retrieval. COM has provided one answer to these problems by merging the capabilities of the computer with microfilm technology.

A COM system requires a recorder, a film developer, a film duplicator, and a reader. The COM recorder may be connected directly to the computer for on-line operation, or it may be connected to a magnetic tape unit for off-line operation.

COM recorders use several methods to form images on the film from the computer-generated data. The most commonly used method is the cathode ray tube system. This system converts the computer-produced digital data into analog signals and forms human readable images on a phosphorescent screen which is then photographed. It should be noted that the COM process does not require that a paper copy be made as is done to produce conventional microforms. COM forms the image directly on photographic film.

There are many formats in which COM may be produced. These include

--reels, 16mm and 35mm;

--cartridges, 16mm;

--cassettes, 16mm;

--microfiche, 105mm;

--aperture cards; and

--jackets, which are strips of 16mm and 35mm film.

A variety of readers is available for viewing the microforms, such as lap, portable, desk, freestanding, and those with automatic retrieval devices. In addition, reader-printers are available which are used for both viewing microfiche and producing hard copy from it.

It should be recognized that, with the exception of the COM recorder, components of a COM system may be identical to and shared with any other microfilm system.

OPERATIONAL ADVANTAGES OF COM

Industrial literature and Government studies contain many examples of savings achieved by using COM. Information can be provided to the user faster if it is produced on film instead of on paper. For example, GAO studied a report which took 52 hours to print on paper and distribute and only 11 hours to produce on film and distribute. Retrieval of information is also faster from film. Industrial literature gives an average of 3/4 less time to retrieve with film. Also, COM can be used with sophisticated automatic retrieval devices that can approach the speed of on-line terminals. Other advantages cited are as follows:

--Microfilm copies are of higher quality than multiple carbon sets.

--Microfilm copies are cleaner than carbon copies.

--Microfilm reports require less storage space than paper reports.

--Microfilm reports weigh less than paper reports.

PRODUCTION COST SAVINGS FROM COM

Industrial literature frequently compares printing computer output on paper with recording the information on microfiche. The magnitudes of savings by using fiche are usually said to be

--99 percent reduction in storage costs,

--95 percent reduction in mailing costs,

--92 percent reduction in labor costs, and

--80 percent reduction in material costs (primarily paper).

The reduction in paper cost is typically the largest direct savings because of the quantities needed and the increasingly high cost of paper. Labor costs also reduced significantly because the need to burst, decollate, and bind paper is eliminated. The following tables illustrate the speed advantage of COM.

5,000 electric typewriters	=	16 impact printers	=	1 COM recorder

	Characters per second	Lines per minute	Lines per hour	Pages per hour
Typewriter	15	13	780	13
Impact printer	4,400	2,000	120,000	2,000
COM recorder	70,000	32,000	1,900,000	30,000

CHAPTER 2

FINDINGS OF THE STUDY

This chapter summarizes the major issues and conclusions from the study done by the Joint Committee on COM. The study has demonstrated that

--production cost savings and operational efficiencies were achieved by agencies converting paper reports to COM, and

--Federal COM service centers can be effective means of providing the service.

Guidance is offered in using COM, the feasibility of COM service centers, acquiring COM services, and establishing in-house COM capability.

USING COM

Determining whether or not a report should be converted to COM requires a cost comparison of producing the report on paper versus film and an analysis of the report's application. Such an analysis should include interviewing users of the reports, and should include:

--What is done with the report: how often it is generated, the number of copies, their distribution, the number and kind of end users, and the retention requirements.

--Whether it is feasible for conversion at all: turnaround requirements, necessity to mark on the report, legal restrictions, or users' refusal to use COM may mitigate against it.

--Whether converting the reports will yield a savings: paper cost avoided versus startup and recurring costs of COM.

Managers should give attention to variables which affect the degree of users' acceptance of COM such as convenient access to good quality readers, amount and type of orientation, and supervisors' attitudes about COM.

FEASIBILITY OF COM

This experiment demonstrated that:

--COM is a viable option for routine reports intended to be read and acted upon. Its use is not limited to archival and catalog systems.

--Small Federal ADP installations can achieve cost savings and increased operational effectiveness through the use of COM.

--These installations can apply COM effectively via a local Federal COM service center.

--Such a COM service center can yield substantial savings to the Government as a whole because:

- It allows small ADP installations to capture paper savings without a capital investment.

- It avoids the cost to the Government of replicating underutilized COM equipment at numerous small ADP installations.

However, it is not possible from this limited experiment to give specific guidance on the following questions:

--Commercial service centers versus Federal service centers.

--Sharing at another agency versus a service center which serves many customers.

--The threshold at which a large ADP installation should get its own COM equipment.

The Committee feels that GSA should develop further guidelines to potential Federal users of COM concerning the above questions.

ACQUIRING COM SERVICES

Federal Property Management Regulation (FPMR), Subpart 101-32.2, requires agencies to give first consideration to obtaining COM service from existing Government sources. If the agency cannot use equipment operated by another agency, commercial service centers should be considered.

OMB Circular A-76 requires that products or services estimated to cost less than $50,000 annually be procured from commercial sources. When the estimated cost exceeds this amount, a cost comparison should be made to see if at least a 10 percent savings for an in-house operation can be realized. If not commercial sources should be used.

Sharing facilities is the preferred alternative unless there are:

--complicated security requirements,

--restrictive turnaround requirements, or

--volume which cannot be handled by the COM equipment available to be shared.

Acquiring COM through sharing or commercial centers offers several advantages, including:

--allowing agencies with very small volume of applications to realize savings,

--limiting agency investment,

--enabling agencies to take advantage of center expertise,

--allowing de-bugging of applications before investing in equipment,

--eliminating inappropriate applications used to build "utilization" of equipment, and

--allowing accurate prediction of costs.

ESTABLISHING COM CAPABILITY

When establishing a COM service center or in-house capability, the first decision which needs to be made is services to be offered. Results of a study of users' needs should be weighed against the cost of the service and expected long-run revenues. Film formats to be offered should conform to standards established by the National Bureau of Standards (NBS).

Decisions in the following areas will also have to be made.

1. Equipment selection will depend on services to be offered, environment of the center, cost, and availability of local maintenance.

2. Personnel required will be dependent on equipment selected and services offered.

3. Pricing strategy should be geared to attract customers and recover costs over the long run.

4. The service must be publicized to attract customers and overcome ignorance of the technology and resistance to change.

5. Classified data requires specialized procedures and a classified safe. Additional recruiting lead time is needed to get clearances. Also, a large volume of classified COM material would add significant document control work to center administration. However, these classification matters are not unique to COM.

6. Internal information systems should be adequate to monitor operation, establish pricing policies, and identify inefficiencies.

7. Archival-quality film is required by a number of regulations dealing with report retention. Archival requirements are specified in FPMR 101-11.5.

CHAPTER 3

RESULTS OF THE TEST SERVICE CENTER

The Federal Government, with over 7,000 computers, is the largest user of automatic data processing (ADP) equipment. Many areas in the United States have concentrations of Federal activities with this equipment, suggesting service centers as a way of efficiently using COM.

In 1972, GAO conducted a study in the Norfolk area to assess the potential improvement in local ADP operations through the use of COM. This study resulted in a letter report to the Director, OMB, suggesting a joint study by GAO, OMB, GSA, and DOD to establish a prototype service center in Norfolk, identify effective ways to apply COM, and highlight the need for standards. The joint study approach was approved and, in March 1973, a joint COM Steering Committee was formed under the leadership of the Director for Data Automation, Office of the Assistant Secretary of Defense (Comptroller.)

It was decided that the Navy Printing and Publishing Service Office (NPPSO) at Norfolk would operate the experimental service center for the joint study. Operation began in November 1973. This chapter presents the results of that operation.

NET SAVINGS TO THE GOVERNMENT FROM OPERATION OF THE COM CENTER

The operation of the COM center resulted in production savings to the Government; thus:

Production cost savings by center users	$56,170
Local loss at service center	2,058
Production savings to Government	$54,112

These savings were realized by the Government even though the center did not develop all its potential users. (The "loss at service center" is a failure to recover operating costs.) The details of the production cost savings realized by individual users during the experiment are shown below. (Some were in operation less than one year.)

Fleet Combat Directional Systems Support Activity, Dam Neck (FCDSSA)	$27,121
Norfolk Naval Shipyard (NNSY)	22,821
Norfolk Naval Supply Center (NSC)	5,372
Tactical Air Command, Langley Air Force Base (TAC)	1,613
Personnel Accounting Machine Installation, Atlantic (PAMILANT)	(757)
Navy Regional Finance Center, Norfolk (NRFC) a/	-
Total	$56,170

The above figures must be offset by the one-time cost to the users of microfiche readers. The costs of readers specifically chargeable to COM applications could not be identified for all users because some applied readers which were already installed for other purposes to their COM applications.

However, as an example, the Naval Supply Center (NSC) bought the following equipment, through GSA, specifically for its COM applications:

11 MINICAT readers @ 124.00	=	$1,364.00
3 IBM reader-printers @ 910.00	=	2,730.00
Total cost of NSC COM-specific readers	=	$4,094.00

Thus, the NSC savings during the experiment would be $1,278 (5,372 minus 4,094). However, the production savings will continue, while the purchase of those readers will not (see below).

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a/ No savings are shown for NRFC because it converted from paper to microfilm several years ago using another service center.

The projected annual production cost savings to the users from their present COM applications are shown below:

FCDSSA	$29,587
NNSY	27,386
NSC	3,581
TAC	2,769
Total annual savings	$63,323

All four users indicated that those COM applications would continue for at least one more year.

Not as many activities became customers of the COM center as anticipated based on area potential. The Norfolk area has 26 Federal activities using computer equipment--23 military and 3 civilian. During the test only 6 became customers of the COM center, some only to a limited extent. In addition, the Philadelphia Naval Shipyard had a report converted each month and a sample report was converted for the Corps of Engineers. Reasons given for activities' not becoming customers included center prices, need to rewrite print tapes for the COM recorder, no intensive publicity, and activities' internal problems such as lack of microfiche readers.

CUSTOMER BENEFITS

Each of the center's customers realized production cost savings and/or improvement in operations by converting to COM. The applications converted varied in content and in length, ranging from 34 to 70,000 pages. The nature of the applications included accounting, inventory, personnel, tactical, and production reports.

The extent to which each activity has converted computer output to microfilm is described below.

Activity	Number of reports converted			Approximate number of	
	Daily	Weekly	Monthly	Pages	Fiche
NSC	1			270	2
		1		200	1
			1	16,373	65
NNSY	1			520	2
		9		16,364	66
			10	16,373	66
FCDSSA	1 (as needed basis)			19,919 monthly	99 monthly
TAC	0				
		0			
			3	18,000	69
	1 (quarterly)			172	4
NRFC	0				
		0			
			2	32,714	(a)
PAMILANT	0				
		4		9,477	62
			8	164,910	637

(a)These two reports are produced on roll film. If they are converted to microfiche, a minimum of 122 fiche will be required.

Improvements in operations

All activities using COM instead of paper realized operating efficiencies, primarily from reduced retrieval time, increased working space, and increased number of copies distributed. At all of the activities some users felt the conversion had improved the retrieval process for them and some did not. Quicker retrieval resulted in reductions in work backlogs and faster response to inquiries. Before converting one of its reports to COM, PAMILANT had five clerks manually update and compile weekly statistics from the report. With microfiche, the report and related statistics are produced weekly, and five clerks have been eliminated at annual savings of about $43,000. Also, users of the report estimate that the retrieval of data from film is 4 or 5 times faster than from paper.

A pronounced operational improvement resulting from the conversion to COM is the reduction in the storage space required. An analysis of COM conversions at four activities indicated space savings in excess of 99 percent. For example, one activity produced a 16,400-page monthly report which required about 105 cubic feet to store for one year. When converted to COM, the report was produced on 61 fiche requiring only .545 cubic feet each year. The picture on page 13 compares one month's paper report to its microfiche equivalent.

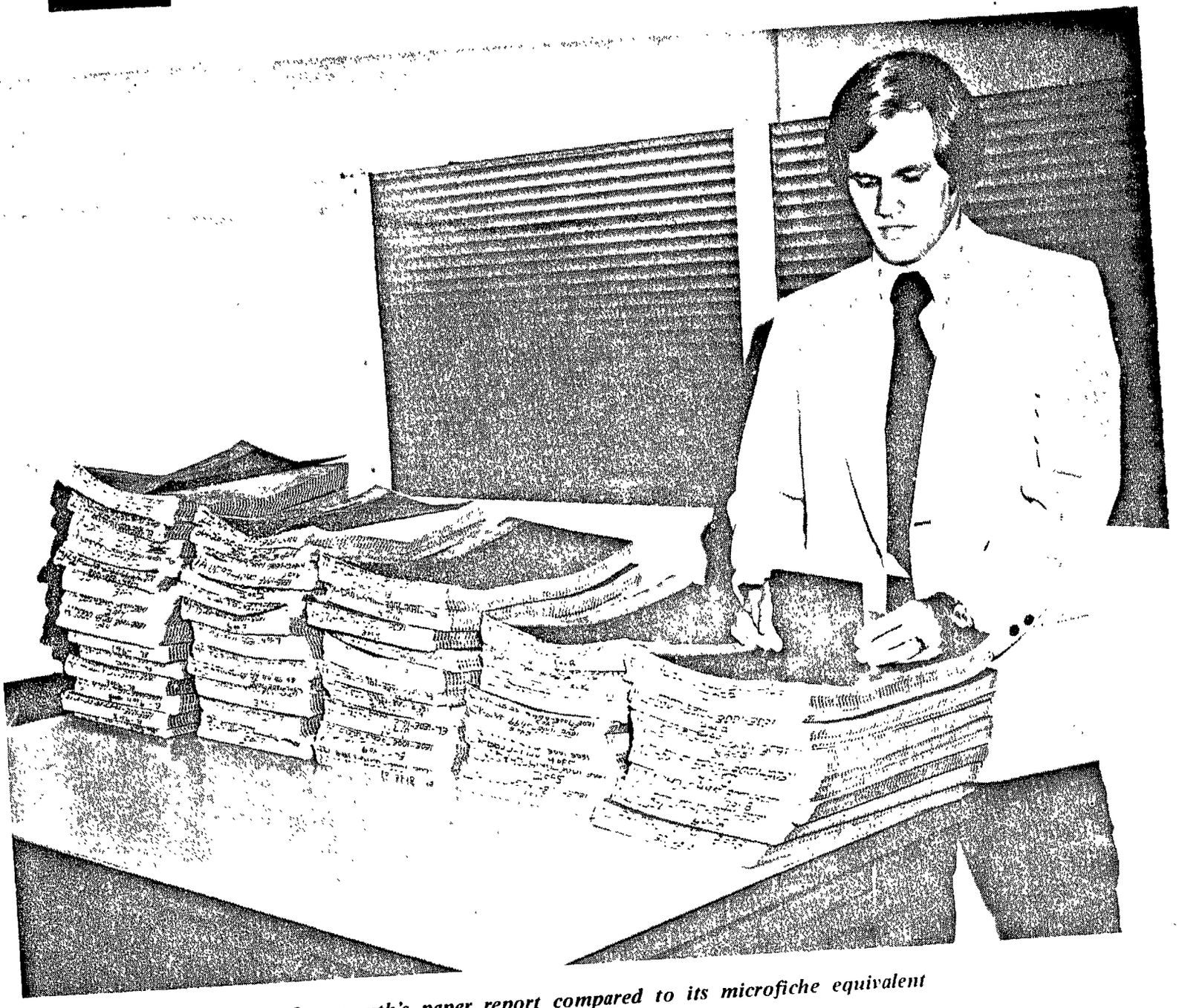
This reduced volume allows more room for past reports or working area. Maintaining additional past reports in the immediate working area improves operations by providing quicker and easier access to historical information when needed. When storage space savings are large enough, report users may have room for additional conference facilities, additional equipment, or the space can be made available for other purposes.

