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ABSTRACT

Experience of the U.S. Government Printing Office and others has shown that electronic composition of computer processed data is more economical than printing from camera copy produced by the line printers of digital computers. But electronic composition of data not already being processed by computer is not necessarily economical. This analysis examines pages from books and catalogs that are broadly representative of the work encountered by printers to determine the impacts on composition costs arising from computer processing. The study uses "break-even" analysis to determine when the costs of electronic composition become equal to composition by two conventional methods of hot metal composition and one method of photocomposition. Two equations were drawn to permit cost comparison. The results are charted here. In general, the scale of production required to achieve a break-even situation over conventional processes for one time typesetting applications is quite high, generally higher than the typical composing firm encounters. At the present stage of development it is clear that the computer process is far more costly than the output composer. (Several pages may be light.) (JK)

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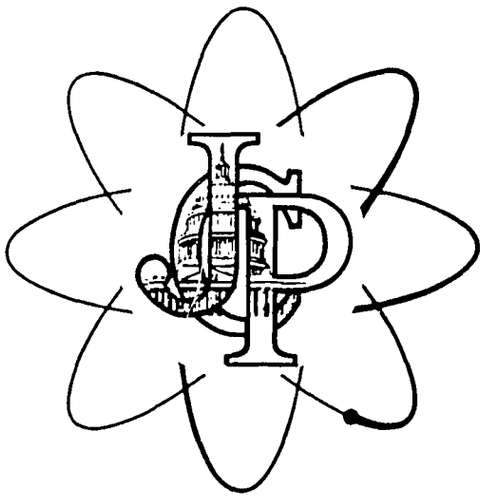
ELECTRONIC COMPOSITION Cost Comparison



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A REVIEW OF THE COSTS OF ELECTRONIC COMPOSITION

Prepared at the direction of the
Federal Electronic Printing Committee
under the supervision of the
Joint Committee on Printing—1969

UNITED STATES GOVERNMENT PRINTING OFFICE

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FOREWORD

The successful completion and consequent publication of this economic analysis of electronic composition is a noteworthy example of generous and understanding cooperation in 1969 between Senator B. Everett Jordan, chairman of the Joint Committee on Printing, and the Honorable Robert H. Finch, Secretary, Department of Health, Education, and Welfare.

Through the collaborative liaison of those principal officers, the services of Mr. Edwin R. Lannon were made available in response to a request of Her Majesty's Stationery Office to make this study as an integrally related part of the Computer Typesetting Research Project of the British Government's Ministry of Technology at the University of Newcastle-Upon-Tyne.

Mr. Lannon, a valuable charter member of the Joint Committee's Federal Electronic Printing Committee, received timely assistance from Mr. John J. Boyle of the U.S. Government Printing Office, another key member of our Electronic Printing Committee; and Mr. James Turner, Assistant Controller, Her Majesty's Stationery Office.

Our warm appreciation also goes to Mr. C. J. Duncan, Director, Computer Typesetting Research Project, University of Newcastle-Upon-Tyne, and his staff and associates; Mr. Roderick Boyd of Richard Clay (The Chaucer Press) Ltd., Bungay, Suffolk, England; Mr. Arthur Phillips of Her Majesty's Stationery Office; to the fellow members of the Joint Committee's Federal Electronic Printing Committee, Mrs. Lucille Handegard, Mr. Lannon's secretary, and other dedicated competent people who furnished invaluable assistance during the development and production of this important project.

Notwithstanding the assistance of many extremely competent people, responsibility for the assumptions used in the analysis, and the conclusions drawn, rests solely with Mr. Lannon. His service with the electronic endeavors of the Joint Committee on Printing since their inception hails him as a persevering specialist who has contributed significantly in expanding his Government's electronic composition horizons.

JOHN F. HALEY
Staff Director.

CONTENTS

A REVIEW OF THE COSTS OF ELECTRONIC COMPOSITION

I. Introduction

A. ELECTRONIC COMPOSITION DEFINED

For the purposes of this analysis the term "electronic composition" has been defined to encompass the following:

1. Output systems producing proportionally spaced characters;
2. Output with a line resolution of not less than 650 lines per inch for final output;
3. Systems employing digital computers to perform the functions of line justification, hyphenation and page makeup; and
4. Output systems employing cathode ray tubes.

B. REASON FOR PERFORMING ANALYSIS

It has been demonstrated by the experience of the U.S. Government Printing Office and others that electronic composition of computer processed data is more economic than printing from camera copy produced by the line printers of digital computers. On the average printing and binding costs related to this type of data have been reduced by 40%.

While the savings realized have been of dramatic size it should not be concluded that electronic composition of data not already being processed by computer is similarly economic.

The purpose of this analysis is to examine pages from books and catalogues that are broadly representative of the work encountered by printers to determine the impacts on composition costs arising from computer processing.

C. METHOD OF ANALYSIS

This study uses "break-even" analysis in order to determine when the costs of electronic composition become equal to composition by two conventional methods of hot metal composition and one method of photocomposition.

Two basic equations were drawn which permit the comparison of the costs of conventional methods to electronic methods under two differing assumptions. The first assumption pertains to the use of a service bureau for computer processing and lease of an electronic composition system. The second assumption pertains to lease of both the computer and the electronic composing device with the total cost of the computer applied to composition. The equations were programmed in Fortran IV for execution on the IBM 360–50.

A "mix feature" was incorporated in the program to permit the computation of break-even points for any given mix of work. In this study each sample was assumed to be of equal weight in the execution of the mix equations.

The outputs of both equations are:

Equation I—

(*a*) Minutes of use per month of the composing device in order to break-even.

(*b*) Pages required to be produced in a month to achieve break-even.

(*c*) Keyboards required on one shift operations to prepare input for the break-even volume of pages.

Equation II—

(*a*) Minutes of use per month of lower speed component in the system in order to achieve break-even.

(*b*) Pages required to be produced in a month to achieve break-even.

(*c*) Keyboards required on one shift operations to prepare input for the break-even volume of pages.

D. EQUIPMENT CONSIDERED

The following computers were reviewed:

(*a*) RCA Spectra 70/35.
(*b*) RCA Spectra 70/45.
(*c*) IBM 360–30.
(*d*) IBM 360–50.
(*e*) Micro-16.

The following electronic composing devices are included in the analysis:

(*a*) RCA Videocomp/70–800 Series.
(*b*) Mergenthaler Linotron 1010.
(*c*) Mergenthaler Linotron 505.*
(*d*) Harris Fototronic CRT (Model 512).

*The Linotron 505 used in the analysis is a system modified by the Computer Typesetting Research Project of the University of Newcastle-upon-Tyne and differs significantly from the standard Linotron 505 marketed by Mergenthaler

E. CONDUCT OF ANALYSIS

The analysis was carried out in both the United States and the United Kingdom.

To determine the costs of composition of the eight

samples used to represent the classes of work normally to be encountered in book and catalogue work the cooperation of the following was obtained:

1. Commercial printers, in both countries;
2. The United States Government Printing Office and Her Majesty's Stationery Office; and
3. The manufacturers of the electronic composing devices specified earlier.

The pages analyzed were actually set by the processes subject to analysis and standard times obtained.

The timing factors were costed using U.S. Department of Labor, Bureau of Labor Statistics wage data for the United States and data of the British Federation of Master Printers for the United Kingdom. Equipment costs were provided on a lease basis (with the exception of the Linotron 505 which is costed on a purchase basis) by the cooperating manufacturers. Supply and such overhead costs as are applied were derived from U.S. Government cost data.

The resources of the Computer Typesetting Research Project of the University of Newcastle-upon-Tyne were made available to the writer by the British Ministry of Technology through the good offices of Her Majesty's Stationery Office and the Joint Committee on Printing of the Congress of the United States.

F. EXCLUSIONS FROM COST

This analysis abstracts from total cost the cost of setting a single page. To the extent that both conventional and electronic composing systems have set up costs they are excluded. Profit and general overhead costs for such elements as supervision, regular floor space, (special purpose space costs such as air-conditioning, raised flooring, and power for the computer and composer are included), heat, power and light are also excluded in the analysis.

In essence then the analysis confines itself to direct labor costs and directly applied capital costs.

The analysis also excludes potential cost benefits, e.g., automatic indexing, now seen to be realizable as a by-product of electronic composition.

II. METHODOLOGICAL ASSUMPTIONS UNDERLYING THE ANALYSIS

The analysis assumes a process for both the conventional and electronic systems whereby direct labor costs, supply costs and directly applied capital costs for the following work elements are measured:

1. Input keyboarding for all processes.
2. Correction keyboarding for all processes except Monotype.
3. For hot metal—proof press set up and drawing of a reproduction proof.
4. For hot metal—insertion of corrections.
5. For hot metal—drawing of a reproduction proof to furnish editor/author after house corrections are made.
6. For electronic systems—conversion of paper tape to magnetic tape except for Linotron 505 which used paper tape as input.
7. For electronic systems—production of output tape by computer.
8. For electronic systems—production of a stabilization paper output on the composer for use in making house corrections.
9. For electronic systems—inserting corrections to copy and producing a corrected output tape on the computer.
10. For electronic systems—production of a stabilization paper output on the composer as a proof to be used by the editor/author.
11. For hot metal—the cost of recycling metal.
12. For Linotype—matrix replacement.
13. For all systems—depreciation of input keyboards.
14. For electronic and photocomposition systems—costs of photographic paper and chemicals.
15. For electronic and photocomposition systems—depreciation of film processor.
16. For electronic systems—site preparation costs including air conditioning, raised flooring, and special power arrangements.

Proof reading costs were assumed to be equal in all processes compared.

III. UNITED STATES COSTS FOR COMPUTER SYSTEMS APPLIED

Listed below are the details of the cost calculations related to the computing systems applied:

(a) IBM 360-50 [1] cost calculation to support Mergenthaler Linotron 1010

Item	*Monthly cost*
1. Monthly lease cost 360-50	$21, 643. 00
2. Operations staff	5, 125. 00
3. Site cost amortization	1, 066. 00
4. Consumable supplies	390. 00
Total	28, 224. 00
Cost/minute: $2.0495.[2]	

[1] Based on U.S. Government Printing Office configuration; cost provided by IBM Corporation.
[2] Based on effective rate of 228.8 system hours of work within 176 hours of central processor meter time.

(b) IBM 360-30 cost calculation to support Harris Fototronic—CRT

Item	*Monthly cost*
1. Monthly rental	$9, 242. 00
2. Personal services/month	5, 125. 00
3. Site cost amortization/month	1, 066. 00
4. Consumable supplies/month	390. 00
Total	15, 823. 00
Cost/minute: $1.4983.	

(c) RCA Spectra 70/45 cost calculation to support Videocomp 830

Item	*Monthly cost*
1. Monthly lease cost	$13, 856. 00
2. Operations staff	5, 125. 00
3. Site cost amortization	$1, 066. 00
4. Consumable supplies	390. 00
Total	20, 437. 00
Cost/minute: $1.9353.	

(d) *RCA Spectra 70/35 cost calculation to support Videocomp 830*

Item	Monthly cost
1. Monthly lease cost	$8, 194. 00
2. Operations staff	5, 125. 00
3. Site cost amortization	1, 066. 00
4. Consumable supplies	390. 00
Total	14, 775. 00

Cost/minute: $1.3991.

IV. United States Costs for Composing Systems Applied

Listed below are the costs used in the analysis for the various output systems used:

(a) *Micro 16—Linotron 505 cost calculation* [1]

1. Monthly amortization of equipment	$3, 053. 82
2. Personal services (operators)	1, 361. 00
3. Personal services (programmer)	1, 319. 00
4. Monthly amortization of film processor	530. 00
5. Monthly amortization of site costs	200. 00
6. Consumable supplies	135. 00
7. Monthly maintenance costs	432. 25
Total	7, 031. 07

[1] This is a special configuration of the Linotron 505 system and differs significantly from the standard system marketed by Mergenthaler.

(b) *Mergenthaler 1010 monthly cost calculation*

1. Lease of Linotron 1010	$10, 315. 00
2. Operations staff	1, 361. 00
3. Systems programmers	2, 638. 00
4. Film processor amortization	530. 00
5. Site amortization	200. 00
6. Consumable supplies	135. 00
7. Maintenance	1, 833. 00
Total	17, 012. 00

(c) *Harris Fototronic CRT monthly cost calculation*

1. Lease of Harris 512	[1] $9, 300. 00
2. Operations staff	1, 361. 00
3. Systems programmers	2, 638. 00
4. Film processor amortization	530. 00
5. Site amortization	200. 00
6. Consumable supplies	135. 00
7. Software charge	[2] 550. 00
Total	14, 714. 00

[1] Includes 1-shift maintenance costs.
[2] Price subject to change, quoted by Harris on Mar. 20, 1970.

(d) *RCA Videocomp monthly cost calculation*

1. Lease of Videocomp	$9, 150. 00
2. Operations staff	1, 361. 00
3. Systems programmers	2, 638. 00
4. Film processor amortization	530. 00
5. Site amortization	200. 00
6. Consumable supplies	135. 00
Total	14, 014. 00

V. United States Extra Shift Costs—Computers

Since usage beyond 10,560 minutes per month would require incremental costs over base costs a series of calculations have been made to deal with situations when extra shift utilization is required to attain break even. Wage rates are based on U.S. Government rates for night work which are 10% higher than day shift rates.

The number of operators charged to extra shift usage is lower than the regular shift complement in keeping with experience.

A. EXTRA SHIFT COST CALCULATION—360–50

Since the programs executed on the 360–50 show a less acute "compute bind" than on the other computer systems reviewed it is presumptive that certain of the peripheral units as well as the central processing unit could be subject to extra shift rental costs. Such an assessment must be arbitary within the context of this analysis. The observed rate of peripheral usage as related to central processor usage in the 360–50 system used by the Environmental Health Service of the U.S. Department of Health, Education, and Welfare, has been used for this calculation. In tabular form these costs are:

Item	170 hours of extra shift costs
1. Equipment rental	$1, 585. 00
2. Personal services	1, 138. 62
3. Consumable supplies	300. 00
4. Maintenance costs (22 hours)	627. 00
Total	$3, 650. 62

Per minute cost: $0.3457.

B. EXTRA SHIFT COSTS—IBM 360–30

Since the composition programs executed on the 360–30 are marked by over-all "compute bind" it has been assumed that the meter time on peripheral units would be a fraction of the meter time of the central processor. Accordingly, this cost calculation assumes that extra shift charges would be payable only on the central processor at the rate of 10% of prime shift costs.

In tabular form the costs established for extra shift rental are as follows:

Item	176 hours of extra shift time
1. Equipment rental	$443. 40
2. Personal services	1, 138. 62
3. Consumable supplies	300. 00
4. Maintenance costs (22 hours)	627. 00
Total	2, 509. 02

Per minute cost: $0.2376.

C. EXTRA SHIFT COSTS—RCA SPECTRA 70/35

Since RCA makes no charge for extra shift usage of their computers the extra shift costs attributable to the system include only the following:

1. Personal services	$1, 138. 62
2. Consumable supplies	300. 00
3. Maintenance	496. 56
Total	1, 935. 18

Cost per minute: $0.1833.

D. EXTRA SHIFT COSTS—RCA SPECTRA/45

1. Personal services	$1,138.62
2. Consumable supplies	300.00
3. Maintenance	786.28
Total	2,224.90

Cost per minute: $0.2107.

VI. United States Extra Shift Costs—Composing Devices

The same amount was charged to each system included in the analysis. Maintenance costs would perhaps vary; however, for the sake of comparability and conservatism maintenance costs were charged. In summary form the extra shift costs applied are as follows:

1. Equipment lease	0
2. Personal services	$1,498.00
3. Maintenance	471.00
Total	1,969.00

Cost per minute: $0.1864.

VII. Specifications for Benchmark Pages

The eight sample pages used for comparative analysis were taken from "Report on Cathode Ray Tube Character Generation Devices" by Jonathan Seybold. The specifications as established by Mr. Seybold were as follows:

1. THE GROUP

1 column by 21 picas.
10/11 type 41 lines deep, 1 line for running head total text type: 1025 10 pt. ems.
Typefaces:
- 10 pt. Roman.
- 10 pt. Roman Cap and Small Caps—once on page.
- 10 pt. Italic—once on page.

2. POLICY

1 column by 27½ picas.
10/12 type 45 lines to text depth—(1485 ems) actually, 40 lines of type—(1320 ems) plus 1 line for running head.
Typefaces:
- 10 pt. Roman.
- 10 pt. Italic—three times on page.
- 8 pt. Sans serif roman—once on page.
- 10 pt. Sans serif bold—three times on page.

3. PRICES AND THE PRODUCTION PLAN

1 column x 25½ picas.
32 lines of 10/12 test (980 ems).
8 lines of 8/10 foot note (304 ems).
1 line of running head.
Typefaces:
- 8 and 10 pt. Roman.

Typefaces—Continued
- 10 pt. Italic—four times on page.
- 8 and 10 pt. superiors—two times on page.
- 10 pt. small caps—once on page.
- 10 pt. bold—once on page.
- 10 pt. special symbols for prime mark.

4. PLEISTOCENE

1 column 27 by 43 picas (1400 10 pt. ems) plus running head.
31 lines of 10/12 type (1010 ems), 3 lines of 6 pt. (162 ems).
8 lines of 8 pt. (including running head) (324 ems).
Typefaces:
- 6, 8 and 10 pt. Roman.
- 6 and 10 pt. Roman superiors.
- 6, 8 and 10 pt. Italic (21 times).
- Brackets in 10 pt. Roman font—(1 time).
- 8 pt. cap and small cap (3 times on page).
- 8 pt. Roman accents (2 times on page).
- 8 pt. Bold (1 time on page).

5. AMERICAN BAR

2 columns 17½ by 52½ picas each (8800 8 pt. ems/page) plus running head of 36 picas.
Actual text—average 67 lines/column (3600 8 pt. ems/page).
Typefaces:
- 8 and 14 pt. Roman.
- 8, 12 and 14 pt. Bold—10 times on page.
- 8 pt. Bold Italic—may be obliqued (counted as Bold above.)

6. BOOK CATALOGUE INDEX

41 by 66⅔ picas.
100 lines of 8 pt. type (6150 ems).
Typefaces:
- 3 faces—
  - 8 pt. Bold Italic (May be obliqued).
  - 8 pt. Roman.
  - 8 pt. San Serif Medium.

7. HARDWARE DIRECTORY

3 columns 13½ picas by 61½ picas.
Average: 100 lines/column (2700 6 pt. ems/column).
Over-all page size 41 picas (8200 6 pt. ems/page).
Typefaces:
- 6 pt. Medium.
- 3 pt. Bold.
- 8 pt. Bold.
- 6 pt. Bold Star.

8. TELEPHONE BOOK PAGE

4 columns of 12 picas each and 120 lines deep (2880 6 pt. ems/column) over-all width: 50 picas (12,000 6 pt. ems/page).
Typefaces:
- Roman and Bold (Bold can be cap only), plus 12 pt. Bold for head.

Mary said, he had had a vocation or a higher call that had bade him assume the office. This conviction had slowly overtaken him in America, where genuine English butlers did not grow on trees. "You're the real article, Hatton!" a gentleman who had come to stay in the Long Island house had said to him one morning with an air of surprise. He was like a stage butler or a butler you say on the films, the gentleman doubtless meant to imply. Hatton had been pleased to hear it; being somewhat younger then and on his own, so to speak, in a foreign country, he had tried to conform to an ideal of the English butler as he found it in films and in crime stories and in the funny papers that Cook read, for the wise man knew how to turn the smallest occasion to profit. Yet he now felt that study alone could not have done it. When the young ladies told him he was a genius, he believed they had hit on the truth: "out of the mouths of babes." He had long accepted the fact that he was the brains of the family and the heavy obligation that went with it. The eternal model of the English butler, which he kept before his eyes, even in his moments of relaxation and on his day off, required that he have the attributes of omniscience and ubiquity, like they taught you in the catechism: "Where is God?" "God is everywhere." Hatton was Church of England, and did not mean to blaspheme, but he could not help noticing those little correspondences, as when he had observed, in his earlier situation, that he was expected to be invisible too.

Folding the newspaper, Hatton sighed. One of the duties or accomplishments of the classic English butler, of which he personally was the avatar, was to be well informed on matters that would not at first glance seem to be relevant to the job in hand and also to be a past master of proper names. That was why, at present, he was reading the *Herald Tribune,* on behalf of the family, having already had a hasty look at Cook's tabloid for the murders, and why he had started with the society columns and the sporting pages, to have a go at them while his mind was fresh. Hatton was not a sporting man, except for the races, and back home, the cricket, but duty obliged him to take cognizance of the proper

This a matter of pure selfish stubbornness; it may be that country A permitted the export of scarce rationed commodities to country C, and was lenient in the licensing of nonessential imports from country B. In that case, the government of A may feel that its exports to C really were of greater value than its imports from B, and that this discrepancy should probably be reflected in the terms of settlement.

In the *open circuit* in which A owes B owes C owes D, a similar situation may occur; also, some new considerations may arise. It may be that countries A and D trade very little with each other, and have no agreement covering the contingency of a sizable debt between them. In this case the cancellation of intermediate debts, giving rise to a debt between A and D, might depend on an entire new negotiation between the latter two countries to cover the terms of settlement.

Polarization of debts and credits

Another problem with the open circuit is that all such circuits may tend to concentrate on the same terminal countries. There may be several countries that show bilateral deficits and no surpluses, several that show bilateral surpluses and no deficits, and an interediate group that show some deficits and some surpluses. Cancelling out the interediate group may leave the countries that are exclusively debtors owing the countries that are exclusively creditors. The creditors would object to holding claims only on the countries least able to settle them; the debtor countries might object to owing all their debts to countries that are least in need of export markets, and therefore least inclined to be lenient.