Another improvement in operations can be increases in report distribution. Although an increase in report distribution does not result in direct savings, additional copies can be made available to employees who need better access to the data. For example, the Program Run Log at NSC, when produced on paper, was infrequently used by the programing department because the only copy available was located outside of the department. Programers researched other sources and used the Run Log only as a last resort. Distribution was increased to include the programing department when the report was converted to COM. The Program Run Log is now more convenient and saves programer time.

Production cost savings

All of the center's customers have converted some reports which resulted in production cost savings. For some reports, savings have been over 50 percent. For many activities, the most significant savings have been reductions in paper cost. For example, when one activity converted a 2,700-page weekly report to COM, the paper cost avoided was $7,270 annually.

Reductions in labor and equipment usage also produced substantial savings. One activity produced a 16,000-page report on two-part paper which required about 21 hours to decollate, bind, and distribute at a labor cost of $72.24 per run. On microfiche the report requires only 20 minutes to review for completeness and distribute at a cost of $2.81.



One month's paper report compared to its microfiche equivalent

Reductions in computer time to produce the report on COM also contributed to savings. For example, one activity printed a 1,450 page report twice to get 11 copies. After conversion, computer time was reduced by 86 percent. Reformating the print tape to COM requires about 15 minutes of data processing time and is valued at $6.60 per run.

Whether a paper report will be cheaper to produce on microfilm depends on the length of the report and the number of copies required. The cost of paper, labor, and equipment will vary among activities, therefore, the minimum report length and number of copies which will result in a savings will also vary. For instance, when NSC converted a 270-page report on 2-part paper to COM they realized savings of $325 annually. On the other hand when NNSY converted a 461-page report on 2-part paper to COM, the cost was greater than that of paper (about $380 more annually). The greater production cost, however, was offset by increased operating efficiencies.

The production cost savings accruing to COM center customers during the test period is shown in the following table.

Activity[1]	Number of months of COM production	Total production cost savings	Overall production savings of microfilm over paper
NSC	18	$ 5,372	27 per cent
NNSY	10	22,821	41
TAC Langley	7	1,613	43
FCDSSA	11	27,121	67
PAMILANT[2]	12	(757)	3

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1 The NRFC is not included in this analysis because it converted to COM several years before establishment of the NPPSO center.

2 The total production cost savings for PAMILANT is not shown in the schedule because of PAMILANT's move to New Orleans during late 1974. The figure represents the conversion of PAMILANT's largest report. They incurred a loss because in addition to fiche they produced one copy of the report on paper; even so the operational savings mentioned on page 12 offset the production loss shown.

Since the cost for duplicate fiche is relatively low, activities realized production cost savings from many reports even though their distribution was increased at the same time as their conversion to COM. For example, the NNSY increased the distribution of 17 of the 20 reports converted, with the increases ranging to a maximum of 800 percent. Moreover, the cost of distribution was decreased significantly at activities mailing reports to other locations.

SERVICE CENTER VERSUS INDIVIDUAL-USER COM OPERATIONS

The average total monthly cost to operate the center was about $4,530. Of this sum, the fixed (equipment) costs alone exceeded $2,400. If the five local microfiche customers had acquired similar equipment, it would have cost the Government over $12,000 per month (5 x $2,400). Five separate COM units would also have multiplied the direct labor portion of the variable costs. The savings to the Government from producing the five users' COM work at a service center are obvious. (Equipment savings alone were about $115,200 per year.)

This additional cost is grossly understated when one considers the separate studies each activity would have undertaken to select its equipment, the lost time from operational startup, and the learning curve of employees operating the units. Using the most optimistic figures, the utilization of the COM equipment at each site would have been only 0.1 percent to 10 percent of one shift.

It is doubtful that the center customers could have cost justified in-house equipment with their present COM volumes, which means they would have had to forego the savings that resulted from their use of COM if they had attempted to produce their own COM.

LOW UTILIZATION OF THE CENTER

The capacity of the COM equipment at the center was 27 original microfiche per hour and 500 duplicates per hour. The highest percentage utilization for any month was 54 percent of one shift on the recorder (originals) and 28 percent of one shift on the duplicator. The table below shows the volume of production by month.

COM CENTER'S PRODUCTION VOLUME FOR WHICH NPPSO CHARGED CUSTOMERS a/

Year	Month	Original fiche	Duplicate fiche
1973	November	97	184
	December	91	178
1974	January	213	1,442
	February	365	1,703
	March	527	7,258
	April	651	16,633
	May	520	18,985
	June	671	9,455
	July	831	12,614
	August	1,267	16,947
	September	1,622	22,037
	October	1,780	22,280
	November	1,551	19,937
	December	1,504	17,048
1975	January	690	3,697
	February	735	4,893
	March	696	5,991
	April	580	5,253
	May	692	5,796
	June	743	5,901

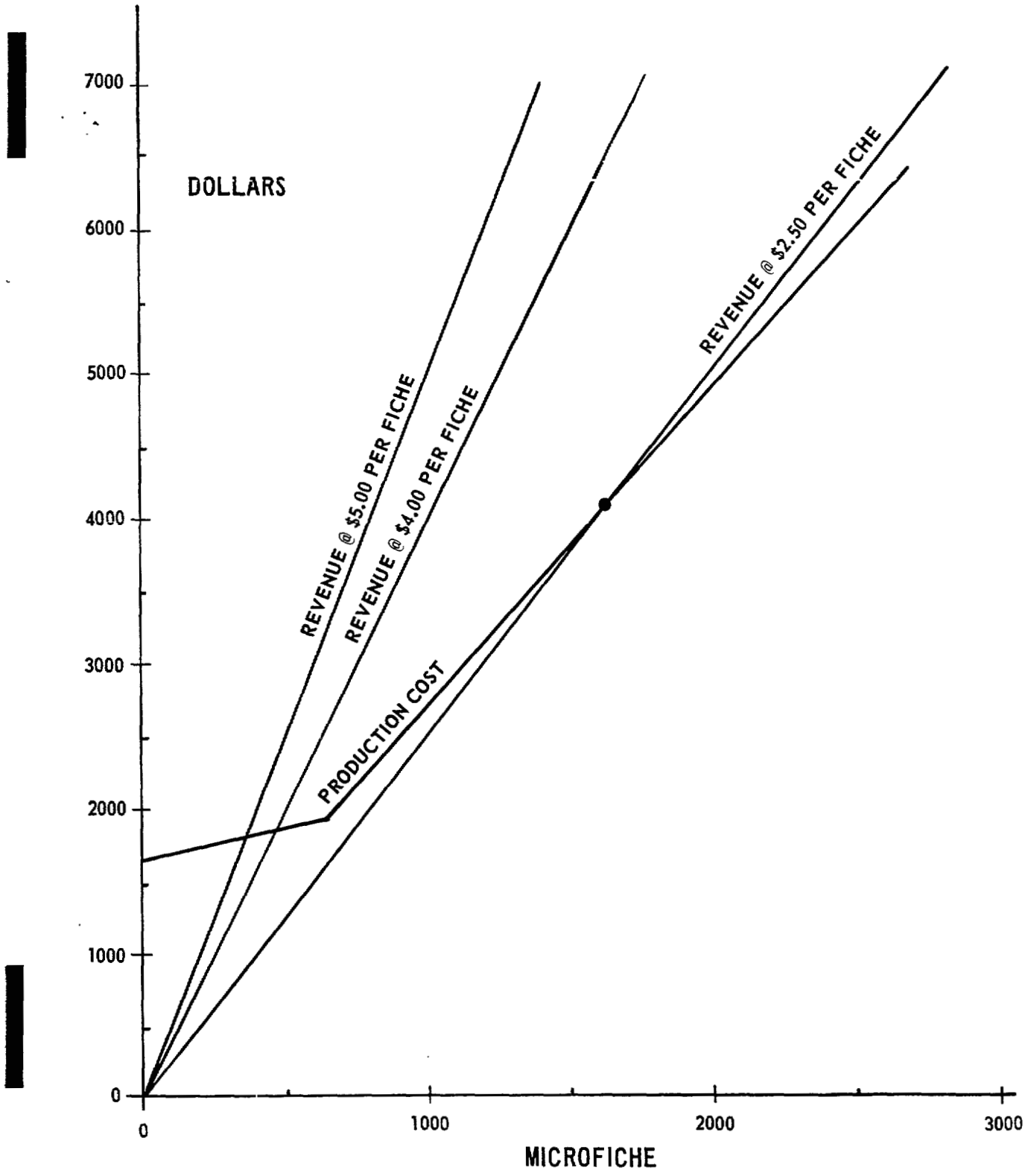
a/These figures exclude test tapes, bad runs, and scrap.

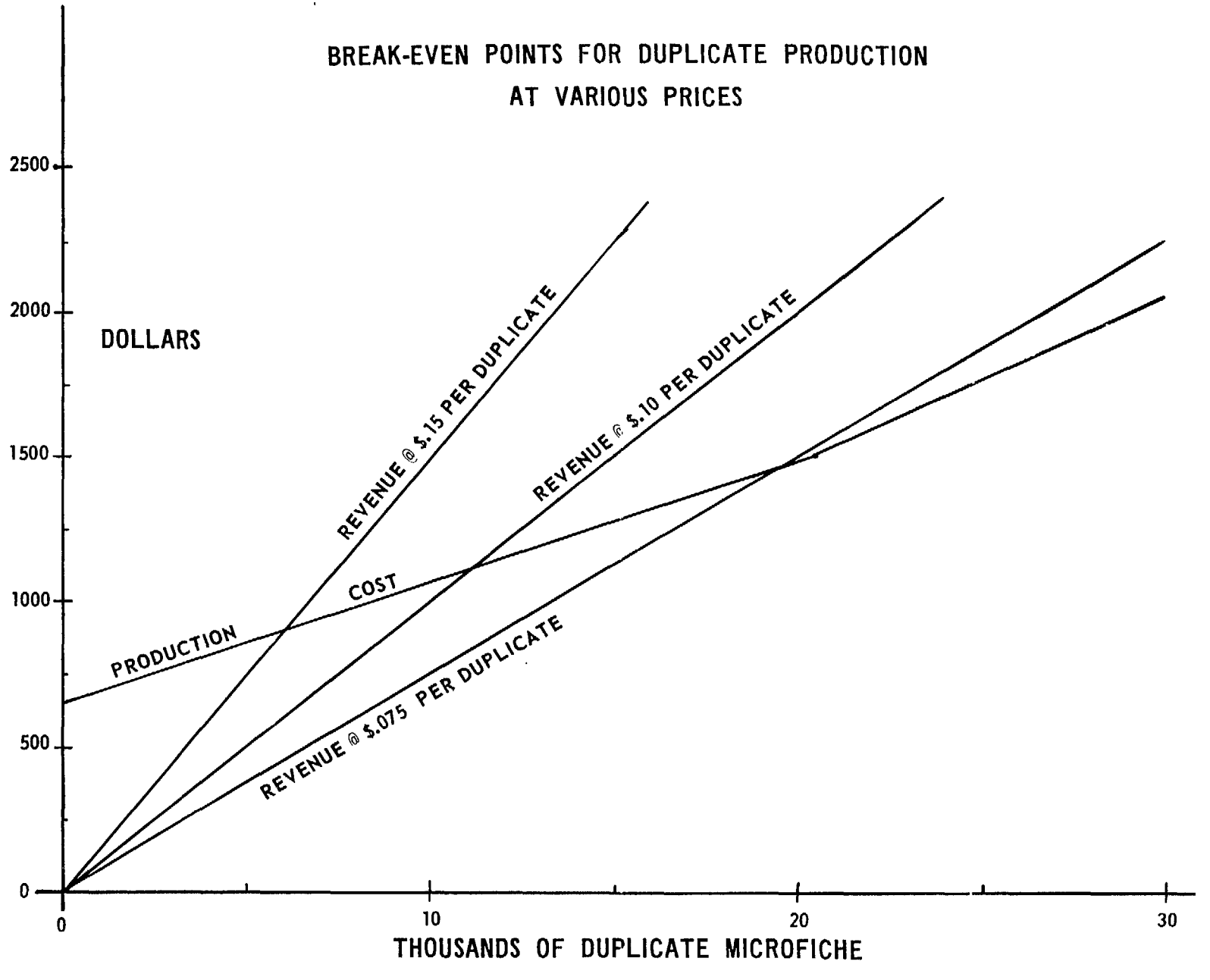
Some potential customers did not use the center because its prices were higher than those charged by local commercial centers. From November 1973 until the middle of 1974, the center's prices were $5.00 per original fiche and $.15 per duplicate. On June 1, 1974, duplicates were reduced to $.075, and on July 1, 1974, originals were reduced to $4.00. With these price changes, a "profit" on the originals had to subsidize a "loss" on the duplicates.

Customers were still not attracted. The Steering Committee urged that the center lower its prices to a more competitive level, and NPPS reduced its prices on May 1, 1975, to $2.50 per original and $.10 per duplicate.

The following break-even charts show the effect of pricing combinations upon break-even volume.

BREAK-EVEN POINTS FOR ORIGINAL FICHE AT VARIOUS PRICES




BREAK-EVEN POINTS FOR DUPLICATE PRODUCTION
AT VARIOUS PRICES
DOLLARS
2500
2000
1500
1000
500
0
REVENUE @ $.15 PER DUPLICATE
REVENUE @ $.10 PER DUPLICATE
REVENUE @ $.075 PER DUPLICATE
COST
PRODUCTION
0
10
20
30
THOUSANDS OF DUPLICATE MICROFICHE

The following table shows the profit or loss for each month of operation.

COM CENTER'S PROFIT (LOSS)

Year	Month	Monthly profit (loss)	Cumulative profit (loss)
1973	November-December	$(2,594)	$(2,594)
1974	January	(864)	(3,458)
	February	(636)	(4,094)
	March	581	(3,513)
	April	1,583	(1,930)
	May	1,679	(251)
	June	1,725	1,474
	July	(2,127)	(653)
	August	1,629	976
	September	46	1,022
	October	663	1,685
	November	690	2,375
	December	3,105	5,480
1975	January	(294)a/	5,186
	February	(2,317)	2,869
	March	(142)	2,727
	April	(1,365)	1,362
	May	(1,417)	(55)
	June	(2,003)	(2,058)

a/The center lost PAMILANT, its largest customer, due to PAMILANT's move to New Orleans during this month.

Other potential customers did not use the center for varied reasons. At least one potential customer would not use the center because it had no minicomputer. If the COM center has a minicomputer, no additional programing is necessary by its customers. A COM unit with a minicomputer will accept a print tape and do the necessary reformatting to create fiche or roll film. Without a minicomputer the print tape must be rewritten to a COM tape using a utility program. (Users' experiences with utility programs for converting print tapes are discussed in chapter 4.) One activity was not willing to invest the time to prepare a utility program after it learned it could use another center which had a minicomputer.

Another reason for the low volume is the lack of intensive publicity of the COM center and its services. Compare, for example, the resources dedicated to such by NPPSO and those by a commercial service bureau in New York. Three of NPPSO's managers with no ADP expertise spent a total of about 10 days a month "boosting" COM. The commercial bureau had five full-time staff devoted to discussing applications with potential customers and helping them recognize opportunities and solve problems.

Miscellaneous sites' internal problems, unrelated to NPPSO policies, also prevented COM exploitation. These individual problems included conversion to a new computer system, problems getting microfiche readers, and a tape compatibility problem.

CHAPTER 4

USING COMPUTER OUTPUT MICROFILM

From a Government-wide point of view, the most efficient and economical way for an agency to obtain COM services is to use COM equipment already owned by the Government. Where such equipment is not available, COM services can be obtained by

--the agency sharing another agency's capability,

--GSA establishing a COM service center,

--GSA contracting for such services for all Federal agencies in the area,

--the agency contracting for its own needs, or

--the agency obtaining its own in-house COM capability.