Circuit-clearing agreement in Western Europe

Nevertheless, there are possibilities here; the objections listed above are possible, even probable, but not inevitable. Five countries of Western Europe did attempt in 1947 to set up formal arrangements for cancelling out such circuits of debts and credits. Belgium, Luxemburg, the Netherlands, France, and Italy agreed that all closed circuits should automatically be cancelled among them. They also agreed in principle to be favorably inclined toward cancelling open circuits, although each case was still to depend on unanimous consent. Each member of the agreement was to report its bilateral debt or credit with other members of the group to a central agent-the Bank for International Settlements in Switzerland-at the end of each month. This bank was then to scrutinize the pattern of debts and credits, notify members of the closed circuits to be automatically cancelled, and propose cancellations of open circuits. (In the terminology used, the clearing of a closed circuit was a *first category compensation*, while the simplification of an open circuit was a *second-category compensation*).

the effects of a rise in the current price which is not expected to last. But when we proceed to work it out, it becomes evident why the effects of such a rise are often very small. In the complementarity case, the effects are almost necessarily nil. There will not be time to install the additional equipment before the price has relapsed to normal, and thus there will be no inducement to install it. In the substitution case, the effect is not so negligible; nevertheless, it is important to observe that substitution can now take place only one way. From the nature of the case, 'there can be no substitution in favour of current output at the expense of output earlier in date than itself; that is to say, there can be no piling up of stocks in anticipation of demand when no notice of that demand is given in advance. We are left with the possibility of accelerating production, of substituting current output for future (of course, some additional input may be required in order to enable production to be accelerated); consequently, either the effect on the output stream is nil, or the new stream takes the form *EA'*.

6. The total effect on the stream of planned outputs, which occurs when the rise in price is expected to be permanent, can be calculated by summing these partial effects. In the complementarity case, when the effect of the rise in the current price (*ceteris paribus*) is practically nil, and the rise in expected future prices induces a set of streams of output increments such as *AD*, it is easy to see that the total effect must be of the form *BB*—the curve we drew for Marshall's case. Each of the components is more or less of this form; consequently the resultant must be of this form too. In this case no exceptions can arise.[1]

In the substitution case, on the other hand, the constituent effects are much less simple in character; and the result of aggregating them is far from being so certain. The total effect on the output of any given date is made up out of things tending to

[1] It is indeed true that a rise in price expected to occur in some particular future 'week', and in that alone, may be insufficient to induce the laying down of the necessary equipment; while a rise expected to last some considerable time may be sufficient. If this occurs (doubtless it often will) the total effect may be greater than the sum of the constituent effects. But, though greater, it will still be of the same kind—as can be seen at once when we recollect that the length of our 'week' is arbitrary; by increasing its length we can diminish the importance of this discrepancy, without damaging the essentials of our argument.

consider the zoogeographic distribution of this group (rather than the disputed problem of occurrences of Oldowan artifacts), as evidence of the range of the earliest known humans. When this is done, the points made by Robinson (1953) in favor of *Mesanthropus* from Java being congeneric with *Paranthropus* gain in importance. Since the latter is usually considered only a subgenus of *Australopithecus*, it becomes possible to maintain that distribution of this group stretched from South Africa to Southeast Asia. There has, however, been a general hesitancy to do this because of the fragmentary nature of the specimens of *Meganthropus*. Due to their proximity, one practice has been to rank *Meganthropus* as a subgenus of *Pithecanthropus*. *Pithecanthropus erectus* itself, however, is now commonly ranked only as a species of *Homo*, *H. erectus*. Description of a new hominid genus *Hemanthropus* by von Koenigswald (1957) based on a number of isolated upper and lower teeth from China drugstores, raises this issue anew.[4] *Hemanthropus* is a *Paranthropus*-like form which evidently occurred in South China. Unless both of these assignments eventually prove to be incorrect, it would appear that australopithecine distribution covered a large area of the Old World. Clearly, more evidence will have to be recovered before theories as to which continent was the cradle of mankind gain a sound foundation. Arambourg's genus *Atlanthropus* (1954) poses a similar situation in a slightly later period. This North African human, and perhaps *Telanthropus* from the Sterkfontein locality in South Africa (see Broom and Robinson 1949, 1950) are not very different in known parts from *Pithecanthropus*. It is time that the often repeated stricture that few genera of Pleistocene men are well based taxonomically had an effect on terminology. The idea that the bases for generic distinctions among Pleistocene men are weak is hardly new, E. D. Cope having remarked in "The Primary Factors of Organic Evolution" (1896:169) with reference to the Java ape-man: "He (Dr. Dubois) proposes for him a new genus *Pithecanthropus* (after Haeckel), and even a new family, Pithecanthropoidae, without having shown that he is not a member of the genus *Homo*."

[4] For centuries the Chinese have used fossils, called "dragon bones," in powdered form as medicinal agents. The first identified teeth of "*Sinanthropus*" and *Gisantopithecus* were also located in collections made for this purpose.

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MORRISON—*Continued*

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BURNERS Unit Oil for Room Heater Range Stove Etc—See Unit Oil Burning for Room Heater Range Stove Etc

BURNERS, Weed

Aeroil—See Aeroil Products Co
Aeroil Products Co South Hackensack NJ
Blackwell Burner Co 5061 W Commerce St San Antonio 7 Tex
Cedarberg Mfg Co 529 Fourth St Minneapolis 15 Minn
Chopin R E Mfg Works Inc Batavia NY
Dobbins Div Chamberlain Corp Monroe Go
Firegun—See Root-Lowell Corp
Flome-Gun—See Smith D B & Co
Flome Sprayer—See H D Hudson Mfg Co
FLB—See Universal Metal Products Co
Hauck—See Hauck Mfg Co
Hauck Mfg Co 124 Tenth St Brooklyn 15 NY
H D Hudson Mfg Co 589 E Illinois St Chicago 11
Root-Lowell Corp Lowell Mich
Smith—See Smith D B & Co
Smith D B & Co 414 Main St Utica 2 NY
Superbilt—See Dobbins Div
Universal Metal Products Co Div Air Control Products Inc Sarasnoc Mich

BURNING BRANDS—See Brands Burning

BURNISHERS

Buck Bros Inc Millbury Mass
Stanley Tools Div Stanley Works New Britain Conn

BURRS—See also Rivets

BURRS Brass—See Burrs Copper and Brass

BURRS, Copper and Brass

Atlas—See Atlas Tack Corp
Atlas Tack Corp 79 Pleasant St Fairhaven Mass
Chase Metals Service Div Chase Brass & Copper Co Waterbury Conn
Cross—See Cross W W & Co
Cross W W & Co Div Plymouth Cordage Industries Inc 140 Federal St Boston 10 Mass
Hussey C G & Co Washington St Leetsdale Pa
Mosser Products Co 6400 Park Av SE Cleveland 5
Sharon Bolt & Screw Co Inc 70 Pleasant St Ashland Mass
United Screw & Bolt Corp 2513 W Cullerton St Chicago 8
Waterbury Brass Goods Corp Waterbury Conn
Wrought Washer Mfg Co 2108 S Bay St Milwaukee 7 Wis

BURRS and RIVETS, Iron

Atlas—See Atlas Tack Corp
Atlas Tack Corp 79 Pleasant St Fairhaven Mass
Clark Bros Bolt Co Milldale Conn
Joliet Wrought Washer Co Joliet Ill
Reed & Prince Mfg Co Duncan Av Worcester Mass
Sharon Bolt & Screw Co Inc 70 Pleasant St Ashland Mass
Tubular Rivet & Stud Co Weston Av Quincy 70 Mass
United Screw & Bolt Corp 2513 W Cullerton St Chicago 8
Wrought Washer Mfg Co 2108 S Bay St Milwaukee 7 Wis

BUSH HAMMERS—See Hammers Bush Forged Steel

BUSH HOOKS—See Hooks Bush

BUSH PRUNERS—See Pruners Bush and Vine

BUSHES ROSE—See Nurseries Rose Bush Shrubs Evergreen etc

BUSHINGS, Machinery

Leitzke—See Leitzke Rein
Leitzke Rein Hustisford Wis
Master Products Co 6400 Park Av SE Cleveland 5
Wrought Washer Mfg Co 2108 S Bay St Milwaukee 7 Wis

BUSHINGS PIPE—See Fittings Pipe

BUSHINGS, Soft Rubber

• Daras-Rockwell Div United Shoe Machinery Corp 455 W Market St Newark 7 NJ
• Well-Nuts—See Daras-Rockwell Div
(With flange and threaded insert)

BUSINESS TRANSCRIPTION MACHINES—See Machines Transcription Business

BUTANE GAS—See Gas Bottle

BUTANE GAS CANDLES—See Candles Butane Gas

BUTCHERING SALTS—See Salts Meat Curing

BUTCHERS BLOCK SCRAPERS—See Scrapers Butchers Block

BUTCHER BLOCKS—See Blocks Butcher Home

BUTCHERS BRUSHES—See Brushes Bakers & Butchers

BUTCHERS CLEAVERS—See Cleavers

BUTCHERS KNIVES—See Knives Butchers

BUTCHERS SAW BLADES—See Blades Butchers Saw

BUTCHERS SAWS—See Saws Butchers

BUTCHERS SCALES—See Scales Counter

BUTCHERS SPLITTERS—See Splitters Butchers

BUTCHERS STEELS—See Steels Knife Sharpening

BUTCHERS TOOL—See article desired

BUTT GAGES—See Gages Butt

BUTT HINGES—See Hinges Butt

BUTTER CHURNS—See Churns Electric and Household

BUTTER CUTTERS—See Cutters Butter

BUTTER JARS—See Jars Butter

BUTTER MOLDS—See Molds Butter

BUTTON LOCKS—See Locks Button

BUTTONS, Door

Amundson Products Co 2111 E S St Superior Wis
Bow Button—See Amundson Products Co
Dexter—See Dexter Lock Div
Dexter Lock Div Dexter Industries Inc 1601 Madison Av Grand Rapids Mich
Ferum Co 815 E 136 St NY
Larson Chas O Co Sterling Ill
Lawrence Bros Sterling Ill
McKinney Mfg Co 820 Davis Av Scranton Pa
National Mfg Co Sterling Ill
New Britain Tool and Mfg Co Inc New Britain Conn
• North & Judd Mfg Co 494 E Main New Britain Conn
Phenix Mfg Co N Port Washington Rd Milwaukee 12 Wis
Phoenix Lock Co 321 Third Av Newark 7 NJ
Rockwood Mfg Co Rockwood Pa
Safe Hardware Div Emhart Corp 102 Washington St New Britain Conn
Sharon Hardware Mfg Co Sharon Pa
Shelby Corp Shelby O
Shelby Metal Products Co Shelby O
Standard—See Shelby Metal Products Co
Stanford Hardware Co 385 Clinton Av New Haven Conn
Stanley Hardware Div Stanley Works New Britain Conn
Star Metal Products Co Inc 366 Butler St Brooklyn NY
Superior—See Amundson Products Co
Wright—See Wright Products Inc
Wright Products Inc 107 W Colsmon St Rice Lake Wis

BUTTONS, Handles and Knobs, China

Scovill Mfg Co Plumbers' Brass Goodt Div Waterville Conn
Trenton Potteries Co Trenton NJ

BUTTONS, Push, *Electric*

Auth Electric Co Inc 34-20 45 St Long Island City NY
Cable Electric Products Inc 234 Doboll St Providence 7 RI
Corbin—See Corbin P & F Div
Corbin P & F Div Emhart Corp New Britain Conn
Edwards Co Inc Norwalk Conn
Erco Mfg Co 2268 N Elston Av Chicago 14
Ferry Mfg Co 3116 Spring Garden St Philadelphia 4
Gem Electric Mfg Co Inc 237 37 St Brooklyn 32 NY
Keynote—See Edwards Co Inc
Lee Electric Inc 309-11 31 St West New York NJ
• Lenape Products Inc 120 Stokes Av Trenton 7 NJ (Ceramic)
Liberty Bell Mfg Co Div Philip Corsy Mfg Co Swainsboro Go
Lockwood—See Lockwood Hardware Mfg Co
Lockwood Hardware Mfg Co Fitchburg Mass
Magic Touch—See Rodale Mfg Co
• Miami-Carey Div Philip Carey Mfg Co 1700 Grand Av Middletown O
Murdock Wm J Co Chelsea 50 Mass
Nutone Inc Madison & Red Bank Rds Cincinnati O
Rockwood Mfg Co Rockwood Pa
Rodale Mfg Co 6 & Minor Sts Emmaus Pa
Ruswin—See Ruswin Div
Ruswin Div Emhart Corp 102 Washington St New Britain Conn
Signet—See Rodale Mfg Co
Snapit—See Cable Electric Products Inc
Standard Bronze Co 175 W 5 St Bayonne NJ

Kelly Jos 2435 N Hancock .....GArfld 3-9158
Kelly Jos 1523 S Patton .....DE 6-3237
Kelly Jos 9302 Rising Sun Av.....OR 3-1261
Kelly Jos 7749 E Roosevlt Blvd....MAylr 4-3141
Kelly Jos 437 Shurs La.....IVyrdg 2-0284
Kelly Jos 2231 S J .....DEwy 6-6975
Kelly Jos 1421 S 55 .....SArtoga 6-5744
Kelly Jos antiq 1024 Pine .....WA 5-5679
Kelly Jos Jr 3400 W Clearfld .....BA 3-4888
Kelly Jos Jr 54*1 Malcolm .....GR 2-8022
Kelly Jos Mrs 1420 Sharswd.....GRnwd 3-2157
Kelly Jos A 7320 Algon Av .....PI 5-1469
Kelly Jos A 3906 Coral .....JEfrsn 5-3741
Kelly Jos A 2024 S Redfield ...SA ratga 9-5226
Kelly Jos A 3106 Unrun .....MAylr 4-2454
Kelly Jos A 1906 S 22 .....FUltn 9-0782
Kelly Jos A dimnd setr 106 S 7....WAint 5-3092
Kelly Jos A Mrs 3553 Brookvw Rd.....NE 7-7464
Kelly Jos B 114 Falcon Ln WestChester...696-6228
Kelly Jos C 468 Gerhard .....IV 2-9173
Kelly Jos D 4046 Nelson .....Ploner 3-8892
Kelly Jos O Rev 154E MtAiryAv...CH estHll 7-0661
Kelly Jos E 610 Arthur .....FI 2-3345
Kelly Jos E 5222 N Fairhl .....DAmpnt 4-1401
Kelly Jos E 2810 N Front .....GA 6-3959
Kelly Jos E 5919 N Hutchnsn .....LI 8-4641
Kelly Jos E 5128 Locust .....GR anit 2-6359
Kelly Jos F 6226 Argyle .....PI 5-0897
Kelly Jos F 5742 N Howard .....CA 4-6899
Kelly Jos F 3449 Indian Queen La ....VI 4-9028
Kelly Jos J 1068 E Cheltnhm Av CUmbrlnd 9-2277
Kelly Jos J 4240 Cottman Av .....OEvnhr 8-5920
Kelly Jos J 4609 Hisbee .....CU 9-9252
Kelly Jos J 1938 King Arthur Rd .....HO 4-1786
Kelly Jos J 1405 S Napa.....HO wrd 8-5646
Kelly Jos J 3562 New Queen .....VI ctr 4-3796
Kelly Jos J 2030 S Redfld.....SArtoga 9-4086
Kelly Jos J 137 Ridgefld Rd.....NEptn 7-8915
Kelly Jos J 446 Shurs La.....IVyrdg 3-2692
Kelly Jos J 2525 S 64 .....SArtoga 7-5779
Kelly Jos J photogrphr 1206 Walnut....PE 5-1327
Kelly Jos J Jr 631 DuPont .....IV 2-9282
Kelly Jos M 708 E Olney Av .....GLadstn 5-9268
Kelly Jos M 3806 Pine .....KI 5-7747
Kelly Jos M 3125 N Wendle.....BAldwn 5-3354
Kelly Jos M Jr 3656 N 21.....BAldwn 5-8165
Kelly Jos P 725 Chandler .....RA 5-7177
Kelly Jos P 6532 Chew .....GE rmtn 8-2805
Kelly Jos P 3820 N Oelhl .....BA 5-4516
Kelly Jos P 1910 Durtor .....DEwy 6-0453
Kelly Jos P 2000 Griffith.....PIgrm 5-3384
Kelly Jos P 110 Hollman .....DE wey 4-2425
Kelly Jos P 5259 N Mascher .....OA 4-1628
Kelly Jos P 221 Nrdro Av .....WAvrly 4-8873
Kelly Jos P 7959 Temple Rd.....WA vrly 4-4477
Kelly Jos P 5351 Thomas.....GRnit 6-6393
Kelly Jos P 263 E Walnut Prk Dr...WAvrly 7-3352
Kelly Jos P 5629 Whitby Av.....GRnit 4-6940
Kelly Jos R 945 Scattergd .....JE 5-3187
Kelly Jos R 5913 N 3 .....WAvrly 7-4866
Kelly Jos S 4120 Princtn Av .....OE 8-8413
Kelly Jos T 6060 Crescntvl Rd.....WA 7-1769
Kelly Jos T 3504 Grant Av.....ORchrd 3-0931
Kelly Jos T 6513 Grays Av.....SArtoga 4-3178
Kelly Jos T 4435 H .....CUmbrlnd 9-8617
Kelly Jos T 8620 Marigold Pl.....MA 4-6215
Kelly Jos T 2821 N Orkney .....GArfld 6-0431
Kelly Jos T 141 Ridgefld Rd .....NE 7-1564
Kelly Jos T 4620 Spruce .....SH 8-4993
Kelly Jos Vincent 5046 N Sydenhm.DAmpnt 4-0713
Kelly Jos W 2062 E Elkhrt.....RE 9-2340
Kelly Jos W 4274 Fkd Av.....CUmbrlnd 8-7543
Kelly Jos W 4230 Lansing .....DE 3-4809
Kelly Jos W 936 E Price .....VI 3-5929
Kelly Jos W 5529 Regent.....SArtoga 9-8413
Kelly Jos W Jr 507 E Bringhurst .....VI 4-4069
Kelly Josephine 3558 Chipendle ....MAylr 4-6554
Kelly Josephine 816 S 47 .....SA 9-6264
Kelly Josephine Mrs 2515 N Franklin.BAldwn 5-7138
Kelly Julia 2619 Catherine .....PE 5-3613
Kelly K M 129 W Carontr Ln .....VI 4-1174
Kelly K T 3433 W Queen Ln .....VI 3-6338
Kelly Katherine 2502 Jackson.....DEwy 6-0230
Kelly Katherine E Mrs 5937 N 3...LIvnstn 9-2673
Kelly Katherine M 7185 N 18 .....WA 7-7093
Kelly Kathryn A 4730 Meridan....DE vnshr 3-6484
Kelly Kathryn A 1924 E Tioga.....NE 4-2138
Kelly Kathryn T Montevista Apt .....GR 3-7887
Kelly Kathy Wigard Av .....IV 2-0573
Kelly Kathyrn M 3065 Belgrade.....GA 3-8419
Kelly Katie 2027 Ogden.....PO 3-8685
Kelly L 2542 N Orkney .....GA 6-5072
Kelly L F 1357 E Price .....CA 4-2795
Kelly L J 1329 W Cheltnhm Av ElkinsPrk..CA 4-2888
Kelly L P 568 E Marnel .....GL 5-6244

KELLY LABORATORIES
5601 Cedar Av.....GR 2-5953
Kelly Larry 1823 S Broad .....HO 3-8088
Kelly Lawrence B2 W Godfrey Av ...LIvnstn 8-6769
Kelly Lawrence J 3961 Lankmu Av .... GR 3-7382
Kelly Lawrence P 4439 Princetn Av.... DE 2-5939
Kelly Lelia 3229 W Montgmry Av.....CE 6-4574
Kelly Leo 7221 Cottage.....DEvnshr 8-1829
Kelly Leo M 6722 Lebanon Av.....GRnwd 3-8742
Kelly Leona 5420 N Girard Av.....GR 3-7153
Kelly Leroy 1402 S Napa .....HOwrd 5-8219
Kelly Lessie 517 N Wanamaker....GRnit 6-8365
Kelly Levi 4130 Parkside Av .....TR 8-4086
Kelly Lila Mrs 5435 Delancey .....GR 2-6033
Kelly Lillian 437 W Raymond.....GLadstn 7-1867
Kelly Lillian 2125 Shallcross ..... PI 4-2975
Kelly Lillian S Mrs 4530 N Carlisle DAmpnt 4-7926
Kelly Lillie M Mrs 818 N 20 .....CEntr 2-0474
Kelly Loretta J Mrs 12050 Glenfld- ... ME 7-0829
Kelly Lorraine 1310 Geary Terr ..... DE 4-4864
Kelly Lorraine M 5506 N 3 .....LIvnstn 8-7272
Kelly Louanna 1728 N Stillmn ..... PO 9-4897
Kelly Louis 2334 E Boston .....NEbrska 4-7773
Kelly Louis E 431 E Montana.....VIctr 3-0910
Kelly Louis V 4811 Windsor Av ....SAratga 7-8230
Kelly Louise 150 N Wilton.....GR anit 4-1070

Kelly Lucelile A 1116 Duncannon..DAvnprt 9-1943
Kelly M 2036 S Bancroft .....DE 6-0383
Kelly M 1615 S 6 .....HO 8-1545
Kelly M A 6368 Columbia Av.....GRnwd 3-1490
Kelly M A 4212 Elsinore .....CUmbrlnd 8-3042
Kelly M A 4938 N Marvine .....DA 9-7719
Kelly M C 7513 Walnut Ln.....HA 4-7620
Kelly M E 2013 E Tioga .....JE 5-5592
Kelly M J Co meats 130 N Delaware Av ..WA 2-3712
Kelly M K 5230 N Amer .....DAvnprt 4-1775
Kelly M M 1143 S Peach .....SA 6-5726
Kelly M M 3468 W Penn St .....GE 8-7017
Kelly M M 2231 N 2 .....RE 9-2275
Kelly M M 5616 N 4 .....WA 4-3768
Kelly M R 3433 W Queen Ln .....VI 3-6338
Kelly Mabel 4247 Levick .....DE 8-3259
Kelly Magdaliene Mrs 101 E Hortter.....VI 4-1149
Kelly Malcolm Mrs 3305 Powltn Av ....EV 7-0278
Kelly Marcella 406 N 40.....EVrgrn 6-9186
Kelly Margaret 2336 Almond.....REgnt 9-5581
Kelly Margaret 4629 Baltmre Av .....SA 9-2810
Kelly Margaret 7901 Bayard .....LIvnstn 9-2271
Kelly Margaret 4222 Elsinore ...CUmbrlnd 9-4426
Kelly Margaret 5464 New Pl .....SH 8-3591
Kelly Margaret 2101 North College Av .CEntr 2-4060
Kelly Margaret 6514 N Park Av.....WA 4-3142
Kelly Margaret Mrs 233 Gates.....IV 2-0576
Kelly Margaret Mrs 629 S 26.....PEnyplv 5-6045
Kelly Margaret A Mrs 1319 S 29....HOwrd 2-2428
Kelly Margaret C Mrs 7134 Torresdle Av DE 2-6449
Kelly Margaret H Mrs 1509 S 28 .....DEwy 6-0231
Kelly Margaret K 7218 Jackson .DEvnshr 2-0621
Kelly Margaret M 4816 Beaumnt Av.....SA 7-7338
Kelly Margaret M 6429 Beechwd ..LIvnstn 9-3022
Kelly Margaret M 1823 S Broad .....HO 3-8088
Kelly Margaret M 2025 S Bucknell..FU ltn 9-4209
Kelly Margaret M 301 E Gravers Ln ....CH 2-0167
Kelly Margaret M 512 Kerper .....RA 2-0230
Kelly Margaret M 2425 Sergeant..BA ldwn 9-5659
Kelly Margaret M 502 S 57.....GRnit 2-6093
Kelly Margaret W 1356 Mapee Av.CUmbrlnd 9-5455
Kelly Marie Mrs 2638 Catharine ...KIngsly 5-3824
Kelly Marie Mrs 1329 S 29 .....HO 2-8348
Kelly Marie B 7113 Erdrick.....DE vnshr 3-3555
Kelly Marie M 122 W Chamblott....WAvrly 4-5243
Kelly Marion L 410 W Woodlwn.....VIctr 8-9861
Kelly Marion V Mrs 5435 Chester Av .....SA 9-7855
Kelly Mark J 5727 N Howard.....WAvrly 4-8380
Kelly Martha Mrs 3433 N Bodine....GArfld 6-1628
Kelly Martha A 4643 Emery .....JEfrsn 5-8909
Kelly Martin 7700 Torrsdle Av .....DE 3-3650
Kelly Martin J 2670 Belgrade.....NEbrska 4-3965
Kelly Martin M 3506 York Rd.....BA 8-1064
Kelly Mary 2337 E Norris .....GA 3-4791
Kelly Mary 1040 N Drianna .....WA 5-3516
Kelly Mary Mrs 3608 Calumet.....VIctr 4-0587
Kelly Mary Mrs 2648 Fkd Av.....REgnt 9-0156
Kelly Mary Mrs 2829 N Front.....RE gnt 9-8059
Kelly Mary Mrs 2217 Montrose.....PE 5-2035
Kelly Mary Mrs 1632 S Yewdall .....SA 9-2875
Kelly Mary A 2646 S 2 .....HOwrd 2-8759
Kelly Mary Ann 1811 Rhawn .....RA 2-1603
Kelly Mary Anne 880 Bridge.....CUmbrlnd 9-6604
Kelly Mary E 5728 Cedar Av.....GRnit 2-1313
Kelly Mary E 6602 Ooret .....SArtoga 6-1896
Kelly Mary E Mrs 1437 S Ringgold St DEwy 4-3590
Kelly Mary F 4661 Adams Av.....Ploner 3-0401
Kelly Mary F Mrs 6101 Algon Av .....JE 5-8652
Kelly Mary G 904 E Cheltn Av .....VIctr 3-0974
Kelly Mary G Mrs 5857 Brush Rd...LIvnstn 8-2307
Kelly Mary I 6345 Cardiff .....CU 8-6118
Kelly Mary J Hookinson House .....WA 2-4142
Kelly Mary J 930 St Vincent .....PI 2-8632
Kelly Mary Jane Mrs 1106 Rising Sun Av.BA 6-2284
Kelly Mary K Mrs 7230 Devon .....CHestHl 7-0491
Kelly Mary Louise 5530 Locust .....KI 6-5095
Kelly Mary M Mrs 3426 Mowtl Terr .... IV 2-7028
Kelly Mary T 5840 Oxford Av.....JE frsn 3-5934
Kelly Mary T Mrs 1644 S Conestoga.SArtoga 7-0471
Kelly Mary Teresa 4136 Levick....DEvnshr 2-5391
Kelly Mary V 2308 E Lehigh Av.....REgnt 9-7553
Kelly Mary V Mrs Overbrook Grdn Apt ....TR 7-0631
Kelly Matthew A 1808 Beverly Rd..LIvnstn 9-0873
Kelly Matthew A 2617 S 17 .....DEwy 4-2692
Kelly Matthew A Jr 11821 Basile Rd NEptn 7-5254
Kelly Matthew R 11717 Lanett Rd...NEptn 7-1383
Kelly Maurice 4842 N Carlisle....DAvnprt 9-4991
Kelly Maybelle 836 E Haines.....VI 3-2725
Kelly&McGinley beer 544EVanKirk ..PIlgrm 5-9067
Kelly Michael 6889 Forrest Av....WAvrly 7-2595
Kelly Michael 2349 S Lee.....FUltn 9-5312
Kelly Michael A 4253 Frost .....MA 4-6934
Kelly Michael A 302 W Sparks .....LIvnstn 9-1931
Kelly Michael D 1300 N 51 .....TR 8-9298
Kelly Michael J 3566 Calumet .....VIctr 8-8450
Kelly Michael J 5331 Heoge.....Ploner 3-6586
Kelly Michael J 4145 Maywood.....JEfrsn 5-4499
Kelly Michael J 4341 Orianna.....GLadstn 5-4466
Kelly Michael J 2120 Snallcrss .....PI 3-2133
Kelly Michael P 4842 E Roosvlt Blvd ...CU 8-1766
Kelly Michael V 322 Heltermn .....PI 5-8372
Kelly Mildred I 221 Higbee .....FIdlty 2-3995
Kelly Milton 6449 N 16 .....WA 7-7492
Kelly&Mooney attys
Phila Natl Bank Bl .....LO 7-3947
Phila Natl Bank Bl .....LO 7-4629

KELLY MOTOR FREIGHT INC
2030 S 62 .....SA 9-2250
2030 S 62 .....SA 7-5377
Kelly Myrtle 5927 Mascher.....LI vnstn 9-3457
Kelly Myrtle 2043 W Oxford St ....POplr 3-3074
Kelly Myrtle A 2148 E Orleans .....NE 4-0803
Kelly Nan Mrs 6507 Grays Av ....SArtoga 9-8081
Kelly Nan G 4835 Walton Av.....SHerwd 7-3488
Kelly Nancy M 4746 N 10 .....GL 5-5662
Kelly Nathaniel C 2478 S 20 .....HO 5-0811
Kelly Nora 4628 Tampa .....GL 7-1051
Kelly Norman A 226 W Queen La.....VI ctr 4-8487
Kelly Norman J 1448 Lardner.....JEfrsn 3-8577
Kelly Norman M 532 Cypress .....WA 2-0243
Kelly Novella S 2432 Kimball.....KI 5-0227

Kelly Orvin 836 E Haines.....VI 3-2725
Kelly Otis T 4720 Larchwd Av.....SA 7-5686
Kelly Owen 2048 E Wishart.....RE gnt 9-2081
Kelly P E 6346 Woodbine Av .....GR 7-3382
Kelly P J 430 E Mt Airy Av .....CH 2-0989
Kelly Patricia A 3224 Cottman Av.DEvnshr 2-1330
Kelly Patricia M 4615 VanKirk .....JE 3-8032
Kelly Patrick 123 W Hanstery.....VI 3-2814
Kelly Patk 518 E Hilton .....GA 6-3744
Kelly Patrick F 1104 Rhawn.....PIlgrm 2-8638
Kelly Patrick J 9777 Clark .....OR 7-3264
Kelly Patrick J 4057 Creston.....CUmbrlnd 9-5694
Kelly Patk J 7504 Dorcas .....FI 2-9780
Kelly Patrick J 7936 Leonard.....DE 2-7658
Kelly Patrick J 9535 Rising Sun Av.ORchrd 3-3365
Kelly Patrick L 8385 Fkd Av .....DE 1-3699
Kelly Paul 4217 Elbridge.....DEvnshr 8-8201
Kelly Paul 963 E Ontario .....GA 3-3693
Kelly Paul Capt 5512 Houghtn.....IV 2-3668
Kelly Paul E 6346 Woodbine Av....TR lnty 7-5964
Kelly Paul J 3170 Almond .....RE 9-8630
Kelly Paul J 7901 Ridge Av.....IV 3-2583
Kelly Paul J 4601 Springfld Av.....BA 2-3691
Kelly Paul J Jr 194 W Fern .....WAvrly 7-1687
Kelly Paul R The Morgan Hse .....CH 7-3203
Kelly Pauline 739 N Corinthian Av....PO 9-3177
Kelly Pauline M Mrs 133 N Salford..GRnit 4-9546
Kelly Pearl Mrs 1416 Clearvw .....WA 7-5160
Kelly Pearl E 5734 Filbert .....SH 8-6028
Kelly Peter 4635 Strahle .....OE 1-0724
Kelly Peter F Verree&Welsh Rds....ORchrd 3-0715
Kelly Peter J 228 W Sparks.....WAvrly 7-5037
Kelly Phillip 1508 N 61 .....TR lnty 7-2262
Kelly Prince 1723 N 18 .....CEntr 2-9059
Kelly Queenie 1847 N Taney .....CE 2-9065
Kelly R A 1001 66 Av .....LI 9-6968
Kelly R W 3131 Guilford.....DE vnshr 3-0948
Kelly Rae Hopkinsn Hse.....MA 7-2715
Kelly Ralph 2839 E Victora .....GA 3-9517
Kelly Ralph Mrs 39&Chestnt .....BA 2-3979
Kelly Raymond 11711 Gifford .....ORchrd 3-8500
Kelly Raymond 3843 Oak Or .....DE 1-1954
Kelly Raymond 442 W Somerset....GArfld 5-0591
Kelly Raymond A 6631 Walker.....DE 8-9755
Kelly Raymond E 8110 Markindale...DEvnshr 3-6469
Kelly Raymond F 1138 Bloomdle Rd ..HObrt 4-7720
Kelly Raymond J 2148 E Stella....NEbrska 4-2037
Kelly Raymond W 1928 S 2.....HOwrd 2-0955
Kelly Reena Mrs 1029 W Somerst .....BA 9-7255
Kelly Richd 1305 Kimberly Dr .....GR 7-9789
Kelly Richd Mrs 6028 Kingsessng Av....SA 6-6208
Kelly Richd A 2813 Rversn Pl .....HO 4-7163
Kelly Richd D 12050 Glenfld.....NE 7-0829
Kelly Richd O 1503 Womrath .....CU 8-0187
Kelly Richd E 3706 Azalea Dr .....DE 8-8592
Kelly Richd F 7502 Tulpehkn St....HAncok 4-4993
Kelly Richd G bldr TobyFarms Brookhvn..SA 7-1395
Kelly Richd J 1349 S Newkirk.....HOwrd 8-6484
Kelly Richd J 1866 E Wensley ....NEbrska 4-4681
Kelly Richd J Jns Girard Tr Bl .....LO 4-1235
Kelly Richd L 870 Carver .....JEfrsn 3-7945
Kelly Richd M 533 Christian.....HOwrd 5-9389
Kelly Rita Beauty Shop 3345 Kensngtn Av GA 5-0935
Kelly Robt 6524 N Amer.....WAvrly 7-4645
Kelly Robt 5213 Florence Av.....SA 4-4176
Kelly Robt 1416 N Frazr .....TR 8-9588
Kelly Robt 1514 S Patton .....FUltn 9-2360
Kelly Robt 1831 Wakelng .....CUmbrlnd 9-2074
Kelly Robt A 1617 S Etting .....HOwrd 8-5944
Kelly Robt A 8104 Michener .....CHestHl 7-4079
Kelly Robt B 6522 Windsr Av.....SArtoga 6-4872
Kelly Robt C 7905 Dungan Rd.....RA 5-3572
Kelly Robt C 9326 Treut Rd.....HObrt 4-5140
Kelly Robt G 866 Wynnwd Rd .....GR 7-7519
Kelly Robt G atty 4 Pen Cntr Plaza ....LO 9-2333
Kelly Robt G Jr atty 4 Pen Cntr Plaza...LO 9-2333
Kelly Robt H 623 E Locust Av.....VIctr 3-4462
Kelly Robt J 2957 Rutledge.....REgnt 9-8560
Kelly Robt J 8011 Terry .....MA 4-6233
Kelly Robt Jas 931 E Woodlawn .....GE 8-1959
Kelly Robt T 341 W Rosemar.....LI vnstn 8-6890
Kelly Robt V Erringer Pl Apt .....GE 8-3412
Kelly Robt W 3805 Oakhill Rd.....NEptn 7-5740
Kelly Robt W 1015 Welsh Rd.....OR 6-1099
Kelly Roland L 1319 N 61.....TRnity 7-5868
Kelly Ronald W 4975 Hardy Rd ....ORchrd 3-7841
Kelly Rose Mrs 436 W Courtland ...GLadstn 5-6875
Kelly Roy 7236 Limekiln Pk .....HA 4-5217
Kelly Rubin 1823 N 35 .....CEntr 2-4308
Kelly Ruby 816 N Markoe .....EV 7-2081
Kelly Russell L 3613 Haywd.....VIctr 8-4232
Kelly Russell S 804 Tyson.....PI lgrm 5-9036
Kelly Russell S Jr 7320 Tabor Rd .....RA 5-3957
Kelly Ruth 7256 Limeklln Pk .....HA 4-5217
Kelly Ruth 5540 Linmore .....SA 4-1423
Kelly Ruth 1618 S 53 .....SA 7-5273
Kelly Ruth A Mrs 57 N 57.....GRnit 2-2372
Kelly Ruth B 3916 Delancey.....EV ergrn 6-1258
Kelly Ruth C 5425 Gathrne.....GR 2-7107
Kelly S 2324 Cheltnhm Av.....HA 4-0548
Kelly S L 411 Kerper .....RA 5-5899
Kelly-Salinas Guillermo 128 S 36 .....BA 2-6684
Kelly Sami 310 E Cornwall.....NE brska 4-1630
Kelly Saml F 3351 Ashville.....DEvnshr 2-6083
Kelly Saml F 8054 Cristpin.....MA yfair 4-6371
Kelly Saml J 3436 N 16 .....BA 5-8805
Kelly Sandra 4324 Mantnk Av .....IV 2-7847
Kelly Sara 4514 Pine .....GR 6-6807
Kelly Sarah Mrs 228 Greenwich.....FU ltn 9-6208
Kelly Savannah 1802 W Ontario....BAldwn 9-1834

KELLY SERVICES
Kelly Girl Div
Regional Ofc 2 Penn Ctr Plz .....LO 4-3110
Northeast Phila 1931 E Cotmn Av...RA 5-3033
Northeast Phila 5027 Frankford Av PI 4-2444
Labor Div 1224 Filbert.....LO 8-7864
Mktg Div 2 Penn Center Plaza.....LO 4-3110
Technical Div 2 Penn Ctr Plaza.....LO 4-5611
Serv Bur Div 6910 Mkt UpperDarby...FL 2-8125
6910 Market UpperDarby .....JA 8-5116

Kelly Sheila A 5030 Greene .....GE 8-2462
Kelly Shields M Mrs
Tulpehckn&Wayne Av.VI 4-4276
Kelly Shirley 6300 N 17 .....LI 8-4347
Kelly Stanley F 1342 Foulkrd.....CU 9-1457
Kelly Stephen 32 Summit.....CHestnl 7-5697
Kelly Steven 248 Apsley .....GLadstn 5-5558
Kelly Susan T 4144 Levick .....RA 4-5412
Kelly T B 533 Gerhard .....IV 3-5812
Kelly T J 225 E Penn .....VI 4-7161
Kelly T J 1419 Shunk .....FUltn 9-2633
Kelly Terence 4108 Paul .....PI 4-8541
Kelly Terence J 301 W Tabor Rd ..... LI 8-8472
Kelly Theresa Mrs 904 Johnstn .....HO 7-4984
Kelly Theresa M 1718 S Front.....HOwrd 2-5319
Kelly Thos 46 E Clapier.....GErmtn 8-8978
Kelly Thos 1338 S Newkirk .....HOwrd 5-1781
Kelly Thos 1730 Oregon Av .....DE 4-5989
Kelly Thos 5600 Spruce .....GRnit 2-7511
Kelly Thos 544 E VanKirk.....PIlgrm 5-9067
Kelly Thos 7226 Walkr .....DEvnshr 8-3455
Kelly Thos 2122 S 10 .....HO 8-5620
Kelly Thos Jr 6065 N Philip.....LIvnstn 9-8929
Kelly Thos Mrs 5631 N Fairhl .....WA 7-1334
Kelly Thos Rev 1719 Morris .....HO 8-0955
Kelly Thos A 9020 Ashton Rd.....ORchrd 7-0923
Kelly Thos A 452 Howell.....PIlgrm 5-3579
Kelly Thos A 1903 S 20.....FUltn 9-1238
Kelly Thos A Jr 646 Allenzrv .....RA 5-3074
Kelly Thos A Jr 544 Vankirk.....RAndlf 5-1045
Kelly Thos B 6507 Newtown Av.....PI 5-6498
Kelly Thos C 2613 S Hicks.....FU ltn 9-3433

KELLY THOMAS CATERERS
Wigard Av .....IV 2-3457
1215 Summer .....LO 4-5575
Kelly Thos E 7523 Briar Rd.....WA vrly 4-1709
Kelly Thos E 2514 S Gross.....SArtoga 6-0966
Kelly Thos E 3242 Wellingtn.....MAylr 4-5167
Kelly Thos F 1127 Anchor .....Ploner 3-9155
Kelly Thos F 8233 Cedarbrk .....CH 7-6204
Kelly Thos F 1521 Lindley Av.....GL 7-5037
Kelly Thos F 4720 N 11.....DAmpnt 4-1172
Kelly Thos G 7124 Glenich.....MA 4-8942
Kelly Thos H 4630 Ditman.....JEfrsn 3-0357
Kelly Thos H 8016 Ridge Av .....IV 3-5940
Kelly Thos J 4804 Alcott .....PI 4-5890
Kelly Thos J 3315 N Amer.....RE gnt 9-8318
Kelly Thos J 12466 Balston Rd.....NEptn 7-6605
Kelly Thos J 1678 Church St.....JEfrsn 5-3051
Kelly Thos J Dorchstr Apt .....PE 5-7137
Kelly Thos J 725 Levick.....FIdlty 2-9227
Kelly Thos J 1512 Lindbrgh Av Roslyn ..OL 9-1599
Kelly Thos J 1942 E Moyamensing Av.HOwrd 8-3733
Kelly Thos J 2637 S Muhlfeld.....SArtoga 6-9266
Kelly Thos J 264 Osborn .....IV 2-4997
Kelly Thos J 441 Pensdle.....IV 3-2740
Kelly Thos J 1327 N 19.....POplr 5-7004
Kelly Thos J Jr 3417 N Dillman...NEbrska 4-4313
Kelly Thos J Sr 4510 McKinley ....DEvnshr 3-5740

KELLY THOMAS J INC ins
761 Huntingdn Pke Rockledge.....RA 5-7200
Kelly Thos J Sons bldrs 1454 EGreenwd HA 4-4434
Kelly Thos M 5019 Copley Rd .....VI 4-6458
Kelly Thos M 5429 Hadfld .....GRnit 6-7659
Kelly Thos M 9807 Wistaria .....OR 6-2955
Kelly Thos N 865 E Cornwall .....RE 9-3822
Kelly Thos P 911 Brill .....JEfrsn 5-3294
Kelly Thos P 2637 S Hobson.....SArtoga 7-2917
Kelly Thos P 3543 Nottingham La....NEptn 7-6468
Kelly Thos P 5911 Weymouth.....PI lgrm 5-7777
Kelly Thos P 1909 Willer.....HObrt 4-0125
Kelly Thos P Rev 700 N 67 .....GR 3-4217
Kelly Thos V 5410 Bartram Dr....SArtoga 4-2365
Kelly Thos W 5523 Mascher .....CA 4-6056
Kelly Timothy 5433 Wayne Av .....VI 8-7067
Kelly Tobias F 7038 Reedind .....SAratga 9-4621
Kelly V E 3135 N 7.....BAldwn 8-5284
Kelly V J 6323 Elmwd Av.....SA ratga 9-7245
Kelly Vermell 2337 N 11 .....PO 5-1179
Kelly Verna E 8220 Rockwell Av.....RAndlf 8-6948
Kelly Vernie L 316 S 62.....GR 2-1947
Kelly Vernon Jr 233 S 46 .....EV 2-0577
Kelly Veronica C 237 W Mentor....GLadstn 5-9610
Kelly Victoria C 4234 N Claridge St.Ploner 3-8668
Kelly Vincent 4118 Paul.....JEfrsn 3-6263
Kelly Vincent 6614 Rising Sun Av..PIlgrm 5-8638
Kelly Vincent 7423 Shister.....FIdlty 2-7669
Kelly Vincent B 3075 Cedar.....RE gnt 9-9243
Kelly Vincent J 531 E Allegheny Av....NE 4-4335
Kelly Viola A 2560 N 16 .....BAldwn 9-5380
Kelly W Boyer 6104 Bustleto Av....JEfrsn 5-7679
Kelly W R Col 684 Rennard .....GR 3-5488
Kelly Walter 162 W Fern .....LIvnstn 8-0452
Kelly Walter 1439 N Perth.....CE 6-7218
Kelly Walter 130 N 51.....GRnit 6-4512
Kelly Walter C 5436 Windsor Av .....SA 9-6024
Kelly Walter E 9231 Andorn Rd....ORchrd 3-1169
Kelly Walter E 6080 Drexel Rd.....TR 7-3316
Kelly Walter E 2316 Soruca.....LOcst 4-2830
Kelly Walter J 5454 Belmar Ter .....SA 6-0959
Kelly Walter J Jr 6106 N Marshall..LIvnstn 8-5712
Kelly Walter L 262 E Clivdn .....VI 4-0538
Kelly Wreiona 6718 Chew.....GE rmtn 8-2400
Kelly Wesley 6265 Gillespie.....DEvnshr 8-6178
Kelly Wilbert apptncs 4118 Mkt .....EV 2-0241
Kelly Wm 1207 W Atlantic.....BAldwn 5-8784
Kelly Wm 2514 E Auburn .....CA 6-9811
Kelly Wm 5218 N Fairhl .....DA 4-4768
Kelly Wm 5840 Florence Av.....SArtoga 4-1329
Kelly Wm 204 W Ruskomb .....GLadstn 5-4922
Kelly Wm 1029 W Somerst .....BA 8-7255
Kelly Wm 2034 S 68 St.....SArtoga 6-4235
Kelly Wm A 4532 Vista .....DEvnshr 2-9474
Kelly Wm A Jr 5315 Arlingtn.....GRnwd 7-1871

KELLY WILLIAM A IND haul
1526 N Amer .....PO 3-1475
1526 N Amer .....PO 3-3321
Kelly Wm Advrg Agncy 1808 Ritnhse Sq ..KI 6-7465

VIII. Keyboarding Times

The times used for keyboarding data for input to the computer in this analysis are based on TTS keyboarding rates and character counts provided by RCA.