Each of these alternatives may be applicable and be the most beneficial to the Government depending on the circumstances and location of the agency. The decision should be made after considering several factors, including

--volume of output,

--use made of the output,

--distribution,

--the size of the Federal community in the area,

--the availability of commercial COM services,

--turnaround time requirements,

--nature of the output (i.e., alpha-numeric, graphic, or both), and

--security requirements.

FACTORS INFLUENCING AN AGENCY'S DECISION TO USE COM

Large volume reports on multiple-part paper requiring no annotations are generally the best candidates for conversion to COM. Determining which reports should be converted to COM requires a cost comparison of producing the report

on paper versus film as well as interviewing users of the reports, to determine what is done with the report, whether it is feasible for conversion, and whether productivity savings can result from use of film and/or reformating the report.

In addition to analyses of specific reports' applicability to COM, there are several factors which may cause concern in an agency considering conversion, such as readers, time to reformat print tapes, turnaround time at service centers, and user acceptance. Some experiences of center customers in these areas may be useful to activities considering conversion.

Readers

Since viewing devices are necessary in any COM system, an adequate number of good quality readers must be obtained. Many types of readers are available from the Defense Supply Agency and GSA. The National Microfilm Association (NMA) publishes a booklet "How to Select a Microfilm Reader--or Reader-Printer" which outlines considerations necessary in selecting readers. The price of a reader ranges from $32 to $4325.

Use made of reports should be carefully studied to determine the number, type, and accessibility requirements for readers. The number and type of readers needed for specific applications will vary considerably. Normally, the great majority of readers will be low-cost read-only readers. Reader printers, which allow a hard copy to be made instantly from the microfiche being read, should be tightly controlled by management. A suggested initial distribution of reader-printers would be one equivalent to the distribution of self-service copying machines. For example, users of a 15,000-page report at 1 activity required only 1 reader and 1 reader-printer. At another activity, users of a 270-page report needed 3 readers.

Funding readers is a one-time expense which some activities may consider a formidable problem. However, at one activity having difficulty funding readers, CAC noted that annual savings from paper costs were more than sufficient to purchase the needed quantity of readers. The 20 reports considered feasible for conversion would save the agency about $41,340 in paper costs, whereas the 45 readers needed would only cost $5,580, resulting in a net savings during the year of conversion of $35,760.

Time to rewrite print tapes

All customers used interface programs which read the print tape and write a new tape acceptable to the COM unit.

These programs may be obtained from vendors of microfilm equipment or may be written locally. Only minor modifications were made to the vendor-supplied software used by test center customers. Customers using locally written programs also encountered no significant software problems.

One activity hesitated to become a test center customer because of the necessity to rewrite print tapes into a form acceptable to the COM unit. However, none of the customers of the center had any serious problems doing so. The table below describes each present customer's data processing department.

Installation	Make(s) and model(s) of computer	Installation "size" (programmers employed)	Major language used
NSC	Burroughs 3700	40	COBOL
NRFC	IBM 360/30	4	COBOL
FCDSSA, Dam Neck	AN/UYK-7 a/ CDC 8090 UNIVAC 9300	400	CMS b/ CMS b/ COBOL
TAC, Langley AFB	IMB 360/40 Honeywell 6000 Burroughs 3500	175	COBOL
NNSY	Honeywell 6060	14	COBOL
PAMILANT	IBM 360/30	Unknown	COBOL

a/Custom-built computer.

b/Custom-built compiler language for tactical applications.

The time necessary to convert the first application to COM ranged from 2-to-4 months, although no customer did so on a "crash" basis. Succeeding applications were converted in only 1-to-2 weeks because the first applications absorbed the learning overhead.

Turnaround provided by the center

Potential test center customers were often concerned with the turnaround that the center could provide. Fears were abated after installations became customers of the center.

Only one customer was dissatisfied with the turnaround provided. However, this resulted from that activity's own pickup and delivery procedures, not from center shortcomings.

Converting longer reports to COM produces greater decreases in turnaround because more printing time is eliminated. NNSY, the center's largest customer in 1975, is located 13 miles from the test center, and they usually have their completed microfiche returned by 9:00 a.m. the same day that the tapes are sent to the COM center at 6:00 a.m. The overall decrease in turnaround for their reports was 23 percent; however, the turnaround for their two largest reports decreased by 60 and 52 percent. These two reports are provided to the users one day earlier than they were when they were printed.

All other customers of the center were satisfied with the turnaround that they received.

User acceptance

Installations considering COM sometimes fear that it will not be accepted by their users. Norfolk users generally accepted microfilm; however, there are factors which influence the degree of its acceptance such as report use, report size, access to readers and reader-printers, the user's age, amount and type of orientation, and supervisor's attitude. Many of these variables are controllable by managers and should be considered when introducing COM.

People favor producing quick-reference reports on COM. Reports which must be analyzed for long periods or copied by the users are not as readily accepted because of difficulty using viewing screens for these purposes. These problems are overcome when reader-printers are provided.

The report's size also influences its acceptance on COM. Users prefer the conversion of larger volume reports to COM because they realize more significant space savings and handling advantages thus.

Some reports on paper are divided with sections being sent to various users. These reports tend to be rejected for COM unless each user continues to receive his own copy and has convenient access to a reader. If this is not provided, conversion to microfilm may actually increase the time necessary to retrieve information from the reports.

User employees complained that poor quality readers and microfilm output had impaired COM's acceptance. The desirability of COM is also reduced when viewing equipment is scarce because users object to walking long distances or waiting to use a viewer. This will also prevent the reduced retrieval time that should result from the use of microfilm.

Experience with microfilm often affects its acceptability. Frequent users of a report produced on COM will become more adept in using it and recognize its advantages sooner than infrequent users.

The user's age is another factor influencing whether the person accepts COM. Older people are more reluctant to change and sometimes object to replacing paper with microfilm. People wearing bifocals find it difficult to read COM because their glasses are not designed for reading material at eye-level from a reader screen. Lap readers or other readers which provide a more horizontal reading position should enhance acceptance of COM among these users.

COM is more apt to be accepted if its advantages are explained to the users before reports are converted. Users stated that supervisors' attitudes influence whether COM is accepted or rejected by subordinates. Favorable supervisor attitudes produce acceptance; unfavorable supervisor attitudes tend to increase the possibility of rejection.

In summary, several factors affect users' reaction to COM and should be considered by management. Applications most likely to be readily accepted should be converted first. These will usually be those of most benefit to the users, such as voluminous reports used for quick reference. Users who are more apt to realize the advantages of COM should get it first. When they express a preference for COM, others will be influenced to accept it. Using COM should be made as convenient as possible. Adequate numbers of good quality readers are necessary, and reader-printers may be needed in some cases. Users wearing bifocals will prefer viewers with a more horizontal reading position. Supervisors should display favorable attitudes about COM, and its advantages should be explained to the users. Although the reaction to COM will vary, acceptance will increase as time passes after the initial conversion.

CRITERIA FOR SELECTING SOURCE FOR COM

An agency considering the acquisition of COM services has several options: (1) it can obtain COM from another government agency, (2) it can use a Federal COM service center, (3) it can obtain COM through GSA area-wide contracts, (4) it can buy the service from a commercial source, or (5) it can get its own in-house capability. The choice will depend ultimately on cost and effectiveness considerations which are unique to that agency. However, some general guidelines can be discussed.

Conditions favoring sharing with another Government agency, using a Federal COM service center, or buying from a commercial source

The most economical way COM services can be obtained is from another Government agency that already has the capability or from a Government-operated service center. There are instances where this method may not be feasible, but experience has shown that where sharing occurs, the cost of the service is minimized to the Government.

Assuming an agency in the area has COM equipment, sharing should be the alternative selected unless one of the following circumstances exists:

--Complicated security requirements.

--Restrictive turnaround requirements.

--Volume cannot be handled by the available agency's COM equipment.

Federal Property Management Regulations (FPMR), Subpart 101-32.2, requires agencies to give first consideration to obtaining the service from existing Government sources. If such is not available, the next alternative which should be considered is a commercial service bureau. OMB Circular A-76 requires that new products or services estimated to cost less than $50,000 annually be procured from commercial sources. If the estimated cost exceeds $50,000, a cost comparision should be made, and if the comparison does not show at least a 10 percent savings for a Government operation, commercial sources should be used. But neither the $50,000 limit nor the cost comparison is necessary if the agency is considering the use of an existing Federal resource.

Acquiring initial COM needs through sharing other agencies' equipment or from commercial sources may prove advantageous for a number of reasons:

1. If an agency has a low volume of COM applications, it is often impractical to obtain in-house COM capability. However, postponing the decision to convert until there is sufficient volume will mean foregoing economies and experience.

2. Minimal investment is required for the new user to become familiar with microfilm. Sometimes systems are changed suddenly without adequate training of employees. Often, the immediate results are chaotic. Although the

new system is eventually debugged, it is at considerable cost to that agency. A gradual transition with sufficient indoctrination and training usually reduces this trauma and yields a much more successful conversion.

3. The agency can take advantage of COM expertise at minimal cost. At times, especially in an agency's initial steps towards COM, the services of a consultant are essential. These can, however, be acquired at less cost by obtaining necessary COM services through Government activities and commercial sources. Often, COM service centers are willing to provide analysis of data systems and suggest solutions to prospective users.

4. The frantic search for more applications to get "maximum equipment utilization" will not be necessary.

5. The agency can systematically plan its COM use without being forced into a "crash" program to meet a conversion deadline, as it might if it acquired its own equipment.

6. Monthly cost to produce microfilm at a service center can be predicted accurately. The user needs only to know the production volume in order to predict the total cost of using a service center. If reruns are needed because of production problems, the COM service center absorbs their cost.

The extent to which other agencies with COM equipment and commercial COM services are available in the area will, naturally, have a significant impact on the agency's consideration of these sources. Agencies located in areas such as Washington, D.C., and New York City, where both commercial and Government COM centers are available, have the best choice of alternatives. In areas where COM services are unavailable or only marginally available, consideration should be given to the turnaround time requirement if the proposed COM supplier is not in the immediate area. (Distance does not affect the time to input COM jobs in a remote terminal environment, but the COM output must return by mail or messenger.)

The decision to go outside the agency for COM services may hinge on the security requirements of the data being processed. While COM recorders can be made secure and COM service bureau employees can be cleared to handle classified data, this often proves to be unworkable. For example,

some commercial sources, unless they are heavily dependent on Government work, are reluctant to incur the expense and trouble of maintaining a secure environment.

In geographical areas with concentrations of Federal ADP activities but no COM equipment available for sharing, GSA can establish a Government service center or negotiate a contract to buy commercial services. GSA negotiating a contract for all Federal agencies would probably result in lower prices than each agency negotiating its own since volume would be higher and many commercial centers set rates based on volume.

Conditions which favor acquiring own COM capabililty

Although COM services may be available locally through commercial outlets or from a Government source, some agencies may find that because of their special circumstances, it is impractical to obtain COM services other than through in-house capability. Conditions favoring the establishment of in-house COM capability include

--large volume,

--stringent turnaround requirements,

--severe security restrictions,

--remoteness of location, and

--the potential for acting as a Federal COM service center.

As mentioned earlier, OMB Circular A-76 sets forth requirements for cost comparisons when commercial services are available and activities are considering in-house equipment. Although large volumes will not necessarily point to in-house capability as the most cost-effective alternative--the DSA MINICATS program is a good example of this--generally, large volumes will favor acquiring in-house capability. Specific guidance on number of pages of COM applications at which agencies should consider an in-house operation cannot be given because the decision will depend on costs of equipment needed as well as prices charged by service bureaus. The figures vary considerably, and each agency should do its own comparative analysis, being sure to include sufficient amounts for equipment and personnel to provide adequate service.

While volume is a significant factor in deciding between in-house and shared service, it has less importance in deciding between sharing other Government agencies' equipment and commercial services. As long as security and turnaround requirements can be met by the existing Government equipment, it is beneficial to the Government to share. Factors governing ability to meet turnaround requirements are distance between COM equipment and the user and volume.

Severe security requirements which cannot be met by another Government or commercial activity may also necessitate establishing in-house capability.

Guidance to agencies who have decided to establish in-house equipment is included in chapter 5.

CONCLUSIONS ON USING COM

Operation of the test center shows that conversion to COM can be cost effective. It is the committee's opinion that determining which reports should be converted to COM requires a cost comparison of producing the report on paper versus film and an analysis of the report's application. Such an analysis should include interviewing users of the reports to determine what is done with the report, whether it is feasible for conversion, and whether productivity savings can result from use of film and/or reformating the report.

Managers should give attention to variables which affect the degree of users' acceptance of COM such as convenient access to good quality readers, amount and type of orientation, and supervisors' attitudes about COM.

The committee believes that if Government facilities exist they should be the alternative selected unless one of the following circumstances exists

--complicated security requirements,

--restrictive turnaround requirements, and

--volume which cannot be handled by the available agency's COM equipment.

If the agency cannot use existing Government equipment, either another agency's or a local Government-operated service bureau, the next alternative which should be considered is a GSA area-wide contract, then a commercial service center.

Acquiring COM through sharing or service centers offers several advantages including

1. allowing agencies to realize savings with a very small volume of applications,

2. limiting agency investment,

3. enabling agencies to take advantages of others' expertise,

4. allowing debugging of applications before investing in equipment,

5. eliminating often-frantic searches for applications to build "utilization" of equipment, and

6. allowing accurate prediction of costs.

CHAPTER 5

GUIDANCE TO ACTIVITIES CONSIDERING ESTABLISHING COM CAPABILITY

The NPPSO experience with the test COM Service Center has provided an opportunity to gather information useful to GSA in establishing COM service centers or to other agencies who have determined that in-house COM is the appropriate method. Several decisions must then be made for which we offer guidance: services to be offered, equipment selection, personnel, pricing, advertising, security, scheduling, and internal information systems.

SERVICES TO BE OFFERED

A survey of potential users' needs is the first step to determine the services which should be offered. Services which could be offered are

--roll film, 16mm at 24:1,
--microfiche at 24:1 or 48:1,
--duplicating,
--graphics,
--ADP expertise to assist customers,
--tape conversion at the center, and
--pickup and delivery.

A full range of services needed by potential customers should be weighed against the cost of providing the service and expected long-run revenues.

A standard on microfilm formats to be used by Federal agencies is being developed by a task group of the NBS. A copy of their draft standard is included as appendix I. The NBS standard will affect the type of film formats used by Federal agencies and simplify the decision on which formats a service bureau should offer.

Duplicating the original microfiche is a necessary service which must be provided by the center unless a convenient source for duplication is available. Duplicating will be discussed in more detail as part of "Equipment Selection."

Some COM recorders can generate graphic images on the microfilm. Bar graphs, sales charts, and cost/performance scheduling are the most common business applications of

graphics. Although data in graphics form may be very useful to managers, there are some disadvantages. The programing required for graphics is more complicated than for alphanumerics, and generally requires more expensive COM recorders as well as special software.

Although none of the customers of the NPPSO Service Center required special indexing of the fiche for automatic retrieval devices, it is likely that a large bureau would have to provide ADP expertise to assist customers in such programing.

To assist potential customers in converting applications to COM, a center needs either a minicomputer or ADP personnel. If a minicomputer is used, the customers need only send their print tapes to the center; the minicomputer reformats the print tape to the COM recorder format. Without a minicomputer, each activity must use a program to rewrite its print tapes. Programs can be written in-house or obtained from COM manufacturers and modified. (Users' experience with software is included in chapter 4.)

A minicomputer increases the price of the COM unit by about $20,000. Because of the cost, NPPSO did not buy this option, nor did it have local ADP expertise. However, a 2-day training session was sponsored by NPPSO and the Steering Committee for all activities in the area. Participants in the workshop were told generally what was necessary to rewrite print tapes. After the workshop, customers had to rely on the manufacturer's representative or the NPPS personnel in Washington for assistance.