It should be noted that for simple work the time for computer input keyboarding is somewhat higher relatively than it is for certain classes of so-called complex work. When dealing with straight text the codes required on the input tape for composition codes actually increased the number of characters keyed as compared to conventional processes such as Linotype. Thus on the sample "The Group" a total of 2,537 characters had to be keyed for computer input compared to 2,388 keystrokes for TTS input to a line casting machine for the same page.

Conversely on the complex sample "Book Catalogue" computer input required 11,196 characters to be keyed as opposed to 12,300 characters via conventional systems.

In this analysis the rate of correction was assumed to be 2.5 lines per 100 lines composed. The correction keying rate was established at 9,000 characters per hour. Initial keying rates were established at an average of 11,590 characters per hour. This difference in keying rates is in keeping with observed practice so as to allow more care in making corrections.

Extreme fluctuations in keying rates were observed in the participating firms. The highest rate achieved was 27,790 characters per hour and the lowest rate reported was 4,825 characters per hour.

Without detailed time studies it is not possible to establish standard keying times by instrument used. In this analysis, however, comparable rates have been used for computer input and TTS keyboarding. Reported rates on Monotype were systematically lower and the Monotype analysis uses standard data of a progressive British firm based on engineered time standards.

It should be stressed that this area is deserving of far more study than it has yet received. Indeed, it may well be that the entire economic rationale for electronic composition rests on its impact on input keyboarding costs.

IX. United States Initial Keyboarding and Correction Costs For Computer Input

Sample	Initial time	Correction time	Rate [1]	Cost
1. The Group	12.11	0.42	0.0866	$1.0851
2. Policy	17.10	.55	.0866	1.5285
3. Prices and Production	15.57	.48	.0866	1.3899
4. Pleistocene	19.80	.62	.0866	1.7683
5. American Bar	35.25	1.10	.0866	3.1479
6. Book catalog	59.25	1.86	.0866	5.2911
7. Hardware directory	88.04	2.77	.0866	7.8641
8. Telephone directory	143.80	4.52	.0866	12.8445

[1] Capital—$0.0054; labor—$0.0812.

X. Paper Tape Conversion

In this analysis standard times for conversion of paper tape to magnetic tape, which was the input medium for the computers involved were, unfortunately, not captured.

Since, however, conversion of paper tape to magnetic tape has impact on processing times and costs the study assumes off-line conversion of paper tape to magnetic tape by means of a 150 character per second Digi Data Converter in Equation I. The lease cost of the converter has been factored into the cost of supplies for execution of Equation I. Computer costs in Equation I exclude paper tape reading equipment.

In Equation II the opportunity to use the computer itself as the conversion device arises. When residual capacity exists on the computer at breakeven *this is the lower cost method of conversion.* Accordingly the computer configurations used in Equation II include paper tape reading equipment. The supply costs do not include a cost for off-line conversion.

XI. Paper Tape to Magnetic Tape Conversion Capacity at 150 CPS

Sample	Characters	Pages per shift
1. The Group	2,537	37,461
2. Policy	3,287	28,913
3. Prices and Production	3,112	30,539
4. Pleistocene	3,722	25,534
5. American Bar	6,661	14,268
6. Book catalog	11,196	8,488
7. Hardware directory	16,637	5,712
8. Telephone directory	27,175	3,497

Note: Cost per month for converter (Digi Data System 10), $453.

XII. Capital Cost to Convert Paper Tape to Magnetic Tape Based on 150 CPS Converter at 100 Percent Prime Shift Utilization

Sample	Characters	Cost per page
1. The Group	2,537	$0.0120
2. Policy	3,287	.0156
3. Prices and Production	3,112	.0147
4. Pleistocene	3,722	.0177
5. American Bar	6,661	.0317
6. Book catalog	11,196	.0533
7. Hardware directory	16,637	.0793
8. Telephone directory	27,175	.1295

XIII. Computer Cycle Times in Minutes [1]

Sample	Computer and generalized software			
	Mergenthaler IBM 360-50	Harris IBM 360-30	RCA 70/45	RCA 70/35
1. The Group	0.1062	0.1000	0.0720	0.1370
2. Policy	.1394	.1666	.0787	.1607
3. Prices and Production	.1162	.1666	.0707	.1507
4. Pleistocene	.1693	.3666	.0983	.1843
5. American Bar	.2722	1.0666	.1830	.3620
6. Book catalog	.6341	2.4000	.6880	1.1790
7. Hardware directory	.3685	2.3666	.4757	.9477
8. Telephone directory	.6108	4.0666	.7313	1.4610

[1] 2 cycles of time for each computer shown when executing the generalized software provided by the indicated firms. See app. II for description of timing methods.

XIV. Composer Cycle Times in Minutes [1]

Sample	Linotron [2] 505	Linotron 1010	Fototronic CRT	Videocomp
1. The Group	1.0332	0.1125	0.1333	0.1117
2. Policy	1.6000	.1166	.1666	.1300
3. Prices and Production	1.3000	.1216	.1666	.1250
4. Pleistocene	2.1000	.1500	.1666	.1567
5. American Bar	3.9000	.2300	.2500	.2433
6. Book catalog	24.7610	.3916	.4000	.4167
7. Hardware directory	5.9320	.3833	.3333	.4183
8. Telephone directory	[3]	.5833	.6500	.5467

[1] 2 cycles; 1 in proof mode at low resolution and the other in high resolution unless otherwise indicated.
[2] 2 cycles; both in 650 line per inch resolution.
[3] Did not set.

XV. Costs to Set Sample Pages by Conventional Processes—United States

The tables that follow represent calculated costs to set the sample pages by Linotype, Monotype, and a Photon 713 driven by an Elliot 903 computer.

PROCESS: LINOTYPE—SAMPLE: THE GROUP

Function	Time	Rate	Cost
I. Input keyboarding:			
A. Labor	18.872	$0.0812	$1.5324
B. Capital	18.872	.0113	.2133
II. Page makeup:			
A. Labor	.65	.0812	.0528
III. Initial proof:			
A. Labor	.50	.0812	.0406
IV. Correction keyboarding:			
A. Labor	.62	.0812	.0503
B. Capital	.62	.0113	.0070
V. Insertion of corrections:			
A. Labor	.36	.0812	.0292
VI. House proof:			
A. Labor	.50	.0812	.0406
VII. Supplies			.0947
Total			2.0609

	Amount	Percent
Cost summary:		
Total capital	$0.2203	10.6
Total labor	1.7459	84.8
Supplies	.0947	4.6
Grand total	2.0609	100.0

PROCESS: LINOTYPE—SAMPLE: POLICY

Function	Time	Rate	Cost
I. Input Keyboarding:			
A. Labor	27.8	$0.0812	$2.2575
B. Capital	27.8	.0113	.3141
II. Page makeup:			
A. Labor	1.35	.0812	.1096
III. Initial proof:			
A. Labor	.50	.0812	.0406
IV. Correction keyboarding:			
A. Labor	1.70	.0812	.1380
B. Capital	1.70	.0812	.0192
V. Insertion of corrections:			
A. Labor	.36	.0812	.0292
VI. House proof:			
A. Labor	.50	.0812	.0406
VII. Supply costs			.0947
Total			3.0435

	Amount	Percent
Cost summary:		
Total capital	$0.3333	10.95
Total labor	2.6155	85.93
Supplies	.0947	3.12
Grand total	3.0435	100.00

PROCESS: LINOTYPE—SAMPLE: PRICES AND PRODUCTION

Function	Time	Rate	Cost
I. Input keyboarding:			
A. Labor	27.7	$0.0812	$2.2493
B. Capital	27.7	.0113	.3030
II. Page makeup:			
A. Labor	1.45	.0812	.1177
III. Initial proof:			
A. Labor	.50	.0812	.0406
IV. Correction keyboarding:			
A. Labor	1.50	.0812	.1218
B. Capital	1.50	.0113	.0170
V. Insertion of corrections:			
A. Labor	.36	.0812	.0292
VI. House proof:			
A. Labor	.50	.0812	.0406
VII. Supply costs			.0947
Total			3.0139

	Amount	Percent
Cost summary:		
Total capital	$0.3200	10.61
Total labor	2.5992	86.25
Supplies	.0947	3.14
Grand total	3.0139	100.00

PROCESS: LINOTYPE—SAMPLE: PLEISTOCENE

Function	Time	Rate	Cost
I. Input keyboarding:			
A. Labor	33.7	$0.0812	$2.7364
B. Capital	33.7	.0113	.3808
II. Page makeup:			
A. Labor	1.85	.0812	.1502
III. Initial proof:			
A. Labor	.50	.0812	.0406
IV. Correction keyboarding:			
A. Labor	1.70	.0113	.0192
B. Capital	1.70	.0812	.1380
V. Insertion of corrections:			
A. Labor	.36	.0812	.0292
VI. House proof:			
A. Labor	.50	.0812	.0406
VII. Supply costs			.0947
Total			3.6298

	Amount	Percent
Cost summary:		
Total capital	$0.5188	14.29
Total labor	3.0163	83.09
Supplies	.0947	2.62
Grand total	3.6298	100.00

PROCESS: LINOTYPE—SAMPLE: AMERICAN BAR

Function	Time	Rate	Cost
I. Input keyboarding:			
A. Labor	57.0	$0.0812	$4.6284
B. Capital	57.0	.0113	.6441
II. Page makeup:			
A. Labor	10.03	.0812	.8959
III. Initial proof:			
A. Labor	.5	.0812	.0406
IV. Correction keyboarding:			
A. Labor	3.0	.0812	.2436
B. Capital	3.0	.0113	.0339
V. Insertion of corrections:			
A. Labor	.36	.0812	.0292
VI. House proof:			
A. Labor	.5	.0812	.0460
VII. Supply costs:			.0947
Total			6.5107

	Amount	Percent
Cost summary:		
Total capital	$0.6780	10.41
Total labor	5.7380	88.13
Supplies	.0947	1.45
Grand total	6.5107	99.99

PROCESS: LINOTYPE—SAMPLE: BOOK CATALOG

Function	Time	Rate	Cost
I. Input keyboarding:			
A. Labor	103.7	$0.0812	$8.4204
B. Capital	103.7	.0113	1.1718
II. Page makeup:			
A. Labor	26.79	.0812	1.3642
III. Initial proof:			
A. Labor	.5	.0812	.0460
IV. Correction keyboarding:			
A. Labor	6.0	.0812	.4872
B. Capital	6.0	.0113	.0678
V. Insertion of corrections:			
A. Labor	.36	.0812	.0292
VI. House proof:			
A. Labor	.5	.0812	.0460
VII. Supply costs			.0947
Total			11.7266

	Amount	Percent
Cost summary:		
Total capital	$1.2396	10.57
Total labor	10.3923	88.62
Supplies	.0947	.80
Grand total	11.7266	99.99

PROCESS: LINOTYPE—SAMPLE: HARDWARE DIRECTORY

Function	Time	Rate	Cost
I. Input keyboarding:			
A. Labor	102.0	$0.0812	$8.2822
B. Capital	102.0	.0113	1.1525
II. Page makeup:			
A. Labor	16.8	.0812	1.3642
III. Initial proof:			
A. Labor	.5	.0812	.0460
IV. Correction keyboarding:			
A. Labor	5.5	.0812	.4466
B. Capital	5.5	.0113	.0622
V. Insertion of corrections:			
A. Labor	.36	.0812	.0292
VI. House proof:			
A. Labor	.5	.0812	.0460
VII. Supply costs			.0947
Total			$11.5236

	Amount	Percent
Cost summary:		
Total capital	$1.2147	10.54
Total labor	10.2142	88.63
Supplies	.0947	.82
Grand total	11.5236	99.99

PROCESS: LINOTYPE—SAMPLE: TELEPHONE DIRECTORY

Function	Time	Rate	Cost
I. Input keyboarding:			
A. Labor	217.18	$0.0812	$17.6350
B. Capital	217.18	.0113	2.4542
II. Page makeup:			
A. Labor	22.8	.0812	1.8514
III. Initial proof:			
A. Labor	.5	.0812	.0460
IV. Correction keyboarding:			
A. Labor	12.0	.0812	.9744
B. Capital	12.0	.0113	.1356
V. Insertion of corrections:			
A. Labor	.36	.0812	.0292
VI. House proof:			
A. Labor	.5	.0812	.0460
VII. Supply costs			.0947
Total			23.2665

PROCESS: LINOTYPE—SAMPLE: TELEPHONE DIRECTORY—Continued

	Amount	Percent
Cost summary:		
Total capital	$2.5898	11.13
Total labor	20.5820	88.46
Supplies	.0947	.41
Grand total	23.2665	100.00

PROCESS: MONOTYPE—SAMPLE: THE GROUP

Function	Time	Rate	Cost
I. Input keyboarding:			
A. Labor	21.8	$0.08120	$1.7702
B. Capital	21.8	.00014	.0033
II. Casting:			
A. Labor	23.0	.0406	.9338
B. Capital	23.0	.00120	.0276
III. Page makeup:			
A. Labor	4.0	.08120	.3248
IV. Insertion of corrections:			
A. Labor	4.1	.08120	.3331
V. House proof:			
A. Labor	.9	.08120	.0731
VI. Supplies			.1200
Total			3.5858

	Amount	Percent
Cost summary:		
Total capital	$0.0390	0.87
Total labor	3.4349	95.79
Supplies	.1200	3.34
Grand total	3.5858	100.00

PROCESS: MONOTYPE—SAMPLE: POLICY

Function	Time	Rate	Cost
I. Input keyboarding:			
A. Labor	25.9	$0.0812	$2.1031
B. Capital	25.9	.00014	.0036
II. Casting:			
A. Labor	29.4	.0406	1.1936
B. Capital	29.4	.0012	.0354
III. Page makeup:			
A. Labor	9.5	.0812	.7714
IV. Insertion of corrections:			
A. Labor	5.2	.0812	.4222
V. House proof:			
A. Labor	.9	.0812	.0731
VI. Supplies			.1200
Total			4.7824

	Amount	Percent
Cost summary:		
Total capital	$0.0390	0.82
Total labor	4.6634	97.51
Supplies	.1200	2.50
Grand total	4.7824	99.83

PROCESS: MONOTYPE—SAMPLE: PRICES AND PRODUCTION

Function	Time	Rate	Cost
I. Input keyboarding:			
A. Labor	26.0	$0.0812	$2.1112
B. Capital	26.0	.00014	.0036
II. Casting:			
A. Labor	27.6	.0406	1.1206
B. Capital	27.6	.0012	.0332
III. Page makeup:			
A. Labor	5.9	.0812	.4791
IV. Insertion of corrections:			
A. Labor	5.2	.0812	.4222
V. House proof:			
A. Labor	.9	.0812	.0731
VI. Supplies			.1200
Total			4.3630

PROCESS: MONOTYPE—SAMPLE: PRICES AND PRODUCTION—Continued

	Amount	Percent
Cost summary:		
Total capital	$0.0368	0.84
Total labor	4.2062	96.40
Supplies	.1200	2.75
Grand total	4.3630	99.99

PROCESS: MONOTYPE—SAMPLE: PLEISTOCENE

Function	Time	Rate	Cost
I. Input keyboarding:			
A. Labor	37.0	$0.0812	$3.0044
B. Capital	37.0	.00014	.0062
II. Casting:			
A. Labor	30.3	.0406	1.2302
B. Capital	30.3	.0012	.0364
III. Page makeup:			
A. Labor	11.0	.0812	.8932
IV. Insertion of corrections:			
A. Labor	5.8	.0812	.4710
V. House proof:			
A. Labor	.9	.0812	.0731
VI. Supplies			.1200
Total			5.8345

	Amount	Percen
Cost summary:		
Total capital	$0.0426	0.73
Total labor	5.6719	97.21
Supplies	.1200	2.50
Grand total	5.8345	99.99

PROCESS: MONOTYPE—SAMPLE: AMERICAN BAR

Function	Time	Rate	Cost
I. Input keyboarding:			
A. Labor	84.2	$0.0812	$6.8370
B. Capital	84.2	.014	.0118
II. Casting:			
A. Labor	67.4	.0406	2.7364
B. Capital	67.4	.0012	.0809
III. Page makeup:			
A. Labor	32.2	.0812	2.6146
IV. Insertion of corrections:			
A. Labor	11.9	.0812	.9664
V. House proof:			
A. Labor	.9	.0812	.0731
VI. Supplies			.1200
Total			13.4402

Cost summary:

	Amount	Percent
Cost summary:		
Total capital	$0.0927	0.69
Total labor	13.2075	98.41
Supplies	.1200	.89
Grand total	13.4202	99.99

PROCESS: MONOTYPE—SAMPLE: BOOK CATALOG

Function	Time	Rate	Cost
I. Input keyboarding:			
A. Labor	159.2	$0.0812	$12.9270
B. Capital	159.2	.00014	.0223
II. Casting:			
A. Labor	88.9	.0406	3.6093
B. Capital	88.9	.0012	.1069
III. Page makeup:			
A. Labor	15.6	.0812	1.2667
IV. Insertion of corrections:			
A. Labor	19.0	.0812	1.5428
V. House proof:			
A. Labor	.9	.0812	.0731
VI. Supplies			.1200
Total			19.6682

PROCESS: MONOTYPE—SAMPLE: BOOK CATALOG—Continued

	Amount	Percent
Cost summary:		
Total capital	$0.1292	0.65
Total labor	19.4190	98.73
Supplies	.1200	.61
Grand total	19.6682	99.99

PROCESS: MONOTYPE—SAMPLE: HAROWARE DIRECTORY

Function	Time	Rate	Cost
I. Input keyboarding:			
A. Labor	156.7	$0.0812	$12.7240
B. Capital	156.7	.00014	.0218
II. Casting:			
A. Labor	141.3	.0406	5.7368
B. Capital	141.3	.0012	.1691
III. Page makeup:			
A. Labor	48.1	.0812	3.9057
IV. Insertion of corrections:			
A. Labor	29.0	.0812	2.3548
V. House proof:			
A. Labor	.9	.0812	.0731
VI. Supplies			.1200
Total			25.1053

	Amount	Percent
Cost summary:		
Total capital	$0.1909	0.76
Total labor	24.7944	98.76
Supplies	.1200	.47
Grand total	25.1053	99.99

PROCESS: MONOTYPE—SAMPLE: TELEPHONE DIRECTORY

Function	Time	Rate	Cost
I. Input keyboarding:			
A. Labor	270.0	$0.0812	$21.9240
B. Capital	270.0	.00014	.0378
II. Casting:			
A. Labor	200.0	.0406	8.1200
B. Capital	200.0	.0012	.2400
III. Page makeup:			
A. Labor	25.0	.0812	2.0300
IV. Insertion of corrections:			
A. Labor	19.5	.0812	1.5834
V. House proof:			
A. Labor	.9	.0812	.0731
VI. Supplies			.1200
Total			34.2483

	Amount	Percent
Cost summary:		
Total capital	$0.2278	0.81
Total labor	38.8505	98.83
Supplies	.1200	.35
Grand total	34.2483	99.99

PROCESS: PHOTON 713, ELLIOT 903—SAMPLE: THE GROUP

Function	Time	Rate	Cost
I. Input keyboarding:			
A. Labor	12.0	$0.0812	$0.9744
B. Capital	12.0	.0054	.0648
II. Computer processing:			
A. Labor	.57	.0583	.0332
B. Capital	.57	.0797	.0454
III. Photocomposing:			
A. Labor	2.86	.0812	.2322
B. Capital	2.86	.1136	.3249
C. Capital	2.86	.0094	.0269
IV. Correction keyboarding:			
A. Labor	3.0	.0812	.2436
B. Capital	3.0	.0054	.0162

PROCESS: PHOTON 713, ELLIOTT 903—SAMPLE: THE GROUP—Continued

Function	Time	Rate	Cost
V. Computer processing:			
A. Labor	0.63	$0.0583	$0.0367
B. Capital	.63	.0797	.0502
VI. Photocomposing:			
A. Labor	2.22	.0812	.1803
B. Capital	2.22	.1136	.2522
C. Capital	2.22	.0094	.0208
VII. Supplies			.2000
VIII. Page makeup:			
A. Labor	0		0
IX. Computer imbalance			.5354
Total			3.2372

PROCESS: PHOTON 713; ELLIOT 903—SAMPLE: POLICY

Function	Time	Rate	Cost
I. Input keyboarding:			
A. Labor	12.0	$0.0812	$0.9744
B. Capital	12.0	.0054	.0648
II. Computer processing:			
A. Labor	.69	.0583	.0401
B. Capital	.69	.0797	.0550
III. Photocomposing:			
A. Labor	3.30	.0812	.2679
B. Capital	3.30	.1136	.3749
C. Capital	3.30	.0094	.0310
IV. Correction keyboarding:			
A. Labor	2.0	.0182	.1624
B. Capital	2.0	.0054	.0108
V. Computer processing:			
A. Labor	.67	.0583	.0391
B. Capital	.67	.0797	.0534
VI. Photocomposing:			
A. Labor	2.70	.0812	.2192
B. Capital	2.70	.1136	.3067
C. Capital	2.70	.0094	.0254
VII. Supplies			.2000
VIII. Page makeup:			
A. Labor	0		0
IX. Computer imbalance			.6405
Total			3.4645

PROCESS: PHOTON 713-ELLIOT 903—SAMPLE: PRICES AND PRODUCTION

Function	Time	Rate	Cost
I. Input keyboarding:			
A. Labor	14.0	$0.0812	$1.1368
B. Capital	14.0	.0054	.0756
II. Computer processing:			
A. Labor	.68	.0583	.0396
B. Capital	.68	.0797	.0542
III. Photocomposing:			
A. Labor	2.55	.0812	.2071
B. Capital	2.55	.1136	.2897
C. Capital	2.55	.0094	.0240
IV. Correction keyboarding:			
A. Labor	2.0	.0812	.1624
B. Capital	2.0	.0054	.0108
V. Computer processing:			
A. Labor	.65	.0583	.0379
B. Capital	.65	.0797	.0518
VI. Photocomposing:			
A. Labor	2.55	.0812	.2071
B. Capital	2.55	.1136	.2897
C. Capital	2.55	.0094	.0240
VII. Supplies			.2000
VIII. Page makeup:			
A. Labor	0		0
IX. Computer imbalance			.5202
Total			3.3309

PROCESS: PHOTON 713—ELLIOT 903—SAMPLE: PLEISTOCENE

Function	Time	Rate	Cost
I. Input keyboarding:			
A. Labor	20.0	$0.0812	$1.6240
B. Capital	20.0	.0054	.1008
II. Compputer rocessing:			
A. Labor	.78	.0583	.0455
B. Capital	.78	.0797	.0622

PROCESS: PHOTON 713—ELLIOT 903—SAMPLE: PLEISTOCENE—Continued

Function	Time	Rate	Cost
III. Photocomposing:			
A. Labor	3.60	$0.0812	$0.2923
B. Capital	3.60	.1136	.4090
C. Capital	3.60	.0094	.0388
IV. Correction keyboarding:			
A. Labor	2.0	.0812	.1624
B. Capital	2.0	.0054	.0108
V. Computer processing:			
A. Labor	.78	.0583	.0454
B. Capital	.78	.0797	.0621
VI. Photocomposing:			
A. Labor	2.93	.0812	.2379
B. Capital	2.93	.1136	.3328
C. Capital	2.93	.0290	.0275
VII. Supplies			.2000
VIII. Page makeup:			
A. Labor	0		0
IX. Computer imbalance			.6859
Total			4.3374

PROCESS: PHOTON 713-ELLIOT 903—SAMPLE: AMERICAN BAR

Function	Time	Rate	Cost
I. Input keyboarding:			
A. Labor	37.0	$0.0812	$3.0044
B. Capital	47.0	.0054	.1998
II. Computer processing:			
A. Labor	1.62	.0583	.0944
B. Capital	1.62	.0797	.1291
III. Photocomposing:			
A. Labor	6.95	.0812	.5643
B. Capital	6.95	.1136	.7895
C. Capital	6.95	.0094	.0653
IV. Correction keyboarding:			
A. Labor	5.0	.0812	.4060
B. Capital	5.0	.0054	.0270
V. Computer processing:			
A. Labor	1.71	.0583	.1027
B. Capital	1.71	.0797	.1363
VI. Photocomposing:			
A. Labor	5.60	.0812	.4547
B. Capital	5.60	.1136	.6362
C. Capital	5.60	.0094	.0526
VII. Supplies			.2000
VIII. Page makeup			
A. Labor	4.0	.0812	.3248
IX. Computer imbalance			1.3055
Total			8.4926

XVI. Results of Equation I—United States

The break-even points computed by Equation I are, with the exception of the Linotron 505, quite high for both Linotype and the Photon 713. Performance against Monotype for those classes of work which would in practice be done by Monotype for reasons of typographic quality are also quite high but lower relative to the other conventional systems.

In reviewing the results of the execution of Equation I it becomes evident that monthly break-even volumes generally conform to the size and speed of the computer applied. The more powerful computers generally bring about a lower break-even point in terms of pages required. This is particularly apparent in comparing the performance of the RCA 70/800 when driven by the Spectra 70/45 and Spectra 70/35.

Since break-even on all of the high speed systems in a mix situation occurs at very low levels of utilization of the composer the opportunity to produce additional work at lower cost than conventional processing is quite marked. The scale of operations required to maximize revenues is, however, dramatically high. For example, to use all of the one shift capacity of the Linotron 1010 when compared to

Linotype in a mix situation would require an increase in average pages produced (12.5% mix assumption) from 5,931 to 40,438 pages per month and an increase in one shift keyboards applied from 28.31 to 193.04. These volumes are, to say the least, awesome.

The entry "negative" in the tables that follow indicates that at the assumed cost per minute for use of the computer break-even would either not occur at any level of production or require multiple shifts of both computer and composer time.

EQUATION I

I. To determine break-even cost per minute of use of CRT photocomposer versus cost of conventional composing process (Assumes necessary computer time can be purchased as required at a given cost per minute). Equation reads:

A X B

Photocomposer cycles in minutes (photocomposer cost per minute) = Cost to set sample page by conventional process —

C C_1 D

Computer cycles in minutes (cost of computer configuration per minute) — Initial keyboarding cycle in minutes

D_1 D_2 E

(Labor cost per minute + capital cost of keyboard per minute) — correction keyboarding cycle in minutes

D_1 D_2 F

(Labor cost per minute + capital cost of keyboard per minute) — Supply costs

or

$$A\,(X) = B - C\,(C_1) - D\,(D_1 + D_2) - E\,(D_1 + D_2) - F$$

$$X = \frac{B - C\,(C_1) - D\,(D_1 + D_2) - E\,(D_1 + D_2) - F}{A}$$

II. Break-even minutes $= \frac{\text{Photocomposer operating costs per month}^1}{X}$

III. Break-even pages $= \frac{\text{Break-even minutes}}{A}$

IV. Break-even keyboards $= \frac{\text{Break-even pages } (D+E)}{\frac{60}{176}}$

[1] This value is taken from item C in equation II.

U.S. INPUT VALUES FOR EXECUTION OF EQUATION I (LINOTYPE)

	A	B	C	C_1	D	D_1	D_2	E	F
I. M-16 Linotron:									
A. The Group	1.0332	$2.0609	0	0	12.11	$0.0812	$0.0054	0.42	$0.2000
B. Policy	1.6000	3.0435	0	0	17.10	.0812	.0054	.55	.2000
C. Prices and Production	1.3000	3.0139	0	0	15.57	.0812	.0054	.48	.2000
D. Pleistocene	2.1000	3.6298	0	0	19.80	.0812	.0054	.62	.2000
E. American Bar	3.0000	6.5107	0	0	35.25	.0812	.0054	1.10	[1].5248
F. Book catalog	24.7610	11.7266	0	0	59.25	.0812	.0054	1.86	[1].5248
G. Hardware directory	5.9320	11.5236	0	0	88.04	.0812	.0054	2.77	[1].5248
H. Telephone directory			0	0					
II. 360-50 Linotron 1010:									
A. The Group	.1125	2.0609	.1062	$2.0495	12.11	.0812	.0054	.42	.2120
B. Policy	.1166	3.0435	.1394	2.0495	17.10	.0812	.0054	.55	.2156
C. Prices and Production	.1216	3.0139	.1162	2.0495	15.57	.0812	.0054	.48	.2147
D. Pleistocene	.1500	3.6298	.1693	2.0495	19.80	.0812	.0054	.62	.2177
E. American Bar	.2300	6.5107	.2722	2.0495	35.25	.0812	.0054	1.10	.2317
F. Book catalog	.3916	11.7266	.6341	2.0495	59.25	.0812	.0054	1.86	.2533
G. Hardware directory	.3833	11.5236	.3685	2.0495	88.04	.0812	.0054	2.77	.2793
H. Telephone directory	.5833	23.2665	.6108	2.0495	143.80	.0812	.0054	4.52	.3295
III. 360-30 Fototronic CRT:									
A. The Group	.1333	2.0609	.1000	1.4983	12.11	.0812	.0054	.42	.2120
B. Policy	.1666	3.0435	.1666	1.4983	17.10	.0812	.0054	.55	.2156
C. Prices and Production	.1666	3.0139	.1666	1.4983	15.57	.0812	.0054	.48	.2147
D. Pleistocene	.1666	3.6298	.3666	1.4983	19.80	.0812	.0054	.62	.2177
E. American Bar	.2500	6.5107	1.0666	1.4983	35.25	.0812	.0054	1.10	.2317
F. Book catalog	.4000	11.7266	2.4000	1.4983	57.25	.0812	.0054	1.86	.2533
G. Hardware directory	.3333	11.5236	2.3666	1.4983	88.04	.0812	.0054	2.77	.2793
H. Telephone directory	.6500	23.2665	4.0666	1.4983	143.80	.0812	.0054	4.52	.3295
IV. RCA 70/45 Videocomp:									
A. The Group	.1117	2.0609	.0720	1.9353	12.11	.0812	.0054	.42	.2120
B. Policy	.1300	3.0435	.0787	1.9353	17.10	.0812	.0054	.55	.2156
C. Prices and Production	.1250	3.0139	.0707	1.9353	15.57	.0812	.0054	.48	.2147
D. Pleistocene	.1567	3.6298	.0983	1.9353	19.80	.0812	.0054	.62	.2177
E. American Bar	.2433	6.5107	.1830	1.9353	35.25	.0812	.0054	1.10	.2317
F. Book catalog	.4167	11.7266	.6880	1.9353	59.25	.0812	.0054	1.86	.2533
G. Hardware directory	.4183	11.5236	.4757	1.9353	88.04	.0812	.0054	2.77	.2793
H. Telephone directory	.5467	23.2665	.7313	1.9353	143.80	.0812	.0054	4.52	.3295
V. RCA 70/35 Videocomp:									
A. The Group	.1117	2.0609	.1370	1.3991	12.11	.0812	.0054	.42	.2120
B. Policy	.1300	3.0435	.1607	1.3991	17.10	.0812	.0054	.55	.2156
C. Prices and Production	.1250	3.0139	.1507	1.3991	15.57	.0812	.0054	.48	.2147
D. Pleistocene	.1567	3.6298	.1843	1.3991	19.80	.0812	.0054	.62	.2177
E. American Bar	.2433	6.5107	.3620	1.3991	35.25	.0812	.0054	1.10	.2317
F. Book catalogue	.4167	11.7266	1.1790	1.3991	59.25	.0812	.0054	1.86	.2533
G. Hardware directory	.4183	11.5236	.9477	1.3991	88.04	.0812	.0054	2.77	.2793
H. Telephone directory	.5467	23.2665	1.4610	1.3991	143.80	.0812	.0054	4.52	.3295

[1] Includes charge of 4 minutes for stripping galleys at $0.0812 per minute.

Note: Composer costs are as follows: M-16 Linotron 505, $7,031; Linotron 1010, $17,012; Fototronic CRT, $14,714; Videocomp, $14,014.

U.S. DATA EQUATION I—BREAK-EVEN RESULTS AGAINST LINOTYPE

System	Minutes[1]	Pages	Keyboards
A. For sample I—The Group:			
Linotron 505	9,364	9,063	10.75
Linotron 1010	3,504	31,149	36.96
Harris Fototronic CRT	3,195	23,965	28.44
Videocomp/45	2,507	22,442	26.63
Videocomp/35	2,736	24,495	29.06
B. For sample II—Policy:			
Linotron 505	8,555	5,347	8.94
Linotron 1010	1,957	16,782	28.05
Harris Fototronic CRT	2,335	14,016	23.43
Videocomp/45	1,588	12,217	20.42
Videocomp/35	1,695	13,041	21.80
C. For sample III—Prices and Production:			
Linotron 505	6,419	4,938	7.50
Linotron 1010	1,766	14,526	22.08
Harris Fototronic CRT	2,114	12,688	19.28
Videocomp/45	1,377	11,013	16.74
Videocomp/35	1,462	11,694	17.77
D. For sample IV—Pleistocene:			
Linotron 505	8,888	4,232	8.18
Linotron 1010	1,968	13,119	25.37
Harris Fototronic CRT	2,238	13,436	25.98
Videocomp/45	1,510	9,637	18.64
Videocomp/35	1,584	10,107	19.54
E. For sample V—American Bar:			
Linotron 505	7,431	2,477	8.53
Linotron 1010	1,521	6,611	22.76
Harris Fototronic CRT	2,400	9,598	33.04
Videocomp/45	1,228	5,047	17.37
Videocomp/35	1,299	5,339	18.38

U.S. DATA EQUATION I—BREAK-EVEN RESULTS AGAINST LINOTYPE—Continued

System	Minutes[1]	Pages	Keyboards
F. For sample VI—Book catalog:			
Linotron 505	(2)		
Linotron 1010	1,365	3,485	20.17
Harris Fototronic CRT	1,860	5,580	32.29
Videocomp/45	1,204	2,890	16.72
Videocomp/35	1,289	3,092	17.90
G. For sample VII—Hardware directory:			
Linotron 505	14,800	2,495	21.46
Linotron 1010	2,484	6,481	55.73
Harris Fototronic CRT	(2)		
Videocomp/45	2,383	5,698	49.00
Videocomp/35	2,854	6,822	58.67
H. For sample VIII—Telephone directory:			
Linotron 505	(3)		
Linotron 1010	1,122	1,924	27.03
Harris Fototronic CRT	2,391	3,679	51.67
Videocomp/45	883	1,615	22.68
Videocomp/35	952	1,741	24.46
I. For Linotype mix- (Each sample 12.5 percent of total volume):			
Linotron 505[4] (197.23)	20,828	3,670	12.66
Linotron 1010 (14.66)	1,548	5,931	28.31
Harris Fototronic CRT (26.60)	2,809	9,916	47.33
Videocomp/45 (12.25)	1,294	4,819	23.00
Videocomp/35 (13.27)	1,401	5,217	24.90

[1] Refers to minutes used per month of composer time.
[2] Negative.
[3] Did not set.
[4] Includes 7 samples at 14.28 percent.

Note: Figures in parenthesis represent percentage use of shift to achieve break-even.

U.S. INPUT VALUES FOR EXECUTION OF EQUATION I (MONOTYPE)

	Factors								
	A	B	C	C_1	D	D_1	D_2	E	F
I. M-16 Linotron:									
A. The Group	1.0332	$3.5857	0	0	12.11	$0.0812	$0.0054	0.42	$0.2000
B. Policy	1.6000	4.7824	0	0	17.10	.0812	.0054	.55	.2000
C. Prices and Production	1.3000	4.3630	0	0	15.57	.0812	.0054	.48	.2000
D. Pleistocene	2.1000	5.8345	0	0	19.80	.0812	.0054	.62	.2000
E. American Bar	3.0000	13.4402	0	0	35.25	.0812	.0054	1.10	[1].5248
F. Book catalog	24.7610	19.6682	0	0	59.25	.0812	.0054	1.86	[1].5248
G. Hardware directory	5.9320	25.1053	0	0	88.04	.0812	.0054	2.77	[1].5248
H. Telephone directory			0	0					
II. 360-50 Linotron 1010:									
A. The Group	.1125	3.5857	.1062	$2.0495	12.11	.0812	.0054	.42	.2120
B. Policy	.1166	4.7824	.1394	2.0495	17.10	.0812	.0054	.55	.2156
C. Prices and Production	.1216	4.3630	.1162	2.0495	15.57	.0812	.0054	.48	.2147
D. Pleistocene	.1500	5.8345	.1693	2.0495	19.80	.0812	.0054	.62	.2177
E. American Bar	.2300	13.4402	.2722	2.0495	35.25	.0812	.0054	1.10	.2317
F. Book catalog	.3916	19.6682	.6341	2.0495	59.25	.0812	.0054	1.86	.2533
G. Hardware directory	.3833	25.1053	.3685	2.0495	88.04	.0812	.0054	2.77	.2793
H. Telephone directory	.5833	34.2483	.6108	2.0495	143.80	.0812	.0054	4.52	.3295
III. 360-30 Fototronic CRT:									
A. The Group	.1333	3.5857	.1000	1.4983	12.11	.0812	.0054	.42	.2120
B. Policy	.1666	4.7824	.1666	1.4983	17.10	.0812	.0054	.55	.2156
C. Prices and Production	.1666	4.3630	.1666	1.4983	15.57	.0812	.0054	.48	.2147
D. Pleistocene	.1666	5.8345	.3666	1.4983	19.80	.0812	.0054	.62	.2177
E. American Bar	.2500	13.4402	1.0666	1.4983	35.25	.0812	.0054	1.10	.2317
F. Book catalog	.4000	19.6682	2.4000	1.4983	59.25	.0812	.0054	1.86	.2533
G. Hardware directory	.3333	25.1053	2.3666	1.4983	88.04	.0812	.0054	2.77	.2793
H. Telephone directory	.6500	34.2483	4.0666	1.4983	143.80	.0812	.0054	4.52	.3295
IV. RCA 70/45 Videocomp:									
A. The Group	.1117	3.5857	.0720	1.9353	12.11	.0812	.0054	.42	.2120
B. Policy	.1300	4.7824	.0787	1.9353	17.10	.0812	.0054	.55	.2156
C. Prices and Production	.1250	4.3630	.0707	1.9353	15.57	.0812	.0054	.48	.2147
D. Pleistocene	.1567	5.8345	.0983	1.9353	19.80	.0812	.0054	.62	.2177
E. American Bar	.2433	13.4402	.1830	1.9353	35.25	.0812	.0054	1.10	.2317
F. Book catalog	.4167	19.6682	.6880	1.9353	59.25	.0812	.0054	1.86	.2533
G. Hardware directory	.4183	25.1053	.4757	1.9353	88.04	.0812	.0054	2.77	.2793
H. Telephone directory	.5467	34.2483	.7313	1.9353	143.80	.0812	.0054	4.52	.3295
V. RCA 70/35 Videocomp:									
A. The Group	.1117	3.5857	.1370	1.3991	12.11	.0812	.0054	.42	.2120
B. Policy	.1300	4.7824	.1607	1.3991	17.10	.0812	.0054	.55	.2156
C. Prices and Production	.1250	4.3630	.1507	1.3991	15.57	.0812	.0054	.48	.2147
D. Pleistocene	.1567	5.8345	.1843	1.3991	19.80	.0812	.0054	.62	.2177
E. American Bar	.2433	13.4402	.3620	1.3991	35.25	.0812	.0054	1.10	.2317
F. Book catalog	.4167	19.6682	1.1790	1.3991	57.25	.0812	.0054	1.86	.2533
G. Hardware directory	.4183	25.1053	.9477	1.3991	88.04	.0812	.0054	2.77	.2793
H. Telephone directory	.5467	34.2483	1.4610	1.3991	143.80	.0812	.0054	4.52	.3295

[1] Includes charge of 4 minutes for stripping galleys at $0.0812 per minute.

Note: Composer Costs are as follows: M-16 Linotron 505, $7,031; Linotron 1010, $17,012; Fototronic CRT, $14,714; Videocomp, $14,014.

U.S. DATA EQUATION I—BREAK-EVEN RESULTS AGAINST MONOTYPE

System	Minutes[1]	Pages	Keyboards
A. For sample I—The Group:			
Linotron 505	3,158	3,056	3.63
Linotron 1010	924	8,215	9.75
Harris Fototronic CRT	917	6,880	8.16
Videocomp/45	728	6,520	7.74
Videocomp/35	747	6,683	7.93
B. For sample II—Policy:			
Linotron 505	3,684	2,302	3.85
Linotron 1010	721	6,180	10.33
Harris Fototronic CRT	879	5,276	8.82
Videocomp/45	631	4,856	8.12
Videocomp/35	648	4,981	8.33
C. For sample III—Prices and Production:			
Linotron 505	3,296	2,535	3.85
Linotron 1010	821	6,750	10.26
Harris Fototronic CRT	977	5,865	8.91
Videocomp/45	668	5,346	8.12
Videocomp/35	688	5,501	8.35
D. For sample IV—Pleistocene:			
Linotron 505	3,819	1,819	3.52
Linotron 1010	729	4,859	9.40
Harris Fototronic CRT	743	4,459	8.62
Videocomp/45	600	3,830	7.41
Videocomp/35	611	3,902	7.55
E. For sample V—American Bar:			
Linotron 505	2,160	720	1.48
Linotron 1010	412	1,790	6.16
Harris Fototronic CRT	435	1,739	5.99
Videocomp/45	351	1,444	4.97
Videocomp/35	357	1,467	5.05

U.S. DATA EQUATION I—BREAK-EVEN RESULTS AGAINST MONOTYPE—Continued

System	Minutes[1]	Pages	Keyboards
F. For sample VI—Book Catalog:			
Linotron 505	13,882	563	3.26
Linotron 1010	520	1,327	7.68
Harris Fototronic CRT	464	1,391	8.05
Videocomp/45	457	1,096	6.34
Videocomp/35	468	1,124	6.50
G. For sample VII—Hardware directory:			
Linotron 505	2,495	421	3.62
Linotron 1010	402	1,050	9.03
Harris Fototronic CRT	440	1,101	9.47
Videocomp/45	365	874	7.51
Videocomp/35	375	896	7.71
H. For sample VIII—Telephone directory:			
Linotron 505	(2)		
Linotron 1010	501	858	12.05
Harris Fototronic CRT	638	982	13.79
Videocomp/45	390	713	10.01
Videocomp/35	403	736	10.34
I. For Monotype mix—(Each sample 12.5 percent of total volume):			
Linotron 505 (52.23)	5,339	940	3.20
Linotron 1010 (4.87)	514	1,967	9.30
Harris Fototronic CRT (5.43)	574	2,025	9.64
Videocomp/45 (4.10)	433	1,613	7.79
Videocomp/35 (4.20)	444	1,655	7.97

[1] Refers to minutes used per month of composer time.
[2] Did not set.
[3] Includes only 7 samples, 14.28 percent mix.