If the service center had had a minicomputer, neither the workshop nor use of the personnel in Washington would have been necessary. The director of the service center said that if he were to start over he would select a COM unit with a minicomputer.

In an environment where the users are not communicating with the center by remote terminal, pickup and delivery service can be either offered by the service center, provided by commercial messenger service when one exists, or handled by the individual activity. It may be cheaper to the customer for the center to provide the service, depending on times when tapes must be picked up and when the film is needed as well as the proximity and numbers of customers.

NPPSC provided only one customer with pickup and delivery service. Our analysis of the time and cost for each customer to pick up the tapes and deliver the microfilm showed that it would have been cheaper to have the center provide the service. The following table shows the details of the analysis. It should be noted that activities did not always want the service because they would have had to spend budgeted funds for it; however, if they used their own salaried employees, there was no additional expense. Also, if the center provides the service at a specified hour each day, some activities may not get the turnaround required.

Cost for Present Pickup and Delivery

Location	Round-trip mileage	Mileage cost	Tolls	Labor	Total cost
NNSY	26	$3.90	$ .60	$6.90	$11.60
FCDSSA	62	9.30	.50	8.60	18.40
TAC:					
Langley AFB 9th Tactical Intelligence Squadron	40	6.00	2.50	6.74	15.24
	38	5.70	2.50	6.59	14.79
NRFC	2	.30	- 0 -	.48	.78
Total					$60.81

Cost for Center to Pickup and Deliver

Route	Round-trip mileage	Mileage cost	Tolls	Labor	Total cost
Center to NNSY to Dam Neck to NRFC and return	70	$10.50	$1.30	$8.02	$19.82
Center to Langley AFB via 9th Intelligence and return	40	6.00	2.50	4.42	12.92
Total					$32.74

This analysis assumes that each customer will bring its tapes to the center and leave them for processing; therefore, labor cost does not include waiting for the microfiche. The analysis also assumes that each customer would be contacted during

the center's pickup and delivery, whereas in reality there would be times when some activities had no tapes.

EQUIPMENT SELECTION

Part of the decision on equipment is made by deciding which services to offer. For example, if both 16mm roll film and microfiche are to be offered at 24x and 48x, only those machines with those capabilitites could be considered. Of course, price and quality of film produced will be considerations in the unit selected as well as availability of local maintenance. Other determinations are whether the COM unit will be located in a photographic environment or an ADP environment.

A wide variety of COM units are available from many manufacturers. The NMA publishes a book, Guide to Microreproduction Equipment, detailing characteristics and costs of equipment. Some COM units develop the microfilm with heat and, therefore, require no special plumbing. Other units develop the film with chemicals, but these chemicals are in self-contained units which are replaced periodically and, consequently, do not require plumbing. Some units produce film which must be developed through chemical processing requiring plumbing, which is sometimes objectionable in an ADP environment. If the COM unit is located in a photographic environment, the plumbing will probably not be objectionable but the facility may need to be modified for temperature controls necessary for ADP equipment.

Duplicating equipment will probably be necessary. The type of duplicator used will depend on the type film used. A variety of equipment is available. NMA's book mentioned above describes capabilities and costs of available duplicators.

For most of the test period, the NPPSO COM center used the equipment described below:

Unit	Monthly rental
Stromberg-Datagraphix Model 4360 COM unit	$1,398.00a/
Kodak Versamat processor	341.92
Bruning Op 40/80 duplicator	650.00b/

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a/This price includes the first 175,000 frames produced each month. Additional frames cost $.00656 each.

b/This price includes the first 20,000 copies made each month. The next 20,000 copies cost $.015 each; the next 20,000 copies cost $.009 each; and the next 20,000 cost $.005 each.

Pictures of the COM recorder and duplicator are on pages 36 and 37, respectively.

NPPSO converted a storage area into its COM room. Since the Datagraphix COM unit does not develop the film by heat process, environmental controls and plumbing had to be installed to process the film. NPPSO painted the walls with epoxy paint to help cut down on dust, tiled the floor, and insulated and air-conditioned the room. They also installed appropriate plumbing and changed the wiring to 220 volts. The total cost of the renovation was $7,493.

Various types of contracts are available for leasing COM equipment. NPPSO had a choice between 1-year lease limited (the one chosen), 1-year lease unlimited, 5-year lease, or purchase. Breakeven analyses for each type of contract on the COM recorder are presented in Appendix II. Decisions on the type of contract should be made based on the projected volume of production and cost. Similar analyses should be made for other COM equipment such as the processor and duplicator. Comparative costs for the Datagraphix COM recorder under various financing agreements are shown below.

Datagraphix COM Recorder Model 4360	Cost
Purchase	$75,000 a/
5-year lease	2,376 per month
1-year lease, unlimited use	3,390 per month
1-year lease, limited use	1,398 per month b/

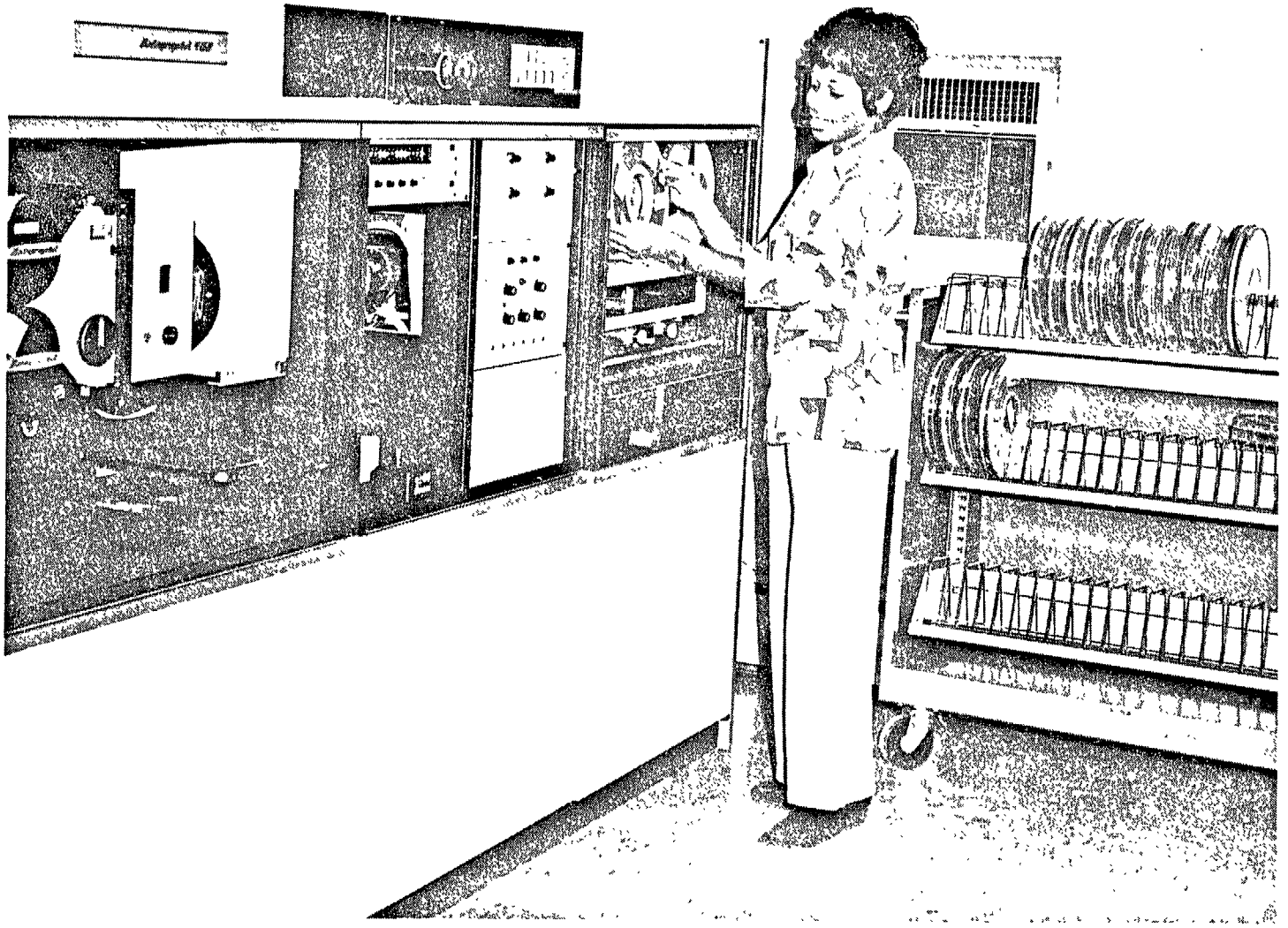
a/Monthly maintenance if purchased is $819 per month.

b/The center was charged $.00656 for each frame produced over 175,000 frames each month.

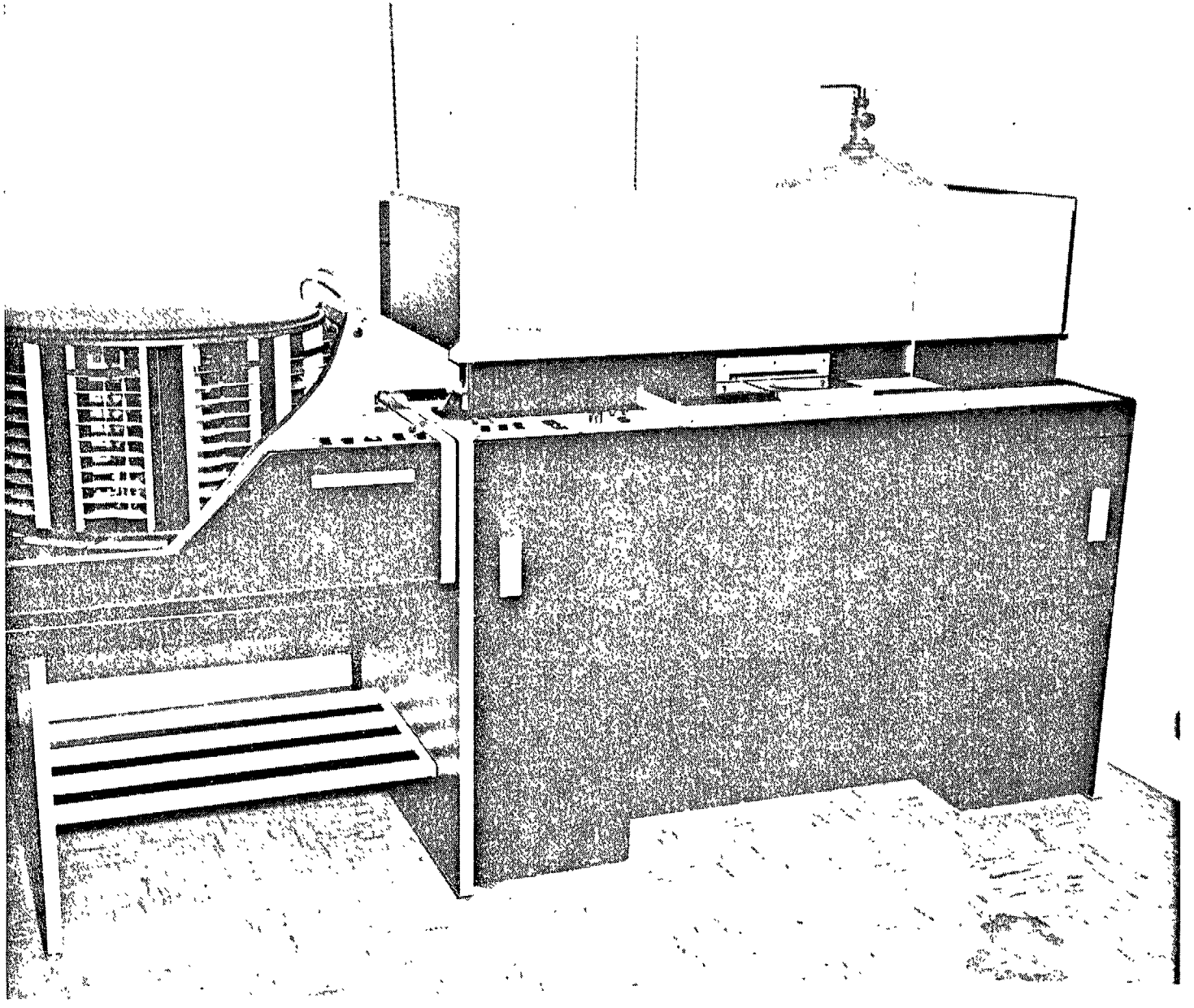
PERSONNEL

Personnel needed to staff the COM center will depend on the services to be offered as well as equipment selected. Qualifications needed in the equipment operator will depend on the type equipment selected. If the COM unit has a self-contained developer, ADP personnel can operate the equipment. If the COM unit has no minicomputer and produces undeveloped film, personnel familiar with film technology will be needed. However, if the machine has both a minicomputer and produces undeveloped film, the operator will need some training in both film technology and computer operations.

Besides the equipment operator, the center needs someone knowledgeable in what COM can do to contact potential users and help them identify good applications.



The NPPSO COM Center



The NPPSO microfiche duplicator

If the center has no minicomputer, it would be advisable to provide EDP expertise at the center to assist users with problems.

PRICING

The pricing policy should be to recover costs of operating over an extended period. Initially, this will require a projection of expected volume based on potential. The short-range objective should be to attract customers, the long-range objective to recover costs.

NPPS establishes prices for its services on a world-wide basis. For this reason, the NPPSO COM center initially charged $5.00 for each original and $.15 for each duplicate. These prices were also felt to be necessary to recover costs on the very limited production of its first few customers. It reduced its prices to $4.00 and $.075, respectively, for originals and duplicates as it built its volume. At those prices, however, they were overcharging for originals and undercharging for duplicates. On May 1, 1975, prices were changed to $2.50 an original and $.10 a duplicate.

INFORMING POTENTIAL USERS

People have a natural tendency to resist change, and many good COM applications are overlooked because of ignorance of the technology. Announcing the COM service with printed material and, even better, through personal contact and demonstration of advantages can overcome these problems. It is important that any service bureau devote the resources necessary to help potential customers recognize opportunities for economies through COM and to help them solve problems related to the coversion.

NPPSO personnel spent approximately 80 hours total per month contacting potential and active customers of the center to discuss progress and problems. In addition, about 400 brochures (copy included in appendix III) were distributed to activities in the area. The director of NPPSO also spoke to the Norfolk Naval Base Area Coordination Council about the advantages of COM and urged command attention to conversions.

Even so, the effort directed to promoting COM was substantially less than that of the commercial service bureau visited. The commercial center had five full-time people contacting potential customers. Over 50 percent of their

total costs were for labor, the majority of which was for sales and technical representatives to contact and help customers.

SECURITY

If any classified information is to be produced on COM, requirements must be met to safeguard the handling of the data. At a minimum, a safe must be available, additional paperwork is required, and clearances must be obtained. The amount and type of classified data will determine additional costs to handle the data.

The NPPSO COM Service Center handles about 19,900 pages of classified data each month and obtained a security clearance to the level of "top secret" from the Naval Electronics Systems Command (NESC). The clearance cost NESC about $1,500 and consisted of testing electronic transmissions to determine whether emanations outside the secured area can be used to interpret data being processed on the COM recorder.

The cost of the clearances varies considerably with the type of equipment, its environment, and the agency conducting the clearance survey. Approximate costs of other initial expenses were:

Safe and related equipment	$1,033
Security clearances for employees	
Top Secret	675 each
Secret	200 each

Other additional expenses may be door locks, "Keep Out" signs for doors, printed forms to account for receipt and return of classified material, and extra packaging material.