Note: Figures in parentheses represent percentage of single shift to achieve break-even.

U.S. INPUT VALUES FOR EXECUTION OF EQUATION I (PHOTON 713-ELLIOT 903)—(UNBALANCED SYSTEM)

	Factors								
	A	*B*	*C*	C_1	*D*	D_1	D_2	*E*	*F*
I. M-16 Linotron:									
A. The Group	1.0332	$3.2372	0	0	12.11	$0.0812	$0.0054	0.42	$0.2000
B. Policy	1.6000	3.4656	0	0	17.10	.0812	.0054	.55	.2000
C. Prices and Production	1.3000	3.3309	0	0	15.57	.0812	.0054	.48	.2000
D. Pleistocene	2.1000	4.3374	0	0	19.80	.0812	.0054	.62	.2000
E. American Bar	3.0000	8.4926	0	0	35.25	.0812	.0054	1.10	.5248
II. 360-50 Linotron 1010:									
A. The Group	.1125	3.2372	.1062	$2.0495	12.11	.0812	.0054	.42	.2120
B. Policy	.1166	3.4656	.1394	2.0495	17.10	.0812	.0054	.55	.2156
C. Prices and Production	.1216	3.3309	.1162	2.0495	15.57	.0812	.0054	.48	.2147
D. Pleistocene	.1500	4.3374	.1693	2.0495	19.80	.0812	.0054	.62	.2177
E. American Bar	.2300	8.4926	.2722	2.0495	35.25	.0812	.0054	1.10	.2317
III. 360-30 Fototronic CRT:									
A. The Group	.1333	3.2372	.1000	1.4983	12.11	.0812	.0054	.42	.2120
B. Policy	.1666	3.4656	.1666	1.4983	17.10	.0812	.0054	.55	.2156
C. Prices and Production	.1666	3.3309	.1666	1.4983	15.57	.0812	.0054	.48	.2147
D. Pleistocene	.1666	4.3374	.3666	1.4983	19.80	.0812	.0054	.62	.2177
E. American Bar	.2500	8.4926	1.0666	1.4983	35.25	.0812	.0054	1.10	.2317
IV. RCA 70/45 Videocomp:									
A. The Group	.1117	3.2372	.0720	1.9353	12.11	.0812	.0054	.42	.2120
B. Policy	.1300	3.4656	.0787	1.9353	17.10	.0812	.0054	.55	.2156
C. Prices and Production	.1250	3.3309	.0707	1.9353	15.57	.0812	.0054	.48	.2147
D. Pleistocene	.1567	4.3374	.0983	1.9353	19.80	.0812	.0054	.62	.2177
E. American Bar	.2433	8.4926	.1830	1.9353	35.25	.0812	.0054	1.10	.2317
V. RCA 70/35 Videocomp:									
A. The Group	.1117	3.2372	.1370	1.3991	12.11	.0812	.0054	.42	.2120
B. Policy	.1300	3.4656	.1607	1.3991	17.10	.0812	.0054	.55	.2156
C. Prices and Production	.1250	3.3309	.1507	1.3991	15.57	.0812	.0054	.48	.2147
D. Pleistocene	.1567	4.3374	.1843	1.3991	19.80	.0812	.0054	.62	.2177
E. American Bar	.2433	8.4926	.3620	1.3991	35.25	.0812	.0054	1.10	.2317

[1] Includes charge of 4 minutes for stripping galleys at $0.0812 per minute.

Note: Composer costs are as follows: M-16 Linotron 505, $7,031; Linotron 1010, $17,012; Fotoronic CRT, $14,714; Videocomp, $14,014.

U.S. DATA EQUATION I.—BREAK-EVEN RESULTS AGAINST PHOTON 713 (UNBALANCED SYSTEM) [1]

System	Minutes [2]	Pages	Keyboards
A. For sample I—The Group:			
Linotron 505	3,721	3,602	4.27
Linotron 1010	1,111	9,877	11.72
Harris Fototronic CRT	1,096	8,219	9.75
Videocomp/45	869	7,782	9.23
Videocomp/35	895	8,015	9.51
B. For sample II—Policy:			
Linotron 505	6,476	4,048	6.77
Linotron 1010	1,382	11,848	19.80
Harris Fototronic CRT	1,665	9,997	16.71
Videocomp/45	1,161	8,931	14.93
Videocomp/35	1,217	9,363	15.65
C. For sample III—Prices and Production:			
Linotron 505	5,250	4,039	6.14
Linotron 1010	1,390	11,432	17.38
Harris Fototronic CRT	1,660	9,964	15.14
Videocomp/45	1,102	8,817	13.40
Videocomp/35	1,156	9,248	14.06
D. For sample IV—Pleistocene:			
Linotron 505	6,233	2,968	5.74
Linotron 1010	1,273	8,488	16.41
Harris Fototronic CRT	1,360	8,162	15.78

U.S. DATA EQUATION I.—BREAK-EVEN RESULTS AGAINST PHOTON 713 (UNBALANCED SYSTEM)—Continued [1]

System	Minutes [2]	Pages	Keyboards
D. For sample IV—Pleistocene—Continued			
Videocomp/45	1,016	6,483	12.54
Videocomp/35	1,049	6,692	12.94
E. For sample V—American Bar:			
Linotron 505	4,376	1,459	5.02
Linotron 1010	859	3,735	12.86
Harris Fototronic CRT	1,047	4,186	14.41
Videocomp/45	716	2,945	10.14
Videocomp/35	740	3,042	10.47
F. For Photon mix—(20 percent of volume for each of 5 samples):			
Linotron 505 (47.66)	5,033	2,786	5.43
Linotron 1010 (10.50)	1,109	7,591	14.81
Harris Fototronic CRT (12.23)	1,292	7,316	14.27
Videocomp/45 (8.56)	904	5,898	11.51
Videocomp/35 (8.87)	937	6,114	11.93

[1] Cost of computer-composer imbalance included.
[2] Refers to minutes used per month of composer time.

Note: Figures in parentheses represent percentage use of shift to achieve break-even.

U.S. INPUT VALUES FOR EXECUTION OF EQUATION I (PHOTON 713, ELLIOT 903)—(SYSTEM BALANCED)

	Factors								
	A	*B*	*C*	C_1	*D*	D_1	D_2	*E*	*F*
I. M-16 Linotron:									
A. The Group	1.0332	$2.7018	0	0	12.11	$0.0812	$0.0054	0.42	$0.2000
B. Policy	1.6000	2.8240	0	0	17.10	.0812	.0054	.55	.2000
C. Prices and Production	1.3000	2.8107	0	0	15.57	.0812	.0054	.48	.2000
D. Pleistocene	2.1000	3.6515	0	0	19.80	.0812	.0054	.62	.2000
E. American Bar	3.0000	7.1871	0	0	35.25	.0812	.0054	1.10	[1].5248
II. 360-50 Linotron 1010:									
A. The Group	.1125	2.7018	$0.1062	$2.0495	12.11	.0812	.0054	.42	.2120
B. Policy	.1166	2.8240	.1394	2.0495	17.10	.0812	.0054	.55	.2156
C. Prices and Production	.1216	2.8107	.1162	2.0495	15.57	.0812	.0054	.48	.2147
D. Pleistocene	.1500	3.6515	.1693	2.0495	19.80	.0812	.0054	.62	.2177
E. American Bar	.2300	7.1871	.2722	2.0495	35.25	.0812	.0054	1.10	.2317
III. 360-30 Fototronic CRT:									
A. The Group	.1333	2.7018	.1000	1.4983	12.11	.0812	.0054	.42	.2120
B. Policy	.1666	2.8240	.1666	1.4983	17.10	.0812	.0054	.55	.2156
C. Prices and Production	.1666	2.8107	.1666	1.4983	15.57	.0812	.0054	.48	.2147
D. Pleistocene	.1666	3.6515	.3666	1.4983	19.80	.0812	.0054	.62	.2177
E. American Bar	.2500	7.1871	1.0666	1.4983	35.25	.0812	.0054	1.10	.2317
IV. RCA 70/45 Videocomp:									
A. The Group	.1117	2.7018	.0720	1.9353	12.11	.0812	.0054	.42	.2120
B. Policy	.1300	2.8240	.0787	1.9353	17.10	.0812	.0054	.55	.2156
C. Prices and Production	.1250	2.8107	.0707	1.9353	15.57	.0812	.0054	.48	.2147
D. Pleistocene	.1567	3.6515	.0983	1.9353	19.80	.0812	.0054	.62	.2177
E. American Bar	.2433	7.1871	.1830	1.9353	35.25	.0812	.0054	1.10	.2317
V. RCA 70/35 Videocomp:									
A. The Group	.1117	2.7018	.1370	1.3991	12.11	.0812	.0054	.42	.2120
B. Policy	.1300	2.8240	.1607	1.3991	17.10	.0812	.0054	.55	.2156
C. Prices and Production	.1250	2.8107	.1507	1.3991	15.57	.0812	.0054	.48	.2147
D. Pleistocene	.1567	3.6515	.1843	1.3991	19.80	.0812	.0054	.62	.2177
E. American Bar	.2433	7.1871	.3620	1.3991	35.25	.0812	.0054	1.10	.2317

Note: Composer Costs are as follows: M-16 Linotron 505, $7,031; Linotron 1010, $17,012; Fototronic CRT, $14,714; Videocomp, $14,014.

[1] Includes charge of 4 minutes for stripping galleys at $0.0812 per minute.

U.S. DATA EQUATION I—BREAK-EVEN RESULTS AGAINST PHOTON 713 BALANCED SYSTEM

System	Minutes [1]	Pages	Keyboards
A. For sample I—The Group:			
Linotron 505	5,128	4,963	5.89
Linotron 1010	1,612	14,331	17.00
Harris Fototronic CRT	1,563	11,725	13.91
Videocomp/45	1,237	11,075	13.14
Videocomp/35	1,290	11,553	13.71
B. For sample II—Policy:			
Linotron 505	10,269	6,418	10.73
Linotron 1010	2,498	21,420	35.80
Harris Fototronic CRT	2,952	17,721	29.62
Videocomp/45	1,964	15,108	25.25
Videocomp/35	2,131	16,389	27.39
C. For sample III—Prices and Production:			
Linotron 505	7,487	5,760	8.75
Linotron 1010	2,137	17,576	26.71
Harris Fototronic CRT	2,563	15,384	23.38
Videocomp/45	1,638	13,106	19.92
Videocomp/35	1,760	14,081	21.40
D. For sample IV—Pleistocene:			
Linotron 505	8,773	4,177	8.08
Linotron 1010	1,935	12,903	24.95
Harris Fototronic CRT	2,195	13,175	25.48

U.S. DATA EQUATION I—BREAK-EVEN RESULTS AGAINST PHOTON 713 BALANCED SYSTEM—Continued

System	Minutes [1]	Pages	Keyboards
D. For sample IV—Pleistocene—Continued			
Videocomp/45	1,488	9,495	18.36
Videocomp/35	1,559	9,951	19.24
E. For sample V—American Bar:			
Linotron 505	6,002	2,001	6.89
Linotron 1010	1,204	5,235	18.02
Harris Fototronic CRT	1,665	6,660	22.92
Videocomp/45	9.87	4,058	13.97
Videocomp/35	1,033	4,245	14.61
F. For Photon mix—(20 percent of volume for each of 5 samples):			
Linotron 505 (67.34)	7,112	3,937	7.68
Linotron 1010 (15.66)	1,654	11,315	22.07
Harris Fototronic CRT (19.32)	2,041	11,553	22.54
Videocomp/45 (12.42)	1,312	8,554	16.67
Videocomp/35 (13.09)	1,382	9,015	17.59

[1] Refers to minutes used per month of composer time.

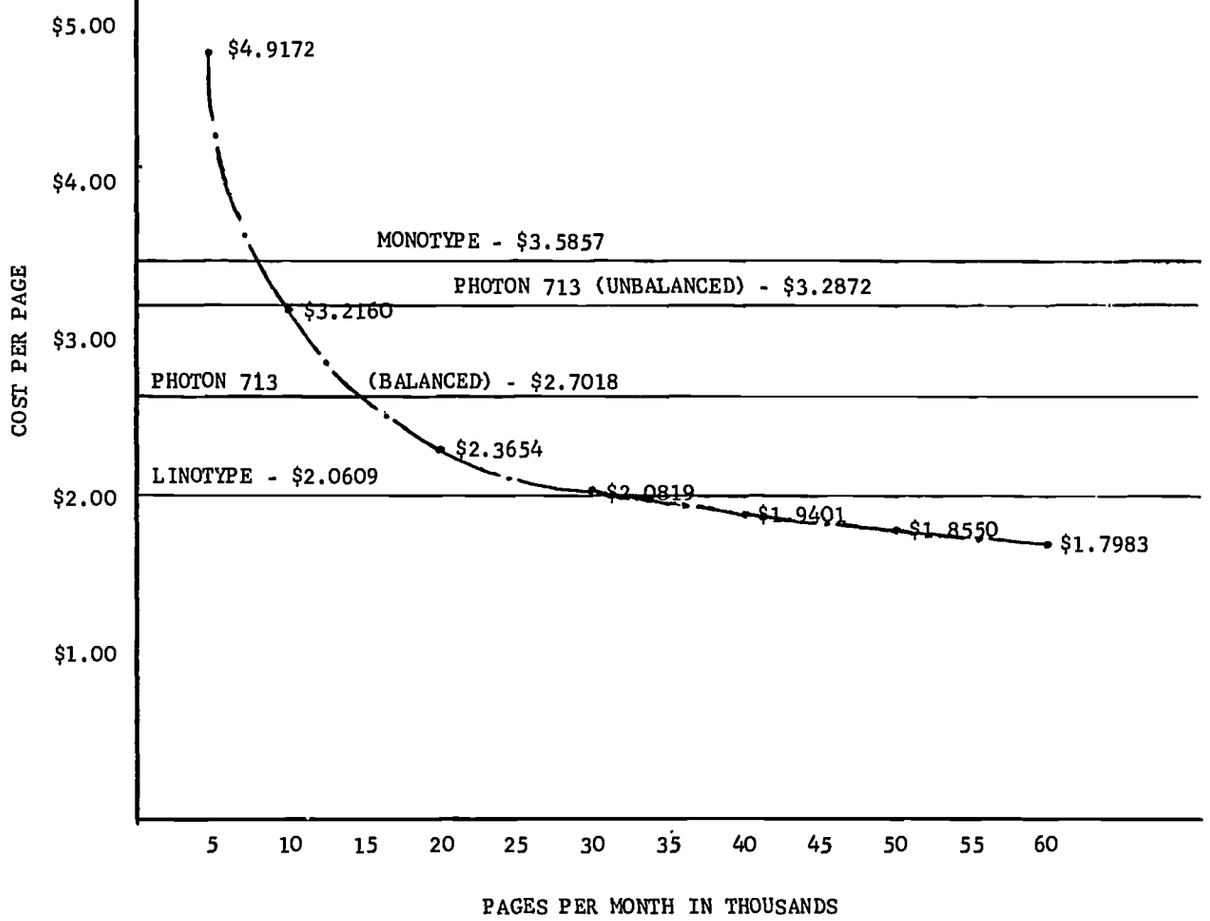
Note: Figures in parentheses represent percentage use of shift to achieve break-even.

LINOTRON 1010 vs CONVENTIONAL PROCESSES

FOR SAMPLE PAGE "THE GROUP"

EQUATION I

LINOTRON 1010 = ——— : ——— .



XVII. Results of Equation II—United States

Equation II is actually a series of successive approximations until a definite answer is obtained. (It may be possible to write this equation more precisely than has been done here).

The break-even points computed by Equation II are, with the exception of the Linotron 505, soberingly high, given the structure of the affected industry. While performance of the systems measured varies from sample to sample it becomes evident that the volume required to break-even is a function of the cost of the computer employed more than it is the relative efficiencies of the composition programs applied. As will be noted from the "mix execution" the more costly the computer the higher is the number of input keyboards necessary to break-even.

The tables pertaining to the execution of Equation II follow:

Equation II-A and II-B

To determine break-even volume of pages to amortize operating costs of CRT photocomposer and supporting computer configuration versus cost of conventional composing process (assume that computer time cannot be purchased from service bureau and costs must be covered by use solely in composing process).

A X

Equation II-A reads: Cost of producing sample by conventional process (unknown number of pages) =

B C

Total monthly one shift operating costs of computer + Total monthly one shift operating costs of photocomposer +

D D_1 D_2

(Initial keyboarding cycle in minutes (labor cost per minute + capital cost of keyboard per minute))

X E D_1

(unknown number of pages) + correction keyboarding cycle in minutes (labor cost per minute +

D_2 X F X

capital cost of keyboard per minute) (unknown number of pages) + supply costs (unknown number of pages)

or $A\ (X) = B + C + (D\ (D_1 + D_2])\ (X) + E\ (D_1 + D_2])\ (X) + F\ (X)$.

When value of X is equal to or less than 10,560 minutes divided by the computer cycles for the page involved (or the composer cycles when the composer is limiting) X = breakeven.

Equation II-B: When value of X exceeds 10,560 minutes divided by the cycle time of the limiting element the equation must be modified to reflect extra shift cost as follows:

$$A\ (G) + A\ (X) = H + I + [H_1\ (H_2\ (G - J)] + [H_1\ (H_2)\ (X)] + [I_1\ (I_2)\ (X)] + F\ (G) + F\ (X) + [D\ (D_1 + D_2])\ G] + [D\ (D_1 + D_2)\ (X)] + [E\ (D_1 + D_2)\ G] + [E\ (D_1 + D_2)\ X].$$

Where A = cost of producing page by conventional process.
G = maximum number of pages capable of production in a single shift by limiting component (when both the computer and composer can not produce the initial X value in a single shift the higher of the page limits will be the value of G).
H = monthly single shift operating costs of limiting component (when both components are limited H = the lower limit).
I = monthly single shift operating costs of nonlimiting component.
H_1 = cycle times of limiting component.
H_2 = extra shift cost per minute of limiting component.
J = one shift monthly limit in pages of limiting component (10,560 divided by limiting cycle times) (when both components can not produce the X value of pages in a single shift the lower limit will be the value of J).
I_1 = cycle times of nonlimiting component (I_1 will have a value of O when value of X in equation II-A can be achieved in one shift by this component.
I_2 = extra shift cost per minute of nonlimiting component.
F = supply cost per page.
D = time in minutes to key page.
D_1 = labor cost per minute.
D_2 = capital cost of keyboard per minute.
E = time in minutes to key corrections.
X = increment to value of G to achieve break-even.

When $X + G$ exceeds the number of pages capable of production in one shift by the initially nonlimiting component the value of I_1 must be inserted into equation II-B and a new X value computed.