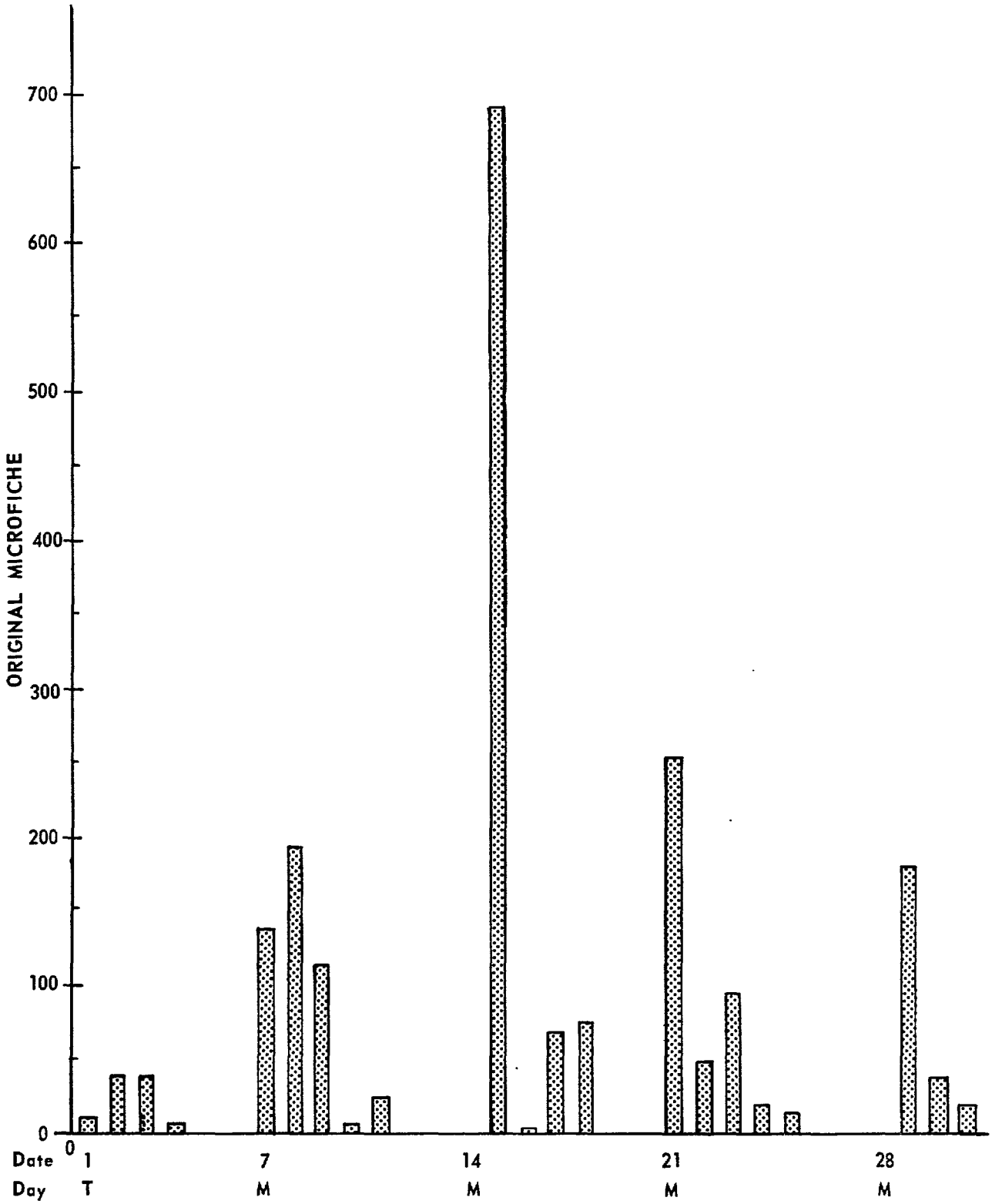
Procedures had to be modified by NPPSO to cover handling classified data, and labor costs increased at NPPSO by 10 percent when handling a classified job.

SCHEDULING

Various schemes exist for establishing priorities for serving customers. The NPPSO COM Service Center processed jobs on a first-come-first-served basis. Because the center was underused, even with one-shift operation, scheduling presented no problems and alternative schemes were not tested. A graph showing the arrivals of jobs during one month follows:

ARRIVAL OF JOBS AT COM CENTER

OCTOBER 1974



In contrast, the NIH operates a large center in Bethesda, Maryland, which serves about 1,000 COM customers. The scheduling system used by NIH is based on the processing time of the job, with the shortest receiving the highest priority.

INTERNAL INFORMATION SYSTEM

Good internal information systems are necessary for a COM center to determine pricing policies, identify inefficiencies in operation, and measure performance. Procedures must be designed to report cost, revenue, and production data in a form useful to managers. A good cost accounting system will provide the basis for computing breakeven points of the center at various prices and volumes of business.

To identify inefficiencies in operation, production records for each job run should show the number of frames produced and labor and materials used. It is important that the center be able to separate testing and waste (for example, bad duplicates and reruns) from production.

Three of the forms developed by NPPSO to monitor its COM center are included in appendix IV. In most respects the data collected is adequate. By analyzing information available from October 1974 to June 1975, we found that the costs and revenues of the NPPSO COM center did not fluctuate in relation to the volume because of four primary variables: (1) amount of testing done at the center for which there is no charge to the customers, but which NPPSO pays for, (2) waste at the center for running bad tapes, (3) lack of accrual accounting for supplies used, and (4) time lag and mistakes in billing from vendors and entry into the computer system. The following table shows the difference in actual production (including waste and tests) and revenue production from October 1974 through June 1975.

Year	Month	Frames produced		Percent
		Actual	Revenue	Revenue of actual
1974	October	449,846	358,647	80
	November	397,484	359,416	90
	December	412,686	390,648	95
1975	January	203,628	174,318	86
	February	234,113	200,706	86
	March	241,586	168,875	70
	April	209,919	191,465	91
	May	261,883	220,252	84
	June	274,231	241,359	88

CONCLUSIONS ON ESTABLISHING COM CAPABILITY

When establishing a COM service bureau or in-house capability, the first decision which needs to be made is services to be offered. A study should be done of user needs, and the results weighed against the cost of the service and expected long-run revenues. Standards prescribed by NBS should be used in selecting film formats to offer.

The following other factors should be considered:

--Equipment selection will be determined by services to be offered, environment of the COM center, cost, and availability of local maintenance.

--Personnel required will be dependent on equipment selected and services offered.

--Pricing strategy should be geared to attract customers and recover costs over the long run.

--Publicity is an important part of attracting customers and can do much to overcome ignorance of the technology and resistance to change.

--Classified data requires safeguards which include additional time of personnel, development of procedures and clearances, and a safe.

--Internal information systems should be adequate to monitor operation, establish pricing policies, and identify inefficiencies.

APPENDIX I

FC 300
TG-18/75-11E
October 21, 1975

D-R-A-F-T

COMPUTER OUTPUT MICROFORM FORMATS AND REDUCTION RATIOS

DRAFT

PREPARED BY: FIPS TG-18

APPENDIX I

FOREWORD

The use of microforms in the recording and dissemination of data and information is widespread in the Federal Government and the volume is steadily increasing, particularly for that information generated by computer. Therefore, the uniformity of Computer Output Microforms is essential in order to enhance the exchange and utilization of recorded information, and to provide compatibility of processing and user equipment. It is also essential that the number of different Computer Output Microform formats and reduction ratios be kept to a minimum in order to reduce the variety of equipment required. The Computer Output Microform Standards Group (TG-18) was formed by the Federal Information Processing Standards Coordinating and Advisory Committee (FIPSCAC) to standardize certain aspects of Computer Output Microforms to meet Federal agency needs. This standard has been developed and issued for this purpose.

APPENDIX I

DRAFT

Federal Information
Processing Standards Publication __
1975

Announcing the Standard For
Computer Output Microform Formats
and Reduction Ratios

Federal Information Processing Standards Publications are issued by the National Bureau of Standards pursuant to the Federal Property and Administrative Services Act of 1949 as amended, Public Law 89-306 (79 Stat. 1127), Executive Order 11717 (38 FR 12315, dated May 11, 1973), and Part 6 of Title 15 CFR (Code of Federal Regulations).

Name of Standard. Computer Output Microform Formats and Reduction Ratios.

Category of Standard. Hardware Standard, Media.

Explanation. This standard specifies the image arrangement, size and reduction ratios to be generated by Computer Output Microfilmers (COM).

Approving Authority. Secretary of Commerce.

Maintenance Agency. Department of Commerce, National Bureau of Standards (Institute for Computer Sciences and Technology).

Applicability. This standard is applicable to all computer output microfilm systems generating information for conversion to microforms using business-oriented fonts.

New COM Systems and Applications. The microform formats and associated reduction ratios specified herein are the only formats and reduction ratios authorized for use within the Federal Government and are mandatory for all new COM systems and applications.

Existing COM Systems and Applications. Users of existing COM systems and applications are encouraged to comply with this standard. Systems and applications not in accordance with this standard shall be evaluated periodically by heads of departments or agencies and the merits of converting to the standard weighed.

Specification. Federal Information Processing Standard __, Computer Output Microform Formats and Reduction Ratios (affixed).

Implementation Schedule. All microforms produced by or for Federal agencies and equipment or services acquired after the date of this FIPS PUB must be in conformance with the specifications contained herein. Exceptions to this standard are made in the following cases:

a. For microforms, equipment, or services produced, procured, or on order, prior to the date of this FIPS PUB.

b. Where procurement actions are into the solicitation phase (i.e., Requests for proposals or Invitations for Bids have been issued) on the date of this FIPS PUB.

Waiver Procedure. Heads of agencies may waive the provisions of the implementation schedule. Proposed waivers relating to the production or procurement of non-conforming microforms will be coordinated in advance with the National Bureau of Standards, Washington, D.C. 20234. They should describe the nature of the waiver and set forth the reasons therefore.

Sixty days should be allowed for review and response by the National Bureau of Standards. The waiver is not to be effective until a reply is received from the National Bureau of Standards; however, the final decision for the granting of a waiver is a responsibility of the agency head.

Where to Obtain Copies of the Standard.

a. Copies of this publication are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20420 (SD Catalog Number C13.52:__).

b. Microfiche of this publication is available from the National Technical Information Service, U.S. Department of Commerce, Springfield, Virginia 22151. Refer to Report Number NBS-FIPS-PUB-__ and title.

APPENDIX I

DRAFT

Federal Information
Processing Standard __
1975

Specifications For
Computer Output Microform Formats
and Reduction Ratios

1. Name of Standard. Computer Output Microform Formats and Reduction Ratios.

2. Category of Standard. Hardware Standard, Media.

3. Explanation. This standard specifies the image arrangement, size and reduction ratios to be generated by Computer Output Microfilmers (COM).

4. Specifications. This standard covers microform formats and reduction ratios for Computer Output Microforms (COM) using business-oriented fonts.

4.1. The choice of microform formats and associated reduction ratio(s), from among those specified herein, for use in a particular system or application is not prescribed by this standard. These choices will be based on user needs and developed from other criteria.

4.2. Authorized Formats and Effective Reduction Ratios.

a. 16mm roll film (24:1)

(1) Cine mode (IA)

(2) Comic mode (IB)

b. 105mm X 148mm microfiche

(1) 63 frame (7 rows X 9 columns) 24:1

(2) 98 frame (7 rows X 14 columns) 24:1

(3) 270 frame (15 rows X 18 columns) 48:1

(4) 420 frame (15 rows X 28 columns) 48:1

4.3. REQUIREMENTS.

a. LEGIBILITY. All characters must be recorded so they are readable by the user. This means that the quality of the master recordings must be sufficiently high to allow for the normal image degradation that results when making subsequent generation copies for the end user. Typically, there is about a 10% loss in the ability to duplicate very closely spaced points for each subsequent generation. The images of the smallest characters should measure at least 0.05 mm in height on the original microform. This represents a character height at an effective magnification of 24X of approximately 1.2mm and at 48X of approximately 2.40mm.

b. ROLL FILM. See Formats 1 and 2.

c. MICROFICHE. See Formats 3 through 6.

(1) PAGINATION. Either vertical or horizontal pagination will be used in the creation of microfiche. When the microfiche is oriented so that the designated header area is upright and right reading, the first data frame will be placed in the left most position of the row immediately below the header.

(a) VERTICAL PAGINATION. Frames following the first data frame will appear in sequence from top to bottom through the rows and from left to right through the columns.

(b) HORIZONTAL PAGINATION. Frames following the first data frame will appear in sequence from left to right through the row and from top to bottom through the columns.

(c) IDENTIFICATION. When used, identification of the method of pagination will be through use of an arrow

placed in the header area. Vertical pagination will be designated by an arrow pointed downwards (↓). Horizontal pagination will be designated by an arrow pointing to the right (→).

(2) IDENTIFICATION OF SENSITIZED FILM SIDE.

(a) SILVER ORIGINAL. When the microfiche is held so that the header is upright and right reading, the sensitized (emulsion) side will be away from the observer.

(b) PRE-CUT STOCK OR DUPLICATES. The sensitized side shall be identified by one of the following methods.

1 Method A--When a sheet of raw film or a duplicate microfiche is held with the long sides in a vertical position and either the notch or the corner cut is in the upper right hand corner, the sensitized side will be towards the observer as specified in American National Standard, PH1.10-1969, Designation of Emulsion Side of Photographic Sheet Film.

2 Method B--When a sheet of raw film or a duplicate microfiche is held with the long sides in a horizontal position and the notch is in the lower right corner or the corner cut is in the upper left corner, the sensitized side is towards the observer.

(c) IDENTIFICATION TECHNIQUES.

1 Corner Cutting--To identify the sensitized side of a microfiche, a corner cut may be placed in the upper left corner of the header area when the sensitized side is facing the observer and the header is at the top. The cut shall extend a nominal 6mm along the long dimension (top) and a nominal 5mm along the short dimension (left side) of the microfiche.

2 Notching--In lieu of a corner cut, a notch may be placed along the right short dimension (side) near the bottom, when the sensitized side is facing the observer and the header area is at the top. The notch may be of any shape but shall not penetrate more than 1.6mm inward from the edge.

(3) HEADER AREA. The header area constitutes the top of the microfiche. The minimum area reserved for the header shall be used only for header and identification purposes on all microfiche and shall not be used for microimages. If additional header space is required, the area dedicated to the next entire row or rows of images shall be used. When this option is utilized, row identification shall remain unchanged. All header characters shall be upright and right reading, and at least 2mm in height. All characters shall be readable without magnification. The minimum areas reserved for the header are indicated in the figures for the microfiche formats by shading.

(4) FRAME IDENTIFICATION. When coordinates are used to identify the location of images, alphabetic characters shall be used to identify rows. Starting at the top left corner, under the minimum header area, the first row of microimages shall be A, the next B, the next C, and so on. Columns shall be identified numerically. Starting at the left, the first column shall be 1, the second 2, and so on.

(5) INDEX. If an index to the microfiche is to be provided, the placement of the last microimage of the index shall be in the bottom right corner frame of the grid area.

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(6) TRAILER IDENTIFICATION. When trailer microfiche are used, each microfiche in the set, including the first one, should be sequentially identified. This information shall appear in the right-most portion of the header area.

(7) CUT MARK. A cut mark will be provided for automatic cutting of 105mm roll film into microfiche. This cut mark shall be 3.0mm X 3.0mm square and the center of the square shall be located 32mm $\pm$ 0.2mm along the bottom edge from the reference corner of each microfiche area.

(8) SQUARENESS. Each side of the microfiche shall be perpendicular to the bottom (reference) edge within $\pm$ 0.13mm for each 25mm of height of the microfiche. The total deviation of the side edges from the perpendicular to the bottom (reference edge) shall not cause the length of the top edge of the microfiche to exceed 148mm plus 0.0mm, minus 1.0mm.

(9) EDGE STRAIGHTNESS. Each of the four edges of a microfiche shall be capable of falling between two straight parallel lines 0.25mm apart.

(10) CURL AND BOW. The curl or bow of a sheet of microfiche, when placed convex side down on a flat surface for at least six hours in a 70°F., 50% relative humidity atmosphere, shall have no part of the microfiche more than 6.35mm above the surface. (See ANSI Standard PH1.29-1971, Methods for Determining Curl of Photographic Film.

(11) CORNER ROUNDING. Where corner rounding is employed, the process shall not remove at any corner more than 3mm of either of the two sides which form the corner.

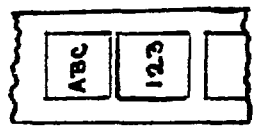
5. DEFINITIONS. Definitions needed for clarification of this standard are given in this section.

Application

Any use of COM that satisfies particular information requirements.

Ciné (motion picture) oriented images (IA orientation)

Jargon used with intent to reference images oriented on microfilm as follows, otherwise known as IA orientation.



Column

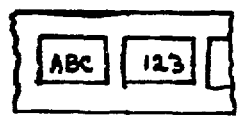
A vertical series of microimages on a microfiche.

COM

Computer Output Microform: Any microform containing images generated by a recorder, and duplicates thereof.

Comic strip oriented images (IB orientation)

Jargon used with intent to reference images oriented on microfilm as follows, otherwise known as IB orientation.



Cut Mark

A mark added to film to permit automatic cutting of microfiche from a roll of film.

Format

A dimensioned layout containing requirements for size, arrangement and orientation of microimages upon a microform.

APPENDIX I

Frame

The total area allocated for exposure, regardless of whether or not this area is filled by the document or data image.

Header

Information, which is readable without magnification, placed at the top of a microfiche.

Microfiche

A sheet of film containing multiple microimages in a grid pattern.

Microfilm

(1) A high resolution film containing an image or images greatly reduced in size from the original.

(2) To record microimages on film.

Microform

A generic term for any form containing microimages.

Microimage

A unit of information, such as a page of text or a drawing, too small to be read without magnification.

Micrographics

The science, art and technology of document and information miniaturization and associated microform systems.

Notch

Used to identify the sensitized side of a piece of photographic film.

Reduction, Effective

A measure of the number of times a given linear dimension of a similar conventional document would be reduced to equal the size of the COM generated microimage.

Row

A horizontal series of microimages on microfiche.

Sensitized Side

The side of the microform coated with a photosensitive material.

Specification

A document which describes the essential and technical requirements for items, materials and services including procedures by which it will be determined that the requirements have been met.

Standard

A document that establishes engineering and technical limitations and applications for items, materials, processes, methods, designs and engineering practices.

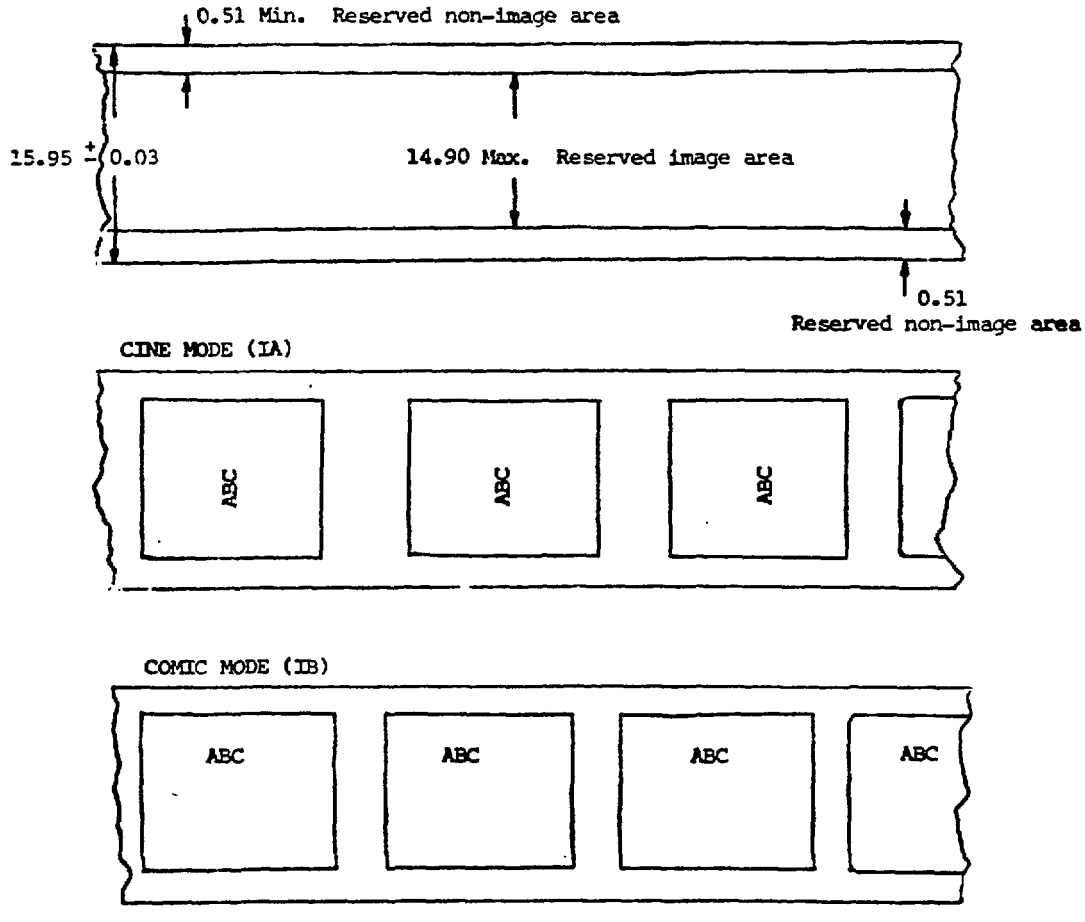
System

(1) All the hardware, software, microforms, etc. employed from production through utilization.

(2) An assembly of elements used to fulfill an application requirement.

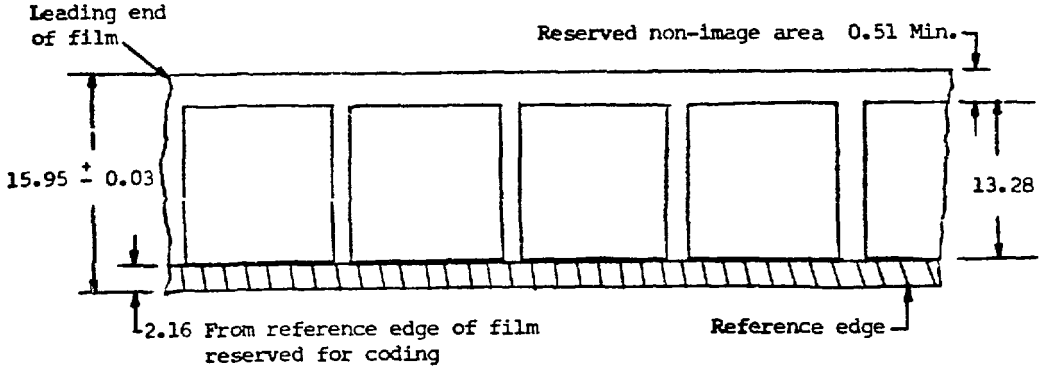
5. DIMENSIONING. The dimensions used in this standard are expressed in the metric system (SI), all dimensions shown being in millimeters. See FIPS Pub 34, ANSI Metric Practice Guide Z210.1 (ASTM E380-72).

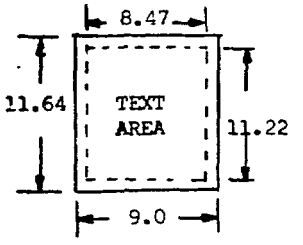
FORMAT 1. 16mm Roll Microfilm 24:1



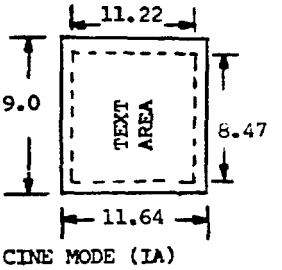
1. Effective reduction 24:1.
2. Dimensions in millimeters.

FORMAT 2. 16mm Roll Microfilm, Document Mark (Blip), 24:1

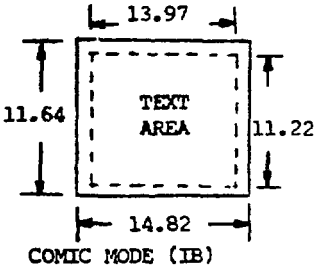




COMIC MODE (IB)
Fig. 1



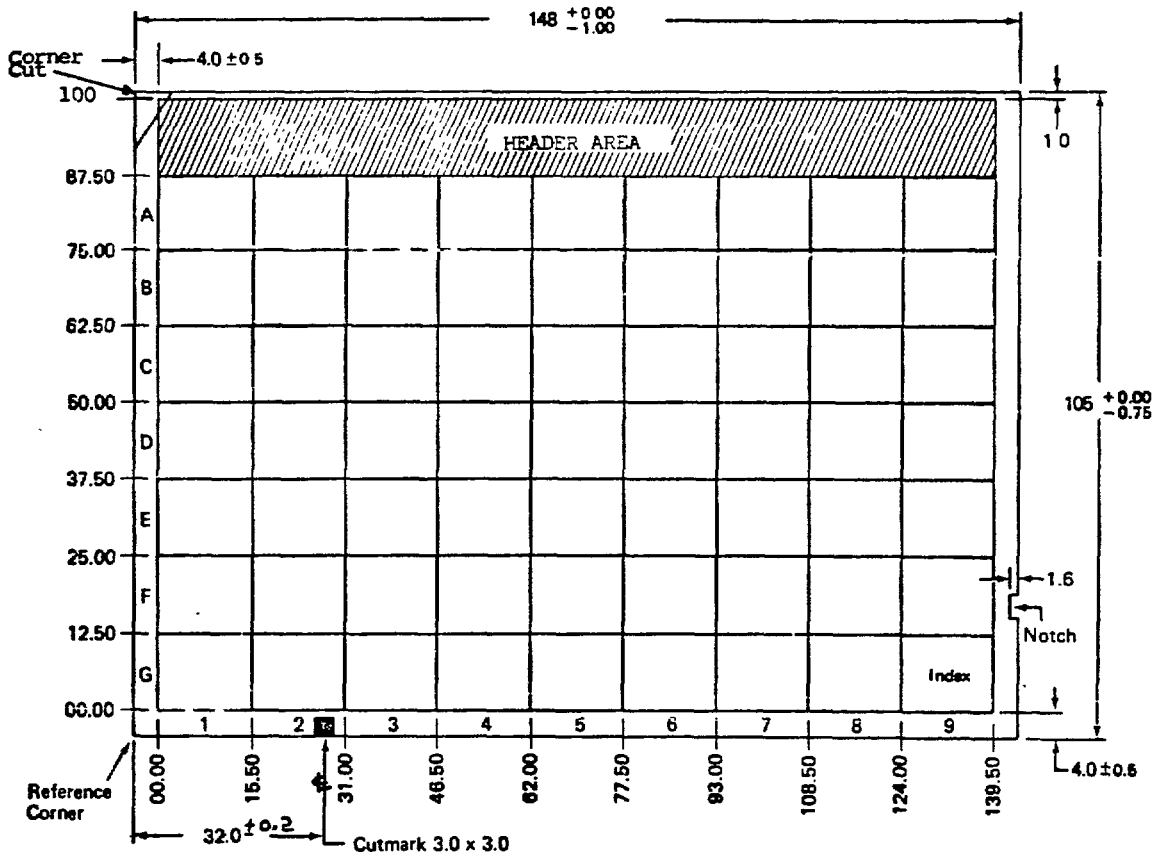
CINE MODE (IA)
Fig. 2



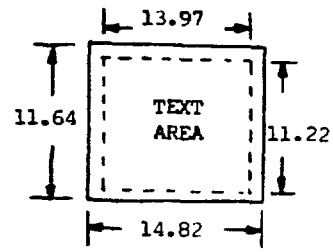
COMIC MODE (IB)
Fig. 3

1. Effective reduction 24:1.
2. Dimensions in millimeters.
3. The text area shown in figure 1 and 2 represents the data placed on a 216.0mm x 279.4mm (8.5 x 11 in) page (typically 64 lines of 80 characters).
4. The text area shown in figure 3 represents the data placed on a 355.6mm x 279.4mm (14 x 11 in) page (typically 64 lines of 132 characters).

FORMAT 3. Microfiche 63 Frame (7 Rows X 9 Columns) 24:1

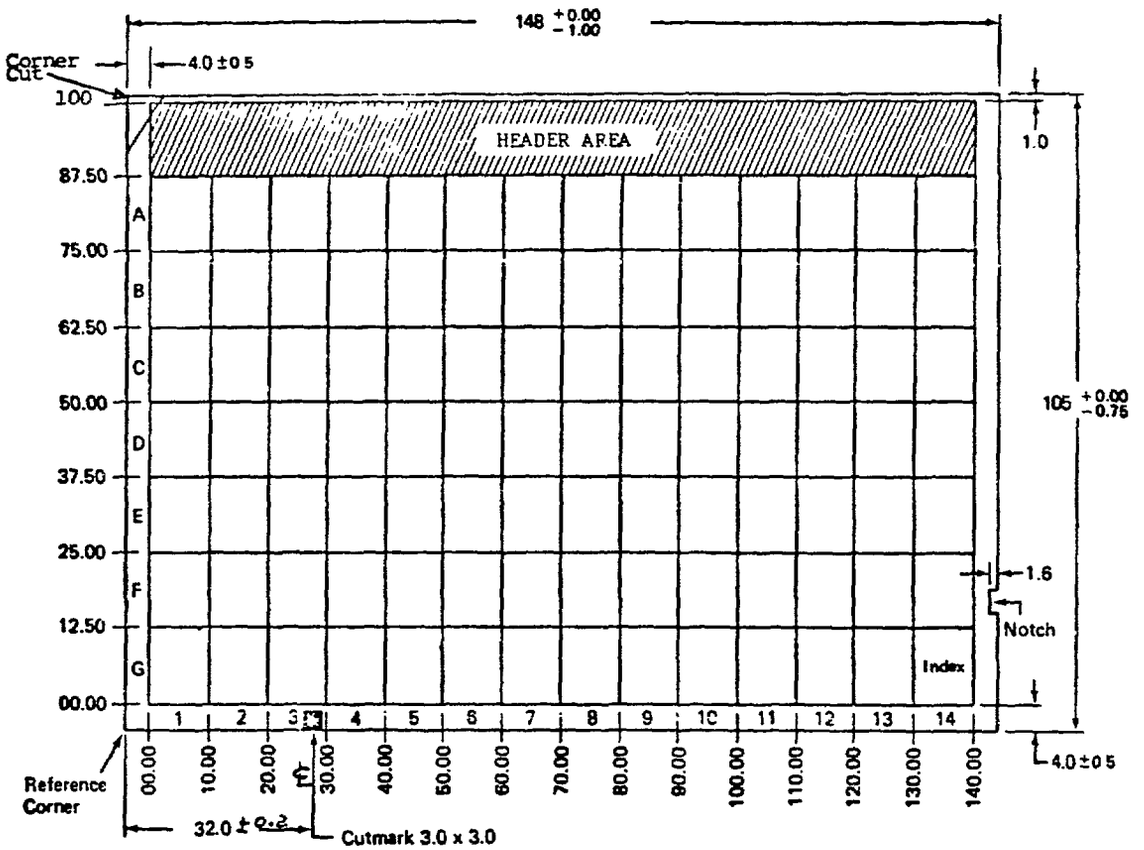


1. Effective Reduction 24X.
2. Dimensions in millimeters.
3. Grid lines shown do not appear on microfiche.
4. With the notch and corner cut in the positions shown on this drawing the sensitized side is facing the observer.