U.S. INPUT VALUES FOR EXECUTION OF EQUATION II: LINOTYPE

	Factors							
	A	*B*	*C*	*D*	D_1	D_2	*E*	*F*
I. M-16 Linotron 505:								
A. The Group	$2.0609	0	$7,031.07	12.11	$0.0812	$0.0054	0.42	$0.2000
B. Policy	3.0435	0	7,031.07	17.10	.0812	.0054	.55	.2000
C. Prices and Production	3.0139	0	7,031.07	15.57	.0812	.0054	.48	.2000
D. Pleistocene	3.6298	0	7,031.07	19.80	.0812	.0054	.62	.2000
E. American Bar	6.5107	0	7,031.07	35.25	.0812	.0054	1.10	1.5248
F. Book catalog	11.7266	0	7,031.07	59.25	.0812	.0054	1.86	1.5248
G. Hardware directory	11.5236	0	7,031.07	88.04	.0812	.0054	2.77	1.5248
H. Telephone directory								
II. 360-50 Linotron 1010:								
A. The Group	2.0609	$28,574.00	17,012.00	12.11	.0812	.0054	.42	.20
B. Policy	3.0435	28,754.00	17,012.00	17.10	.0812	.0054	.55	.20
C. Prices and Production	3.0139	28,574.00	17,012.00	15.57	.0812	.0054	.48	.20
D. Pleistocene	3.6298	28,574.00	17,012.00	19.80	.0812	.0054	.62	.20
E. American Bar	6.5107	28,574.00	17,012.00	35.25	.0812	.0054	1.10	.20
F. Book catalog	11.7266	28,574.00	17,012.00	59.25	.0812	.0054	1.86	.20
G. Hardware directory	11.5236	28,574.00	17,012.00	88.04	.0812	.0054	2.77	.20
H. Telephone directory	23.2665	28,574.00	17,012.00	143.80	.0812	.0054	4.52	.20
III. 360-30 Fototronic CRT:								
A. The Group	2.0609	16,173.00	14,714.00	12.11	.0812	.0054	.42	.20
B. Policy	3.0435	16,173.00	14,714.00	17.10	.0812	.0054	.55	.20
C. Prices and Production	3.0139	16,173.00	14,714.00	15.57	.0812	.0054	.48	.20
D. Pleistocene	3.6298	16,173.00	14,714.00	19.80	.0812	.0054	.62	.20
E. American Bar	6.5107	16,713.00	14,714.00	35.25	.0812	.0054	1.10	.20
F. Book catalog	11.7266	16,173.00	14,714.00	59.25	.0812	.0054	1.86	.20
G. Hardware directory	11.5236	16,713.00	14,714.00	88.04	.0812	.0054	2.77	.20
H. Telephone directory	23.2665	16,173.00	14,714.00	143.80	.0812	.0054	4.52	.20
IV. RCA 70/45 Videocomp:								
A. The Group	2.0609	20,897.00	14,014.00	12.11	.0812	.0054	.42	.20
B. Policy	3.0435	20,897.00	14,014.00	17.10	.0812	.0054	.55	.20
C. Prices and production	3.0139	20,897.00	14,014.00	15.57	.0812	.0054	.48	.20
D. Pleistocene	3.6298	20,897.00	14,014.00	19.80	.0312	.0054	.62	.20
E. American Bar	6.5107	20,897.00	14,014.00	35.25	.0812	.0054	1.10	.20
F. Book catalog	11.7266	20,897.00	14,014.00	59.25	.0812	.0054	1.86	.20
G. Hardware directory	11.5236	20,897.00	14,014.00	88.04	.0812	.0054	2.77	.20
H. Telephone diretory	23.2665	20,897.00	14,014.00	143.80	.8012	.0054	4.52	.20
IV. RCA 70/35 Videocomp:								
A. The Group	2.0609	15,235.00	14,014.00	12.11	.0812	.0054	.42	.20
B. Policy	3.0435	15,235.00	14,014.00	17.10	.0812	.0054	.55	.20
C. Prices and Production	3.0139	15,235.00	14,014.00	15.57	.0812	.0054	.48	.20
D. Pleistocene	3.6298	15,235.00	14,014.00	19.80	.0812	.0054	.62	.20
E. American Bar	6.5107	15,235.00	14,014.00	35.25	.0812	.0054	1.10	.20
F. Book catalog	11.7266	15,235.00	14,014.00	59.25	.0812	.0054	1.86	.20
G. Hardware directory	11.5236	15,235.00	14,014.00	88.04	.0812	.0054	2.77	.20
H. Telephone directory	23.2665	15,235.00	14,014.00	143.80	.0812	.0054	4.52	.20

[1] Charged with 4 minutes to strip galleys at $0.0812 per minute.

U.S. DATA EQUATION II—BREAK-EVEN RESULTS AGAINST LINOTYPE

System	Minutes[1]	Pages	Keyboards
A. For sample I—The Group:			
Linotron 505	9,364	9,063	10.75
Linotron 1010	6,610	58,759	69.72
Harris Fototronic CRT	5,307	39,813	47.24
Videocomp/45	5,027	45,000	53.39
Videocomp/35	5,165	37,702	44.73
B. For sample II—Policy:			
Linotron 505	8,555	5,347	8.94
Linotron 1010	4,832	34,665	57.94
Harris Fototronic CRT	3,913	23,488	39.26
Videocomp/45	3,451	26,548	44.37
Videocomp/35	3,574	22,242	37.18
C. For sample III—Prices and Production:			
Linotron 505	6,419	4,938	7.50
Linotron 1010	3,893	32,013	48.66
Harris Fototronic CRT	3,614	21,691	32.97
Videocomp/45	3,065	24,517	37.26
Videocomp/35	3,095	20,540	31.22
D. For sample IV—Pleistocene:			
Linotron 505	8,887	4,232	8.18
Linotron 1010	4,645	27,438	53.06
Harris Fototronic CRT	6,815	18,591	35.95
Videocomp/45	3,293	21,013	40.63
Videocomp/35	3,245	17,605	34.04
E. For sample V—American Bar:			
Linotron 505	7,431	2,477	8.53
Linotron 1010	3,923	14,413	49.61
Harris Fototronic CRT	10,416	9,766	33.62
Videocomp/45	2,686	11,038	38.00
Videocomp/35	3,348	9,248	31.83
F. For sample VI—Book catalog:			
Linotron 505	(2)		
Linotron 1010	4,637	7,312	42.31

U.S. DATA EQUATION II—BREAK-EVEN RESULTS AGAINST LINOTYPE—Continued

System	Minutes[1]	Pages	Keyboards
F. For sample VI—Book catalog—Con.			
Harris Fototronic CRT	12,007	5,003	28.95
Videocomp/45	3,853	5,600	32.40
Videocomp/35	5,531	4,691	27.15
G. For sample VII—Hardware directory:			
Linotron 505	14,300	2,495	21.46
Linotron 1010	5,051	13,177	113.32
Harris Fototronic CRT	23,573	9,822	84.46
Videocomp/45	4,800	10,091	86.78
Videocomp/35	8,013	8,455	72.71
H. For sample VIII—Telephone directory:			
Linotron 505	(2)		
Linotron 1010	2,724	4,460	62.64
Harris Fototronic CRT	12,468	3,066	43.07
Videocomp/45	2,497	3,415	47.97
Videocomp/35	4,180	2,861	40.19
I. For Linotype mix—(Each sample 12.5 percent of total volume):			
Linotron 505 [4] (197.23)	20,828	3,670	12.66
Linotron 1010 (36.92)	3,899	12,907	61.61
Harris Fototronic CRT (113.57)	11,994	8,829	42.14
Videocomp/45 (31.15)	3,289	9,885	47.18
Videocomp/35 (44.92)	4,744	8,282	39.53

[1] Refers to minutes of use per month of lower speed component which is generally the computer.
[2] Negative.
[3] Did not set.
[4] 505 includes 7 samples at 14.28 percent of total volume.

Note: Figures in parentneses represent percentage use of shift to achieve break-even.

U.S. INPUT VALUES FOR EXECUTION OF EQUATION II. (MONOTYPE)

	Factors							
	A	*B*	*C*	*D*	D_1	D_2	*E*	*F*
I. M-16 Linotron 505:								
A. The Group	$3.5858	0	$7,031.07	12.11	$0.0812	$0.0054	.042	$0.2000
B. Policy	4.7824	0	7,031.07	17.10	.0812	.0054	.055	.2000
C. Prices and Production	4.3630	0	7,031.07	15.57	.0812	.0054	.48	.2000
D. Pleistocene	5.8345	0	7,031.07	19.80	.0812	.0054	.62	.2000
E. American Bar	13.4402	0	7,031.07	35.25	.0812	.0054	1.10	[1].5248
F. Book catalog	19.6682	0	7,031.07	59.25	.0812	.0054	1.86	[1].5248
G. Hardware directory	25.1053	0	7,031.07	88.04	.0812	.0054	2.77	[1].5248
H. Telephone directory								
II. 360-50 Linotron 1010:								
A. The Group	3.5858	$28,574	17,012.00	12.11	.0812	.0054	.42	.20
B. Policy	4.7824	28,574	17,012.00	17.10	.0812	.0054	.55	.20
C. Prices and Production	4.3630	28,574	17,012.00	15.57	.0812	.0054	.48	.20
D. Pleistocene	5.8345	28,574	17,012.00	19.80	.0812	.0054	.62	.20
E. American Bar	13.4402	28,574	17,012.00	35.25	.0812	.0054	1.10	.20
F. Book catalog	19.6682	28,574	17,012.00	59.25	.0812	.0054	1.86	.20
G. Hardware directory	25.1053	29,574	17,012.00	88.04	.0812	.0054	2.77	.20
H. Telephone directory	34.2483	28,574	17,012.00	143.80	.0812	.0054	4.52	.20
III. 360-30 Fototronic CRT:								
A. The Group	3.5858	16,173	14,714.00	12.11	.0812	.0054	.42	.20
B. Policy	4.7824	16,173	14,714.00	17.10	.0812	.0054	.55	.20
C. Prices and Production	4.3630	16,173	14,714.00	15.57	.0812	.0054	.48	.20
D. Pleistocene	5.8345	16,173	14,714.00	19.80	.0812	.0054	.62	.20
E. American Bar	13.4402	16,173	14,714.00	35.25	.0812	.0054	1.10	.20
F. Book catalog	19.6682	16,173	14,714.00	59.25	.0812	.0054	1.86	.20
G. Hardware directory	25.1053	16,173	14,714.00	88.04	.0812	.0054	2.77	.20
H. Telephone directory	34.2483	16,173	14,174.00	143.80	.0812	.0054	4.52	.20
IV. RCA 70/45 Videocomp:								
A. The Group	3.5858	20,897	14,014.00	12.11	.0812	.0054	.42	.20
B. Policy	4.7824	20,897	14,014.00	17.10	.0812	.0054	.55	.20
C. Prices and Production	4,3630	20,897	14,014.00	15.57	.0812	.0054	.48	.20
D. Pleistocene	5.8345	20,897	14,014.00	19.80	.0812	.0054	.62	.20
E. American Bar	13.4402	20,897	14,014.00	35.25	.0812	.0054	1.10	.20
F. Book catalog	19,6682	20,897	14,014.00	59.25	.0812	.0054	1.86	.20
G. Hardware directory	25.1053	20,897	14,014.00	88.04	.0812	.0054	2.77	.20
H. Telephone directory	34.2483	20,897	14,014.00	143.80	.0812	.0054	4.52	.20
V. RCA 70/35 Videocomp:								
A. The Group	3.5858	15,235	14,014.00	12.11	.0812	.0054	.42	.20
B. Policy	4.7824	15,235	14,014.00	17.10	.0812	.0054	.55	.20
C. Prices and Production	4.3630	15,235	14,014.00	15.57	.0812	.0054	.48	.20
D. Pleistocene	5.8345	15,235	14,014.00	19.80	.0812	.0054	.62	.20
E. American Bar	13.4402	15,235	14,014.00	35.25	.0812	.0054	1.10	.20
F. Book catalog	19.6682	15,235	14,014.00	59.25	.0812	.0054	1.86	.20
G. Hardware directory	25.1053	15,235	14,014.00	88.04	.0812	.0054	2.77	.20
H. Telephone directory	34.2483	15,235	14,014.00	143.80	.0812	.0054	4.52	.20

[1] Charged with 4 minutes to strip galleys at $0.0812 per minute.

U.S. DATA EQUATION II—BREAK-EVEN RESULTS AGAINST MONOTYPE

System	Minutes[1]	Pages	Keyboards
A. For sample I—The Group:			
Linotron 505	3,157	3,056	3.63
Linotron 1010	2,229	19,815	23.51
Harris Fototronic CRT	1,790	13,426	15.93
Videocomp/45	1,695	15,174	18.01
Videocomp/35	1,742	12,714	15.09
B. For sample II—Policy:			
Linotron 505	3,683	2,302	3.85
Linotron 1010	2,081	14,927	24.95
Harris Fototronic CRT	1,685	10,114	16.90
Videocomp/45	1,486	11,432	19.11
Videocomp/35	1,539	9,578	16.01
C. For sample III—Prices and Production:			
Linotron 505	3,296	2,535	3.85
Linotron 1010	1,999	16,439	24.99
Harris Fototronic CRT	1,856	11,138	16.92
Videocomp/45	1,574	12,589	19.13
Videocomp/35	1,590	10,548	16.03
D. For sample IV—Pleistocene:			
Linotron 505	3,819	1,819	3.52
Linotron 1010	1,996	11,791	22.80
Harris Fototronic CRT	2,928	7,989	15.45
Videocomp/45	1,415	9,030	17.46
Videocomp/35	1,394	7,565	14.63
E. For sample V—American Bar:			
Linotron 505	2,160	720	2.48
Linotron 1010	1,230	4,517	15.55
Harris Fototronic CRT	3,264	3,060	10.53
Videocomp/45	842	3,459	11.91
Videocomp/35	1,049	2,898	9.98
F. For sample VI—Book catalog:			
Linotron 505	13,569	548	3.17
Linotron 1010	2,039	3,216	18.61

U.S. DATA EQUATION II—BREAK-EVEN RESULTS AGAINST MONOTYPE—Continued

System	Minutes [3]	Pages	Keyboards
F. For sample VI—Book Catalog—Continued			
Harris Fototronic CRT	5,230	2,179	12.61
Videocomp/45	1,695	2,463	14.25
Videocomp/35	2,432	2,063	11.94
G. For sample VII—Hardware directory:			
Linotron 505	2,495	421	3.62
Linotron 1010	1,025	2,675	23.00
Harris Fototronic CRT	4,291	1,813	15.59
Videocomp/45	975	2,049	17.62
Videocomp/35	1,626	1,716	14.76
H. For sample VIII—Telephone directory:			
Linotron 505	(2)		
Linotron 1010	1,313	2,150	30.20
Harris Fototronic CRT	5,925	1,457	20.46
Videocomp/45	1,204	1,647	23.13
Videocomp/35	2,015	1,379	19.37
I. For Monotype mix—(Each sample 12.5 percent of total volume):			
Linotron 505 [3] (50.55)	5,339	940	3.24
Linotron 1010 (14.01)	1,479	4,895	23.36
Harris Fototronic CRT (42.00)	4,436	3,316	15.83
Videocomp/45 (11.81)	1,247	3,748	17.89
Videocomp/35 (17.04)	1,799	3,140	14.99

[1] Refers to minutes of use per month of lower speed component which is generally the computer.
[2] Did not set.
[3] 505 includes seven samples at 14.28% of total volume.

Note: Figures in parenthesis represent percentage use of shift to achieve break-even.

U.S. INPUT VALUES FOR EXECUTION OF EQUATION II: PHOTON 713—ELLIOT 903 (UNBALANCED)

	Factors							
	A	*B*	*C*	*D*	D_1	D_2	*E*	*F*
I. M-16 Linotron 505:								
A. The Group	$3.2372	0	$7,031.07	12.11	$0.0812	$¼.0054	0.42	$0.2000
B. Policy	3.4645	0	7,031.07	17.10	.0812	.0054	.55	.2000
C. Prices and Production	3.3309	0	7,031.07	15.57	.0812	.0054	.48	.2000
D. Plestocene	4,3374	0	7,031.07	19.80	.0812	.0054	.62	.2000
E. American Bar	8,4926	0	7,031.07	35.25	.0812	.0054	1.10	¼.5248
II. 360-50 Linotron 1010:								
A. The Group	3,2372	$28,574	17,012.00	12.11	.0812	.0054	.42	.20
B. Policy	3.4645	28,574	17,012.00	17.10	.0812	.0054	.55	.20
C. Prices and Production	3,3309	28,574	17,012.00	15.57	.0812	.0054	.48	.20
D. Pleistocene	4,3374	28,574	17,012.00	19.80	.0812	.0054	.62	.20
E. American Bar	8,4926	28,574	17,012.00	35.25	.0812	.0054	1.10	.20
III. 360-30 Fototronic CRT:								
A. The Group	3.2372	16,173	14,714.00	12.11	.0812	.0054	.42	.20
B. Policy	3.4645	16,173	14,714.00	17.10	.0812	.0054	.55	.20
C. Prices and Production	3.3309	16,173	14,714.00	15.57	.0812	.0054	.48	.20
D. Pleistocene	4.3374	16,173	14,714.00	19.80	.0812	.0054	.62	.20
E. American Bar	8.4926	16,173	14,714.00	35.25	.0812	.0054	1.10	.20
IV. RCA 70/45 Videocomp:								
A. The Group	3,2372	20,897	14,014.00	12.11	.0812	.0054	.42	.20
B. Policy	3.4645	20,897	14,014.00	17.10	.0812	.0054	.55	.20
C. Prices and Production	3.3309	20,897	14,014.00	15.57	.0812	.0054	.48	.20
D. Pleistocene	4,3374	20,897	14,014.00	19.80	.0812	.0054	.62	.20
E. American Bar	8.4926	20,897	14,014.00	35.25	.0812	.0054	1.10	.20
V. RCA 70/35 Videocomp:								
A. The Group	3.2372	15,235	14,014.00	12.11	.0812	.0054	.42	.20
B. Policy	3.4645	15,235	14,014.00	17.10	.0812	.0054	.55	.20
C. Prices and Production	3.3309	15,235	14,014.00	15.57	.0812	.0054	.48	.20
D. Pleistocene	4,3374	15,235	14,014.00	19.80	.0812	.0054	.62	.20
E. American Bar	8.4926	15,235	14,014.00	35.25	.0812	.0054	1.10	.20

[1] Charged with 4 minutes to strip galleys at $0.0812 per minute.

U.S. DATA, EQUATION II—BREAK-EVEN RESULTS AGAINST PHOTON 713—UNBALANCED SYSTEM[1]

System	Minutes[2]	Pages	Keyboards
A. For sample I—The Group:			
Linotron 505	3,722	3,602	4.27
Linotron 1010	2,627	23,352	27.71
Harris Fototronic CRT	2,109	15,822	18.77
Videocomp/45	1,998	17,884	21.22
Videocomp/35	2,053	14,983	17.78
B. For sample II—Policy:			
Linotron 505	6,477	4,048	6.77
Linotron 1010	3,658	26,242	43.86
Harris Fototronic CRT	2,962	17,781	29.72
Videocomp/45	2,613	20,097	33.59
Videocomp/35	2,706	16,838	28.14
C. For sample III—Prices and Production:			
Linotron 505	5,250	4,039	6.14
Linotron 1010	3,184	26,184	39.80
Harris Fototronic CRT	2,955	17,740	26.96
Videocomp/45	2,507	20,053	30.48
Videocomp/35	2,532	16,800	25.53
D. For sample IV—Pleistocene:			
Linotron 505	6,231	2,967	5.74
Linotron 1010	3,258	19,242	37.21
Harris Fototronic CRT	2,172	13,038	25.21

U.S. DATA, EQUATION II—BREAK-EVEN RESULTS AGAINST PHOTON 713—UNBALANCED SYSTEM [1]—Continued

System	Minutes [1]	Pages	Keyboards
D. For sample IV—Pleistocene—Continued			
Videocomp/45	2,309	14,736	28.50
Videocomp/35	2,275	12,346	23.90
E. For sample V—American Bar:			
Linotron 505	4,376	1,459	5.02
Linotron 1010	2,412	8,861	20.50
Harris Fototronic CRT	6,396	6,004	20.67
Videocomp/45	1,651	6,786	23.36
Videocomp/35	2,058	5,685	19.57
F. For Photon mix (20 percent of volume for each of 5 samples):			
Linotron 505 (47.69)	5,036	2,786	5.43
Linotron 1010 (26.80)	2,830	17,609	34.35
Harris Fototronic CRT (42.16)	4,452	11,931	23.27
Videocomp/45 (19.57)	2,067	13,486	26.31
Videocomp/35 (21.28)	2,247	11,298	22.04

[1] Cost of computer-composer imbalance included.
[2] Refers to minutes of use per month of lower speed component which is generally the computer.

Note: Figures in parentheses represent percentage use of shift to achieve break-even.

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U.S, INPUT VALUES FOR EXECUTION OF EQUATION II: PHOTON 713—ELLIOT 903 (BALANCED)

	A	*B*	*C*	*D*	D_1	D_2	*E*	*F*
I. M-16 Linotron 505:								
A. The Group	$2.7018	0	$7,031.07	12.11	$0.0812	$0.0054	0.42	$0.2000
B. Policy	2.8240	0	7,031.07	17.10	.0812	.0054	.55	.2000
C. Prices and Production	2.8107	0	7,031.07	15.57	.0812	.0054	.48	.2000
D. Pleistocene	3.6515	0	7,031.07	19.80	.0812	.0054	.62	.2000
E. American Bar	7.1871	0	7,031.07	35.25	.0812	.0054	1.10	[1].5248
II. 360-50 Linotron 1010:								
A. The Group	2.7018	$28,574.00	17,012.00	12.11	.0812	.0054	.42	.20
B. Policy	2.8240	28,574.00	17,012.00	17.10	.0812	.0054	.55	.20
C. Prices and Production	2.8107	28,574.00	17,012.00	15.57	.0812	.0054	.48	.20
D. Pleistocene	3.6515	28,574.00	17,012.00	19.80	.0812	.0054	.62	.20
E. American Bar	7.1871	28,574.00	17,012.00	35.25	.0812	.0054	1.10	.20
III. 350-30 Fototronic CRT:								
A. The Group	2.7018	16,173.00	14,714.00	12.11	.0812	.0054	.42	.20
B. Policy	2.8240	16,173.00	14,714.00	17.10	.0812	.0054	.55	.20
C. Prices and Production	2.8107	16,173.00	14,714.00	15.57	.0812	.0054	.48	.20
D. Pleistocene	3.6515	16,173.00	14,714.00	19.80	.0812	.0054	.62	.20
E. American Bar	7.1871	16,173.00	14,714.00	35.25	.0812	.0054	1.10	.20
IV. RCA 70/45 Videocomp:								
A. The Group	2.7018	20,897.00	14,014.00	12.11	.0812	.0054	.42	.20
B. Policy	2.8240	20,897.00	14,014.00	17.10	.0812	.0054	.55	.20
C. Prices and Production	2.8107	20,897.00	14,014.00	15.57	.0812	.0054	.48	.20
D. Pleistocene	3.6515	20,897.00	14,104.00	19.80	.0812	.0054	.62	.20
E. American Bar	7.1871	20,897.00	14,014.00	35.25	.0812	.0054	1.10	.20
V. RCA 70/35 Videocomp:								
A. The Group	2.7018	15,235.00	14,014.00	12.11	.0812	.0054	.42	.20
B. Policy	2.8240	15,235.00	14,014.00	17.10	.0812	.0054	.55	.20
C. Prices and Production	2.8107	15,235.00	14,014.00	15.57	.0812	.0054	.48	.20
D. Pleistocene	3.6515	15,235.00	14,014.00	19.80	.0812	.0054	.62	.20
E. American Bar	7.1871	15,235.00	14,014.00	35.25	.0812	.0054	1.10	.20

[1] Charged with 4 minutes to strip galleys at $0.0812 per minute.