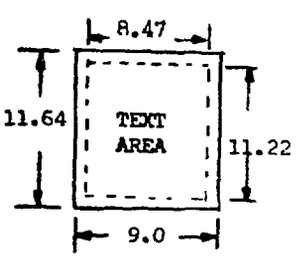


The text area shown represents the data placed on a 355.6mm x 279.4mm (14 x 11 in) page (typically 64 lines of 132 characters).

FORMAT 4. Microfiche 98 Frame (7 Rows X 14 Columns) 24:1



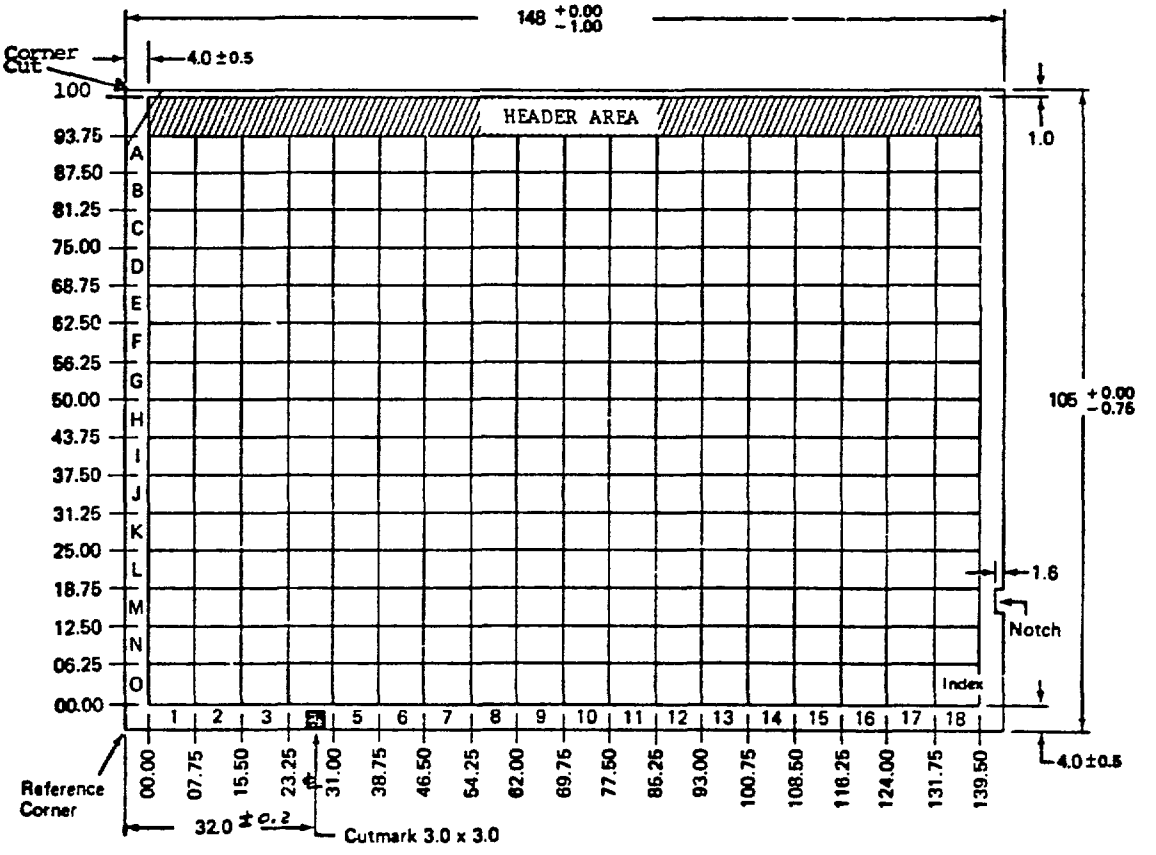
1. Effective Reduction 24X.
2. Dimensions in millimeters.
3. Grid lines shown do not appear on microfiche.
4. With the notch and corner cut in the positions shown on this drawing the sensitized side is facing the observer.



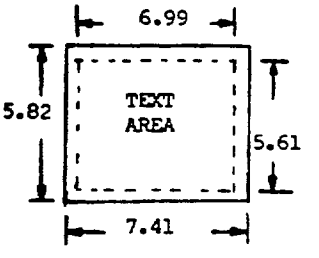
The text area shown represents the data placed on a 216.0mm x 279.4mm (8.5 x 11 in) page (typically 64 lines of 80 characters).

DRAFT

FORMAT 5. Microfiche 270 Frame (15 Rows X 18 Columns) 48:1



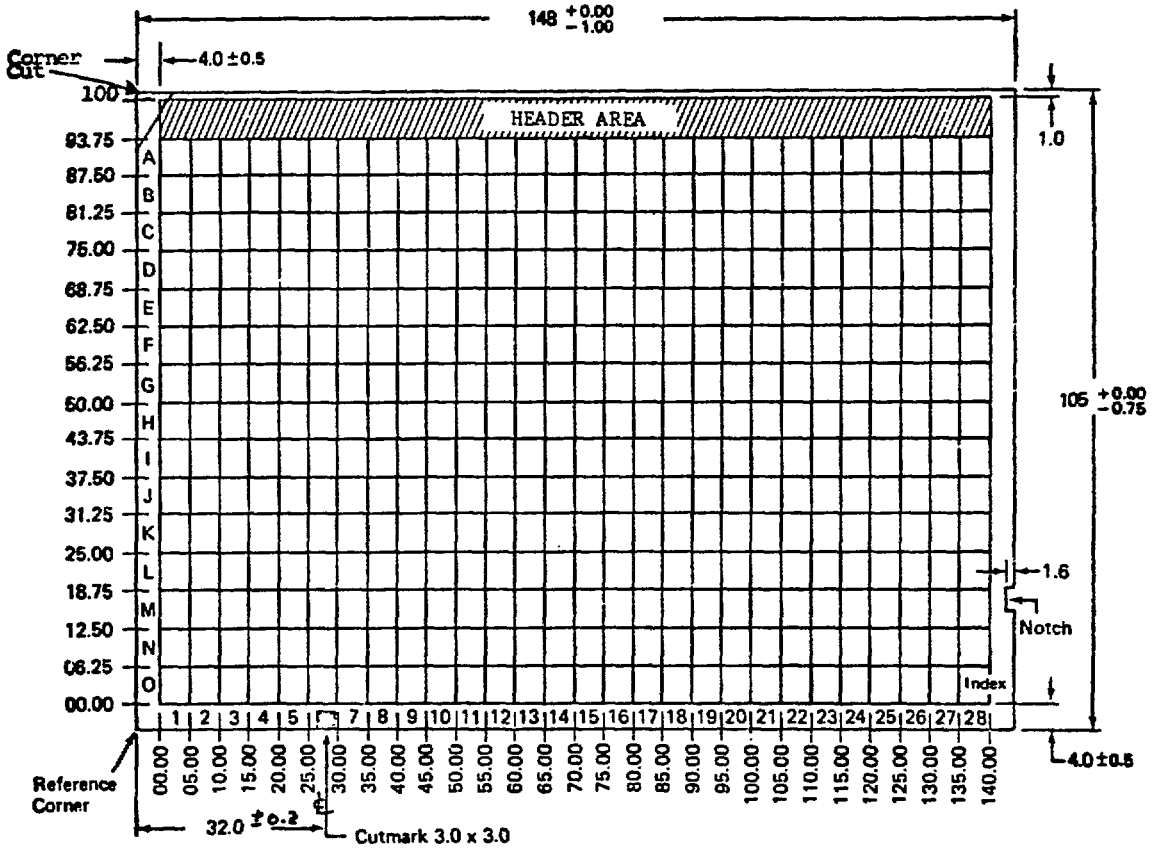
1. Effective Reduction 48X.
2. Dimensions in millimeters.
3. Grid lines shown do not appear on microfiche.
4. With the notch and corner cut in the positions shown on this drawing the sensitized side is facing the observer.



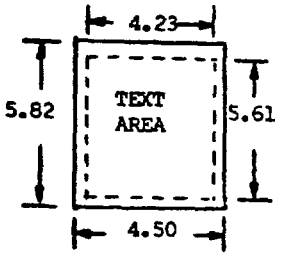
The text area shown represents the data placed on a 355.6mm x 279.4mm (14 x 11 in) page (typically 64 lines of 132 characters).

DRAFT

FORMAT 6. Microfiche 420 Frame (15 Rows X 28 Columns) 48:1



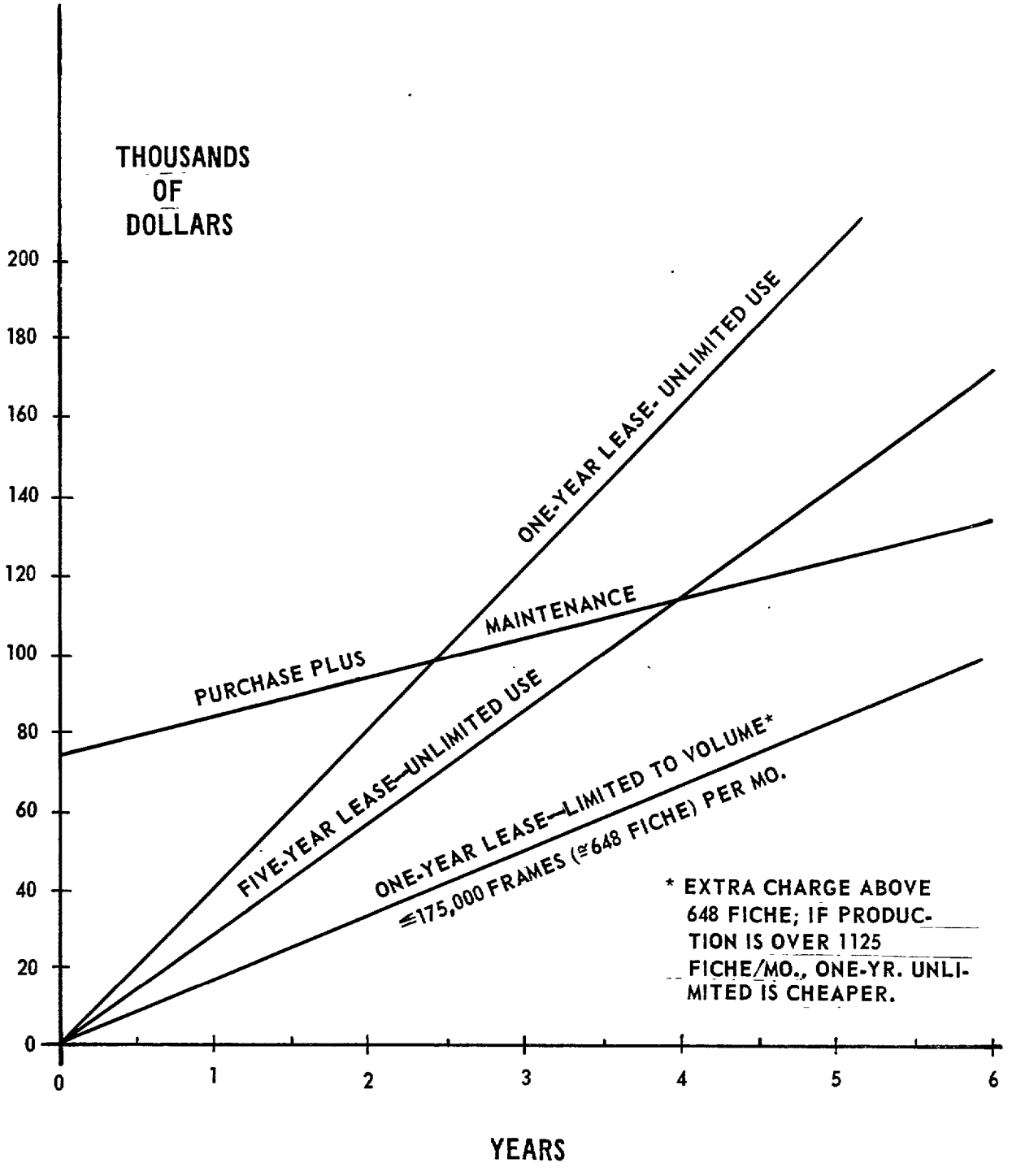
1. Effective Reduction 48X.
2. Dimensions in millimeters.
3. Grid lines shown do not appear on microfiche.
4. With the notch and corner cut in the positions shown on this drawing the sensitized side is facing the observer.



The text area shown represents the data placed on a 216.0mm x 279.4mm (8.5 x 11 in) page (typically 64 lines of 80 characters).

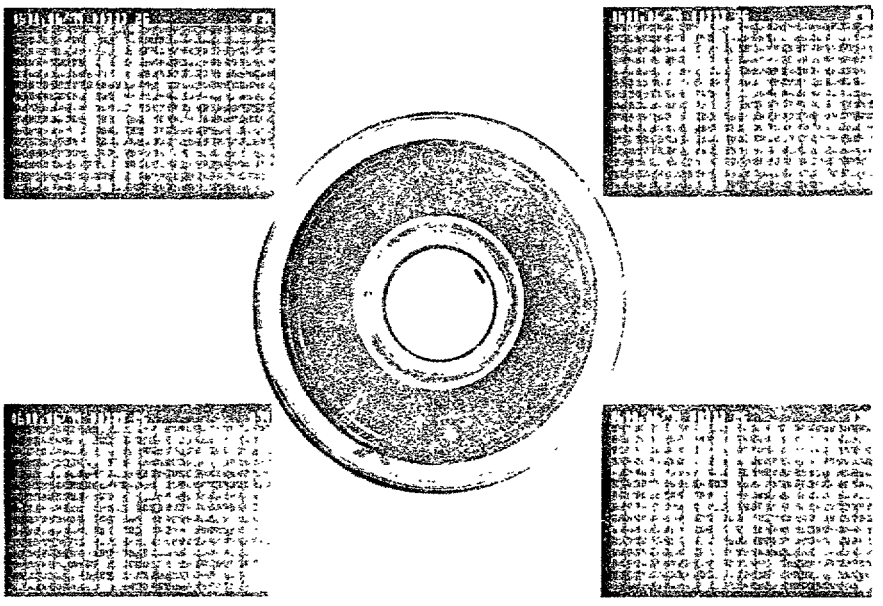
APPENDIX II

COMPARISON OF VARIOUS CONTRACTS FOR THE CENTER'S COM RECORDER



APPENDIX III

COMPUTER OUTPUT MICROFILM



COM SERVICE CENTER

operated by

Navy Publications and Printing Service Office

Southeast Division

Fifth Naval District, Norfolk, Virginia

5ND NPPSO 5210-1

APPENDIX III

FEDERAL GOVERNMENT INTEREST IN COM

The Comptroller General of the United States has expressed keen interest in the progress and trend of development of Federal agencies using COM. He recently suggested that the Executive Branch OMB, GSA, and the Federal agencies in the Norfolk area join with GAO in a study to determine efficient methods for acquiring and using COM technology. As part of this effort a pilot COM Service Center has been established in the Norfolk area and is managed and operated by the Navy Publications and Printing Service Office (NPPSO), Southeast Division, Fifth Naval District.

COM SERVICE CENTER OPERATED BY NAVY PUBLICATIONS AND PRINTING SERVICE OFFICE

The NPPSO COM Service Center is located on the 6th floor of Building 143, Naval Supply Center, Naval Station, Norfolk, Virginia. The services are available to all Federal Government agencies located in the Norfolk area. Potential customer activities are provided with a software package, designed for their type of data processing equipment, to insure compatability with the service center COM equipment. Computer tapes programmed by activity data processing personnel to meet the input specification of the micromation recorder are furnished to the COM Service Center. Presently installed COM equipment generates 105mm microfiche and 16mm microfilm. In accordance with the DOD Mini-Cats Program, 24X and 48X microfiche reductions are offered. The cost of microfiche master copies (silver) is presently $4.00 each, and duplicate copies are only seven and one-half cents each. DD Form 282 and 5ND NPPSO Form 5603/36 should

be utilized for ordering COM service. DD Form 282 is available as a supply item. An initial supply of this form and copies of 5ND NPPSO Form 5603/36 may be obtained at the COM Service Center.

BACKGROUND

Microform is a generic term for any form, either film or paper, which contains microimages. Basically, there are several types of microforms currently in use. Microfiche is a more recent development in microform and is rapidly becoming a standard medium for microimaging. Microfiche is a sheet of microfilm recording multiple microimages in a grid pattern. Microfiche film is approximately 6 x 4 inches in size. The principal application for microfiche is in the reproducing of multi-page documents such as catalogs, reports, and technical publications. The latest technique used to generate microfiche is a machine system for translating computer generated tape information into human readable form and recording it on film in a microimage format. This system is known as computer-output-microfilm or simply as COM.

Utilization of microfiche drastically reduces handling, distribution, and storage space requirements — smaller, lighter microfiche are obviously easier to handle than large books or computer reports. Shipping, mailing and other distribution costs are a fraction of those for paper output.

Duplicate copies can be distributed easily by air mail instead of surface transportation. Most important is the fact that page changes are no longer necessary as corrections can be quickly distributed on new fiche. Instead of requiring everyone on the distribution list to insert new pages, the low cost and flexibility of COM permits the originator to update the ADP tape and centrally reproduce microfiche copies of

APPENDIX III

the publication. Subsequently a revised microfiche is distributed to the user who has only to replace the obsolete microfiche with the revised one.

The merger of ADP equipment with microfilm equipment offers distinct opportunities for other advantages:

- COM printing and processing is much faster than ADP printing to hard copy.
- Forms can be overprinted with data simultaneously.
- Graphic capability with certain COM units.
- Reduced cost of supplies and material.
- Weight of information is significantly reduced.
- Microfilm does not require decollating, bursting, or binding.
- Users of data now have immediate "fingertip" access to information without the requirement for bulky, difficult to manage, hard copy files.
- COM provides a computer generated index or retrieval coding system directly onto the film as created, eliminating the requirement for drawn-out manual search activities. If necessary, a printed copy can be produced.
- Original silver microfiche generated by computer tapes is of archival quality and is available immediately for the generation of additional duplicates.
- There is no longer the requirement for an additional line printer run simply to provide one additional printout copy.
- After conversion of large data files to a microfiche format, data processors are free to use line printers for other applications.

APPENDIX III

STANDARD AND TEST OVERLAY FORM SLIDES

STANDARD LINE SLIDES

Three standard line slides are available for COM users to aid in locating information in column or tabular data when no custom form overlay slide is used. Slides contain horizontal lines either every two print lines (SL-2), every three print lines (SL-3), or every six print lines (SL-6) from the top to the bottom of the normal 64 line format. In addition the slides have a border line around the 132 x 64 print position matrix.

CUSTOM DESIGN OVERLAYS

Form overlays can be designed for specific application. Cost of overlays are approximately $65.00 plus $20.00 per hour preparation time. NPPSO will assist the customer activity in locating procurement sources.

PRECISION CHARACTER POSITION OVERLAY GRID

Transparent overlay grids are provided for use by COM manufacturers and COM users to aid in specifying the column and row print positions of characters, lines, and headings that are to appear on form slides. Overlay grids contain the 132 x 64 character position format at the original form scale on 14" x 17" film. Every print column and row is numbered.

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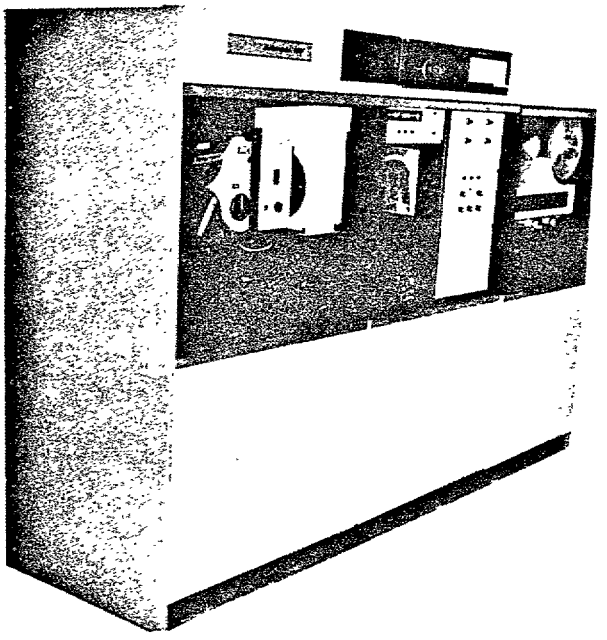
COM EQUIPMENT LOCATED



STROMBERG DATAGRAPHIX
MODEL 4360 MICROMATION RECORDER

Accepts computer generated data directly from a magnetic tape drive and translates it to alphanumerics at a rate of up to 60,000 characters per second.

Readable text is produced at speeds exceeding 15,000 lines a minute. These are standard computer pages of 132 characters a line and 64 lines to the page.

Output — 16mm roll film, also 105mm microfiche reductions at 24X or 48X.

Input — 7 or 9 track tape — 556, 800 or 1600 BPI (Bits Per Inch).

Character Font: Sans Serif — 75 characters of which 64 are selectable at one time.

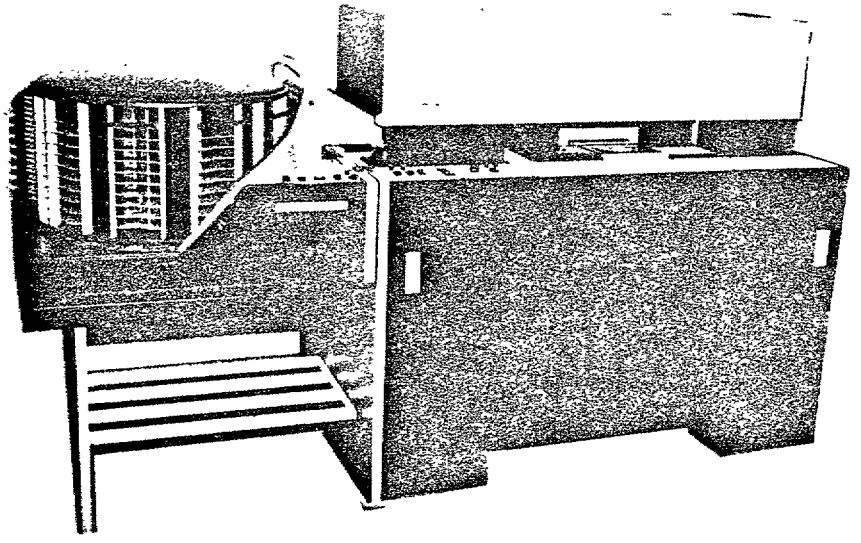
Output is in a computer page format.

Forms Projector — Has form overlay capability.

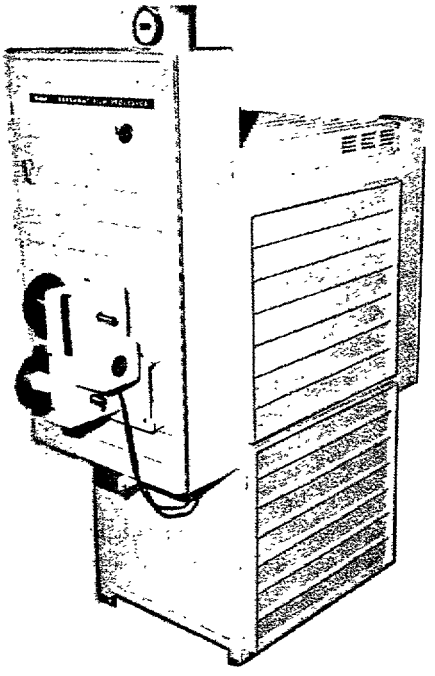
At 48X — Approximately 270 computer pages per Fiche.

APPENDIX III

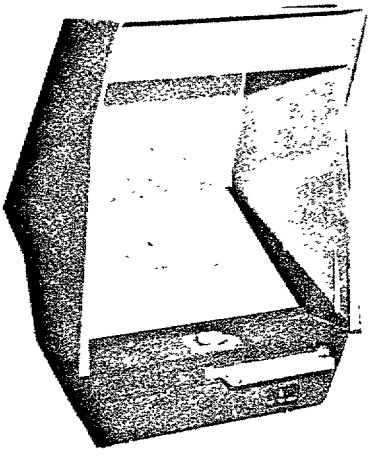
IN NPPSO SERVICE CENTER



BRUNING OP 40/80 — FICHE DUPLICATOR



KODAK VERSAMAT FILM PROCESSOR



WSI MINI-CAT FICHE READER

APPENDIX III

FOR GENERAL INFORMATION CONTACT:

Mr. L. G. Hudson, Director, Navy Publications and Printing Service Office, Southeast Division, Fifth Naval District, Building K-BB, Naval Station, Norfolk, Virginia 23511, Area Code 804, 444-7068, Autovon 690-7068.

COM SERVICE CENTER LOCATION

COM Service Center — % NPPSO Service Center, 6th Floor, Building 143, Naval Station, Norfolk, Virginia 23511, Area Code 804, 444-3247 or 444-4930. (Messrs: R. L. Snowden or P. T. Hodges.)

PRESENT HOURS OF OPERATION

0600-1630, Monday thru Friday.

PRESENTLY INSTALLED EQUIPMENT

Stromberg-Datagraphix Model 4360 COM Unit.
Kodak Model 75 Versamat Film Processor.
Bruning Model OP 40/80 Microfiche Duplicator/Collator.

Reviewed and Approved October, 1974

Lloyd L Hudson

Director, Navy Publications and Printing
Service Office, Southeastern Division, Norfolk, Va.

[redacted]

[redacted]

FORMS USED BY NPPSO

MICROFICHE MASTER LISTING
5ND NPPSO 5600/35 (Rev. 9-74)

J. O. NO./ ACTIVITY	RECEIVED		PRO-GRAM	NO. OF REELS	CLASS.	OPERATOR	TRACK		BPI			REDUCT			CC540	CC543		CC541	CC544	JOB COMP'D		JOB PICKED UP		
	DATE	TIME					7TK	9TK	556	800	1600	24X	48X	OTHER	NO. OF SILVERS	NO. DUPS EACH	TOTAL DUPS	COM 16MM	MICRO FICHE LABOR	DATE	TIME	DATE	TIME	SIGNATURE

APPENDIX IV

COM 4360 DATAGRAPHIC MASTER FILE RECORD
5ND NPPSO 5600/19

DATE

ACTIVITY

TITLE OF PROGRAM

PROGRAM J. O. NUMBER	NO. OF REELS	TOTAL NO. OF FICHE
NUMBER DUP PER FICHE	COLLATE INSETS ☐ YES ☐ NO	

MACHINE SET UP

TRACT *(Code Plug)*
☐ 7 TRACT BUSINESS ☐ 7 TRACT SCIENTIFIC ☐ 9 TRACT BUSINESS ☐ 9 TRACT SCIENTIFIC

BPI
☐ 556 ☐ 800 ☐ 1600

SIZE OF FILM
☐ 16MM ☐ 105MM

REDUCTION
☐ 24X ☐ 48X ☐ OTHER

FORM SLIDE NO FOR 105MM

FOR INFORMATION CALL *(Name & Tel. No.)*

HISTORY NOTES

APPENDIX IV

COMPUTER OUTPUT MICROFILM (COM) MONTHLY PRODUCTION RECORD
5ND NPPSO 5600/20 (Rev. 2/75)

CUSTOMER PROGRAM NO.	JAN			FEB			MAR			APR			MAY			JUN		
	COST CENTER UNITS			COST CENTER UNITS			COST CENTER UNITS			COST CENTER UNITS			COST CENTER UNITS			COST CENTER UNITS		
	540	543	544	540	543	544	540	543	544	540	543	544	540	543	544	540	543	544
NSC 100																		
PHIL. NAVSHIP 700																		
NNSY 701																		
DAM NECK 702																		
LANGLEY AFB 703																		
TOTAL UNITS																		
COST PROCESS 540 REVENUE																		
COST PROCESS 543 REVENUE																		
COST PROCESS 544 REVENUE																		
TOTAL REVENUE																		
DIRECT PROCESS LABOR COSTS																		
DIRECT MATERIAL COSTS																		
EQUIPMENT RENTAL COSTS																		
AMORTIZATION OF EQUIPMENT																		
SUPERVISORY COSTS																		
OVERHEAD COSTS																		
TOTAL COSTS																		
OPERATING GAIN/LOSS																		
HOURS EARNED CP 540																		
HOURS EARNED CP 543																		
HOURS EARNED CP 544																		
TOTAL DIRECT PROCESS HRS.																		
TOTAL SUPV'Y HRS.																		
CC 54 EFFICIENCY																		

APPENDIX IV

COMPUTER OUTPUT MICROFILM (COM) MONTHLY PRODUCTION RECORD

5ND NPPSO 5600.70 Rev. 2-75

CUSTOMER PROGRAM NO.	~~JAN~~ JUL			~~FEB~~ AUG			~~MAR~~ SEP			~~APR~~ OCT			~~MAY~~ NOV			~~JUN~~ DEC		
	COST CENTER UNITS			COST CENTER UNITS			COST CENTER UNITS			COST CENTER UNITS			COST CENTER UNITS			COST CENTER UNITS		
	540	543	544	540	543	544	540	543	544	540	543	544	540	543	544	540	543	544
NSC 100																		
PHIL. NAVSHIP 700																		
NNSY 701																		
DAM NECK 702																		
LANGLEY AFB 703																		
TOTAL UNITS																		
COST PROCESS 540 REVENUE																		
COST PROCESS 543 REVENUE																		
COST PROCESS 544 REVENUE																		
TOTAL REVENUE																		
DIRECT PROCESS LABOR COSTS																		
DIRECT MATERIAL COSTS																		
EQUIPMENT RENTAL COSTS																		
AMORTIZATION OF EQUIPMENT																		
SUPERVISORY COSTS																		
OVERHEAD COSTS																		
TOTAL COSTS																		
OPERATING GAIN/LOSS																		
HOURS EARNED CP 540																		
HOURS EARNED CP 543																		
HOURS EARNED CP 544																		
TOTAL DIRECT PROCESS HRS.																		
TOTAL SUPV'Y HRS.																		
CC 54 EFFICIENCY																		

LIST OF REFERENCE MATERIAL

I. FEDERAL REGULATIONS

Microfilming - Federal Property Management Regulations (FPMR) Subpart 101-11.5.

Micropublishing - Government Printing and Binding Regulations No. 23.

Federal standards - FIPS Task Group 18. (See Appendix I.)

Sharing of Federal resources - FPMR Subpart 101.32.2.

Use of commercial versus in-house facilities - Office of Management and Budget (OMB) Circular A-76.

Procurement requirements - FPMR Subpart 101-32.4.

II. BOOKS ON COM

Gildenberg, R. F., Computer Output Microfilm Systems, Los Angeles, California: Melvill Publishing Company, 1974.

GSA Records Management Handbook, Computer Output Microfilm, National Stock Number (FSN) 7610-00-117-8777, 1975.

Guide to Microreproduction Equipment, National Microfilm Association, Bethesda, Maryland, 1975.

How to Select a Microform Reader or Reader-Printer, National Microfilm Association, Bethesda, Maryland, 1974.

Increased Use of Computer Output Microfilm by Federal Agencies Could Result in Savings, (B-115369), Comptroller General of the United States, November 26, 1974.

Microfiche Viewing Equipment Guide, 3rd ed., Defense Documentation Center, Defense Supply Agency, Report No. DDC-TR-73-1, 1973

III. MAGAZINE ARTICLES

Iveson, Kenneth, "Trout Ficheing in America", Computer Decisions, June 1975.

The Journal of Micrographics, (various issues).

The Office (various issues; esp. Volume 79, Number 5, May 1970).