U.S. DATA EQUATION II—BREAK-EVEN RESULTS AGAINST PHOTON 713 (BALANCED SYSTEM) [1]

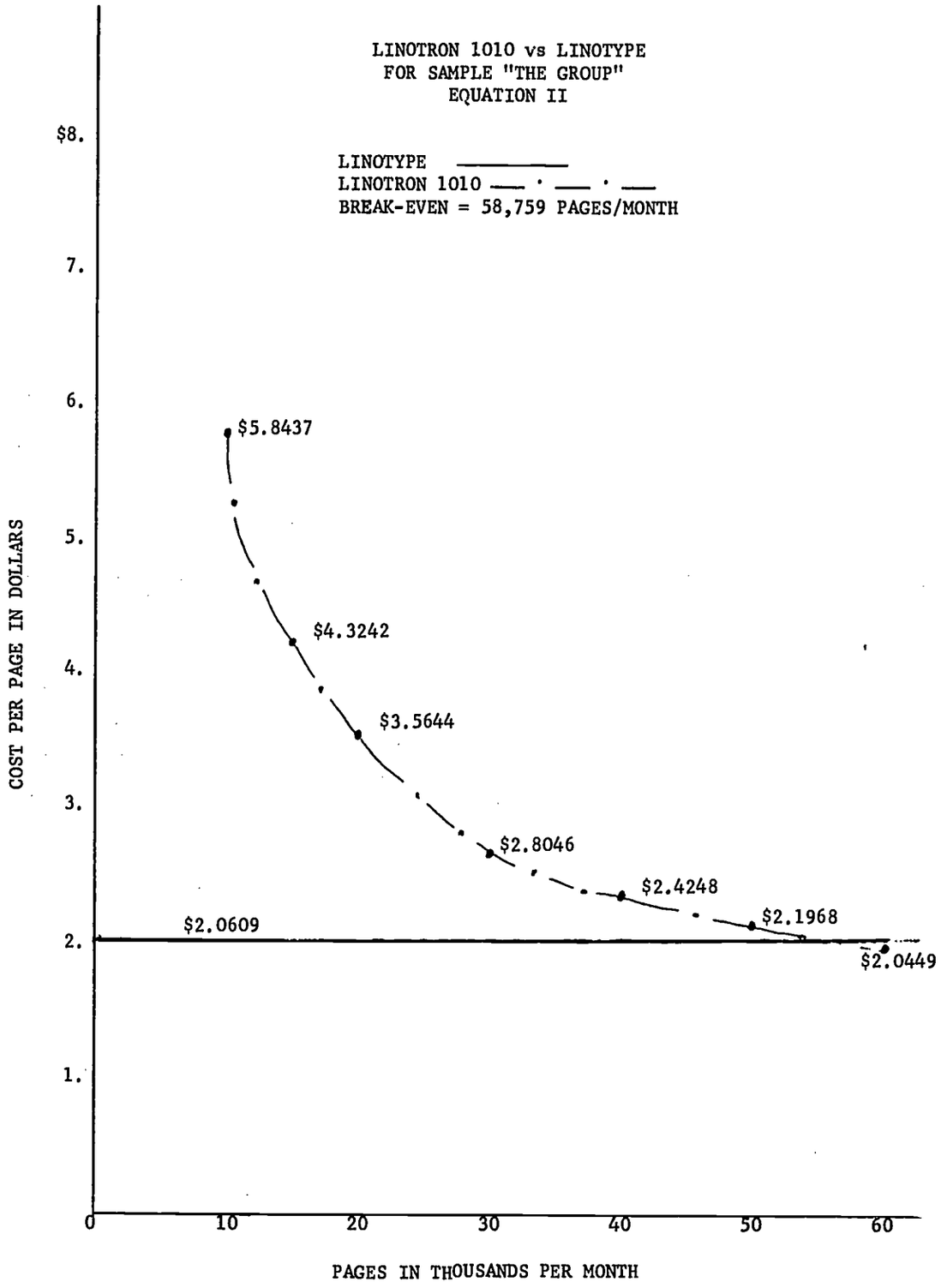
System	Minutes [2]	Pages	Keyboards
A. For sample I—The Group:			
Linotron 505	5,128	4,963	5.89
Linotron 1010	3,620	32,178	38.18
Harris Fototronic CRT	2,180	21,802	25.87
Videocomp/45	2,753	24,642	29.24
Videocomp/35	2,829	20,646	24.50
B. For sample II—Policy:			
Linotron 505	10,269	6,418	10.73
Linotron 1010	5,801	41,612	69.55
Harris Fototronic CRT	4,697	28,194	47.12
Videocomp/45	4,143	31,867	53.26
Videocomp/35	4,291	26,699	44.62
C. For sample III—Prices and Production:			
Linotron 505	7,487	5,759	8.75
Linotron 1010	4,541	37,342	56.76
Harris Fototronic CRT	4,215	25,301	38.45
Videocomp/45	3,575	28,598	43.46
Videocomp/35	3,611	23,959	36.42
D. For sample IV—Pleistocene:			
Linotron 505	8,772	4,177	8.08
Linotron 1010	4,585	27,084	52.37

U.S. DATA EQUATION II—BREAK-EVEN RESULTS AGAINST PHOTON 713 (BALANCED SYSTEM) [1]—Continued

System	Minutes [2]	Pages	Keyboards
D. for sample IV—Pleistocene—Continued			
Harris Fototronic CRT	6,727	18,351	35.49
Videocomp/45	3,250	20,742	40.11
Videocomp/35	3,203	17,378	33.60
E. For sample V—American Bar:			
Linotron 505	6,000	2,000	6.89
Linotron 1010	3,232	11,874	40.87
Harris Fototronic CRT	8,581	8,045	27.69
Videocomp/45	2,212	9,093	31.30
Videocomp/35	2,758	7,619	26.22
F. For Photon mix—(Each sample 20 percent of total volume):			
Linotron 505 (67.35)	7,113	3,937	7.68
Linotron 1010 (37.48)	3,958	24,627	48.04
Harris Fototronic CRT (58.96)	6,227	16,686	32.55
Videocomp/45 (27.38)	2,891	18,860	36.79
Videocomp/35 (29.76)	3,143	15,801	30.82

[1] Cost of computer-composer imbalance not charged.
[2] Refers to minutes of use per month of lower speed component.

Note: Figures in parenthesis represent percentage use of shift to achieve break-even.


LINOTRON 1010 vs LINOTYPE
FOR SAMPLE "THE GROUP"
EQUATION II
LINOTYPE
LINOTRON 1010
BREAK-EVEN = 58,759 PAGES/MONTH
$8.
7.
6.
5.
4.
3.
2.
1.
0
10
20
30
40
50
60
$5.8437
$4.3242
$3.5644
$2.8046
$2.4248
$2.1968
$2.0609
$2.0449
COST PER PAGE IN DOLLARS
PAGES IN THOUSANDS PER MONTH

XVIII. Break-Even Points for the United Kingdom

Since labor costs are significantly lower in the United Kingdom than in the United States and capital costs prior to redevelopment allowances are higher, the break-even points will be considerably higher in the United Kingdom than in the United States.

Computer costs have been calculated at 115% of American rates and the lease costs of the composing devices have been increased by 9.3% of purchase price amortized over sixty months for the Linotron 1010 and Fototronic CRT. RCA quoted a 15% differential on the Videocomp. The cost of the M–16 Linotron 505 system is based on the costs of the system installed at the University of Newcastle-upon-Tyne. No marketing price has been established by Linotype-Paul Ltd. for this particular configuration of the Linotron 505.

Computer operating costs are based on British Government data and operator costs for keyboarding and related composing operations are based on data provided by the British Federation of Master Printers.

As with the results portrayed for the United States break-even will be directly related to wage costs. To the extent that there are regional differences there will be differences in results.

XIX. United Kingdom Costs For Computers Applied—Equation I

(a) *IBM 360–50*

1. Monthly lease cost	$24, 889. 00
2. Operations staff/month	1, 402. 00
3. Site cost amortization/month	1, 066. 00
4. Consumable supplies/month	390. 00
Total	27, 747. 00

Cost per minute: $2.0211.

(b) *IBM 360–30*

1. Monthly lease cost	$10, 628. 00
2. Operations staff/month	1, 402. 00
3. Site cost amortization/month	1, 066. 00
4. Consumable supplies/month	390. 00
Total	13, 486. 00

Cost per minute: $1.2771.

(c) *RCA Spectra 70/45*

1. Monthly lease cost	$15, 934. 00
2. Operations staff/month	1, 402. 00
3. Site cost amortization/month	1, 066. 00
4. Consumable supplies/month	390. 00
Total	18, 792. 00

Cost per minute: $1.7795.

(d) *RCA Spectra 70/35*

1. Monthly lease cost	$9, 423. 00
2. Operations staff/month	1, 402. 00
3. Site cost amortization/month	1, 066. 00
4. Consumable supplies	390. 00
Total	12, 281. 00

Cost per minute: $1.1630.

XX. United Kingdom Costs for Composing Systems Applied

(a) *Micro-16 Linotron 505*

1. Monthly amortization of equipment	$3, 054. 00
2. Operations staff	372. 00
3. Programer support	361. 00
4. Monthly amortization of film processor	530. 00
5. Monthly amortization of site costs	200. 00
6. Consumable supplies	135. 00
7. Monthly maintenance costs	432. 00
Total	5, 084. 00

(b) *Mergenthaler 1010*

1. Monthly lease costs	$11, 168. 00
2. Operations staff	372. 00
3. Programers support	722. 00
4. Monthly amortization of film processor	530. 00
5. Monthly amortization of site costs	200. 00
6. Consumable supplies	135. 00
7. Monthly maintenance costs	432. 00
Total	13, 559. 00

(c) *Harris Fototronic CRT*

1. Lease of Harris 512	$9, 835. 00
2. Operations staff	372. 00
3. Programers support	722. 00
4. Monthly amortization of film processor	530. 00
5. Monthly amortization of site costs	200. 00
6. Consumable supplies	135. 00
7. Software charge	550. 00
Total	12, 344. 00

(d) *RCA Videocomp 830*

1. Monthly lease	$10, 523. 00
2. Operations staff	372. 00
3. Programer support	722. 00
4. Monthly amortization of film processor	530. 00
5. Monthly amortization of site costs	200. 00
6. Consumable supplies	135. 00
Total	12, 482. 00

XXI. United Kingdom Extra Shift Costs—Computers

The extra shift costs charged to the four computing systems applied in the analysis were adjusted for differences in labor costs and extra shift rental costs for the IBM 360–50 and IBM 360–30. These charges are as follows:

(a) *IBM 360–50*

1. Equipment rental	$1, 823. 00
2. Personal services	312. 00
3. Consumable supplies	300. 00
4. Maintenance costs	627. 00
Total	3, 062. 00

Cost per minute: $0.2900.

(b) *IBM 360–30*

1. Equipment rental	$500. 00
2. Personal services	312. 00
3. Consumable supplies	300. 00
4. Maintenance costs	627. 00
Total	1, 739. 00

Cost per minute: $0.1647.

(c) *RCA Spectra 70/45*

1. Equipment rental	0
2. Personal services	$312.00
3. Consumable supplies	300.00
4. Maintenance costs	786.00
Total	1,39.800

Cost per minute: $0.1324.

(d) *RCA Spectra 70/35*

1. Equipment rental	0
2. Personal services	$312.00
3. Consumable supplies	300.00
4. Maintenance	497.00
Total	1,109.00

Cost per minute: $0.1050.

XXII. United Kingdom Extra Shift Costs—Composing Devices

The same cost was charged to each of the systems. The personal services costs were reduced to reflect lower British wage rates.

1. Equipment lease	0
2. Personal services	$410.00
3. Maintenance	471.00
Total	881.00

Cost per minute: $0.0834.

XXIII. United Kingdom Initial Keyboarding and Correction Costs for Computer Input

Sample	Total time	Rate [1]	Cost
1. The Group	12.53	0.0317	0.3972
2. Policy	17.65	.0317	.5595
3. Prices and Production	16.05	.0317	5088
4. Pleistocene	20.42	.0317	.6473
5. American Bar	36.35	.0317	1.1523
6. Book Catalogue	90.81	.0317	2.8787
7. Hardware Directory	61.11	.0317	1.9372
8. Telephone Directory	148.32	.0317	4.7017

[1] $.0054/minute-capital $.0263/minute-labor.

XXIV. Costs in the United Kingdom To Compose Sample Pages by Conventional Processes

The tables that follow depict direct labor and directly applied capital costs to compose the sample pages by Linotype, Monotype and a Photon 713 driven by an Elliot 903 computer.

Labor rates are based on data provided by the British Federation of Master Printers.

UNITED KINGDOM COST PROCESS: LINOTYPE—SAMPLE: THE GROUP

Function	Time	Rate	Cost
I. Input keyboarding:			
A. Labor	18.8	$0.0263	$0.4944
B. Capital	18.8	.0013	.2124
II. Page makeup:			
A. Labor	.65	.0263	.0171
III. Initial proof:			
A. Labor	.50	.0263	.0132
IV. Correction keyboarding:			
A. Labor	.62	.0263	.0163
B. Capital	.62	.0113	.0070
V. Insertion of corrections:			
A. Labor	.36	.0263	.0094
VI. House proof:			
A. Labor	.50	.0263	$0.0132
VII. Supply costs			.0947
Total			.8777

Cost summary:	Amount	Percent
Total capital	$0.2194	24.99
Total labor	.4636	64.21
Supplies	.0947	10.78
Grand total	.8777	99.89

PROCESS: LINOTYPE—SAMPLE: POLICY

Function	Time	Rate	Cost
I. Input keyboarding:			
A. Labor	27.8	$0.0263	$0.7311
B. Capital	27.8	.0113	.3141
II. Page makeup:			
A. Labor	1.35	.0263	.0355
III. Initial proof:			
A. Labor	.50	.0263	.0132
IV. Correction keyboarding:			
A. Labor	1.70	.0263	.0447
B. Capital	1.70	.0113	.0192
V. Insertion of corrections:			
A. Labor	.36	.0263	.0094
VI. House proof:			
A. Labor	.50	.0263	.0132
VII. Supply costs			.0947
Totals			1.2751

Cost summary:	Amount	Percent
Total capital	$0.3333	26.13
Total labor	.8471	66.43
Supplies	.0947	7.42
Grand total	1.2751	99.98

PROCESS: LINOTYPE—SAMPLE: PRICES AND PRODUCTION

Function	Time	Rate	Cost
I. Input keyboarding:			
A. Labor	27.7	$0.0263	$0.7285
B. Capital	27.7	.0113	.3130
II. Page makeup:			
A. Labor	1.45	.0263	.0381
III. Initial proof:			
Labor	.50	.0263	.0132
IV. Correction keyboarding:			
A. Labor	1.50	.0263	.0395
B. Capital	1.50	.0113	.0170
V. Insertion of corrections:			
A. Labor	.36	.0263	.0094
VI. House proof:			
A. Labor	.50	.0263	.0132
VII. Supply costs			.0947
Total			1.2665

Cost summary:	Amount	Percent
Total capital	$0.3300	26.05
Total labor	.8418	66.46
Supplies	.0947	7.47
Grand total	1.2665	99.98

PROCESS: LINOTYPE—SAMPLE: PLEISTOCENE

Function	Time	Rate	Cost
I. Input keyboarding:			
A. Labor	33.7	$0.0263	$0.8863
B. Capital	33.7	.0113	.3808
II. Page makeup:			
A. Labor	1.85	.0263	.0487

PROCESS: LINOTYPE—SAMPLE: PLIESTOCENE—Continued

Function	Time	Rate	Cost
III. Initial proof:			
A. Labor	.50	$0.0263	$0.0132
IV. Correction keyboarding:			
A. Labor	1.70	.0263	.0447
B. Capital	1.70	.0113	.0192
V. Insertion of corrections:			
A. Labor	.36	.0263	.0094
VI. House proof:			
A. Labor	.50	.0263	.0132
VII. Supply costs			.0947
Total			1.5102

	Amount	Percent
Cost summary:		
Total capital	$0.4000	26.48
Total labor	1.0155	67.24
Supplies	.0947	6.27
Grand total	1.5102	99.99

PROCESS: LINOTYPE—SAMPLE: AMERICAN BAR

Function	Time	Rate	Cost
I. Input keyboarding:			
A. Labor	57.0	$0.0263	$1.4991
B. Capital	57.0	.0113	.6441
II. Page makeup:			
A. Labor	10.03	.0263	.2638
III. Initial proof:			
A. Labor	.5	.0263	.0132
IV. Correction keyboarding:			
A. Labor	3.0	.0263	.0789
B. Capital	3.0	.0113	.0339
V. Insertion of corrections:			
A. Labor	.36	.0263	.0094
VI. House proof:			
A. Labor	.5	.0263	.0132
VII. Supply costs			.0947
Total			2.6503

	Amount	Percent
Cost summary:		
Total capital	$0.6780	25.58
Total labor	1.8776	70.84
Supplies	.0947	3.57
Grand total	2.6503	99.99

PROCESS: LINOTYPE—SAMPLE: BOOK CATALOG

Function	Time	Rate	Cost
I. Input keyboarding:			
A. Labor	103.7	$0.0263	$2.7273
B. Capital	103.7	.0113	1.1718
II. Page makeup:			
A. Labor	26.79	.0263	.7046
III. Initial proof:			
A. Labor	.5	.0263	.0132
IV. Correction keyboarding:			
A. Labor	6.0	.0263	.1578
B. Capital	6.0	.0113	.0678
V. Insertion of corrections:			
A. Labor	.36	.0263	.0094
VI. House proof:			
A. Labor	.5	.0263	.0132
VII. Supply costs			.0947
Total			4.9598

	Amount	Percent
Cost summary:		
Total capital	$1.2396	24.99
Total labor	3.6255	73.09
Supplies	.0947	1.90
Grand total	4.9598	99.98

PROCESS: LINOTYPE—SAMPLE: HAROWARE DIRECTORY

Function	Time	Rate	Cost
I. Input keyboarding:			
A. Labor	102.0	$0.0263	$2.6826
B. Capital	102.0	.0113	1.1526
II. Page makeup:			
A. Labor	16.8	.0263	.4418
III. Initial proof:			
A. Labor	.5	.0263	.0132
IV. Correction keyboarding:			
A. Labor	5.5	.0263	.1447
B. Capital	5.5	.0113	.0622
V. Insertion of corrections:			
A. Labor	.36	.0263	.0094
VI. House proof:			
A. Labor	.5	.0263	.0132
VII. Supply costs			.0947
Total			4.6144

	Amount	Percent
Cost summary:		
Total capital	$1.2148	26.32
Total labor	3.3049	71.62
Supplies	.0947	2.05
Grand total	4.6144	99.99

PROCESS: LINOTYPE—SAMPLE: TELEPHONE DIRECTORY

Function	Time	Rate	Cost
I. Input keyboarding:			
A. Labor	217.18	$0.0263	$5.7118
B. Capital	217.18	.0113	2.4540
II. Page makeup:			
A. Labor	22.8	.0263	.5996
III. Initial proof:			
A. Labor	.5	.0263	.0132
IV. Correction keyboarding:			
A. Labor	12.0	.0263	.3156
B. Capital	12.0	.0113	.1356
V. Insertion of corrections:			
A. Labor	.36	.0263	.0094
VI. House proof:			
A. Labor	.5	.0263	.0132
VII. Supply costs			.0947
Total			9.3471

	Amount	Percent
Cost summary:		
Total capital	$2.5896	27.70
Total labor	6.6628	71.28
Supplies	.0947	1.01
Grand total	9.3471	99.99

PROCESS: MONOTYPE—SAMPLE: THE GROUP

Function	Time	Rate	Cost
I. Input keyboarding:			
A. Labor	21.8	$0.0263	$0.5733
B. Capital	21.8	.00014	.0031
II. Casting:			
A. Labor	23.0	.0182	.4186
B. Capital	23.0	.0012	.0276
III. Page makeup:			
A. Labor	4.0	.0263	.1052
IV. Insertion of corrections:			
A. Labor	4.1	.0263	.1078
V. House Proof:			
A. Labor	.9	.0263	.0237
VI. Supplies			.1200
Totals			1.3793

	Amount	Percent
Cost summary:		
Total capital	$0.0307	2.22
Total labor	1.2286	89.07
Supplies	.1200	8.70
Grand total	1.3793	99.99

PROCESS: MONOTYPE—SAMPLE: POLICY

Function	Time	Rate	Cost
I. Input keyboarding:			
A. Labor	25.9	$0.02630	$0.62812
B. Capital	25.9	.00014	.0036
II. Casting:			
A. Labor	29.4	.0182	.5351
B. Capital	29.4	.0012	.0353
III. Page makeup:			
A. Labor	9.5	.0263	.2499
IV. Insertion of corrections:			
A. Labor	5.2	.0263	.1368
V. House proof:			
A. Labor	.9	.0263	.0237
VI. Supplies			.1200
Total			1.7856

	Amount	Percent
Cost summary:		
Total capital	$0.0389	2.17
Total labor	1.6267	91.10
Supplies	.1200	6.72
Grand total	1.7856	99.99

PROCESS: MONOTYPE—SAMPLE: PRICES AND PRODUCTION

Function	Time	Rate	Cost
I. Input keyboarding:			
A. Labor	26.0	$0.02630	$0.6838
B. Capital	26.0	.00014	.0036
II. Casting:			
A. Labor	27.6	.0182	.5023
B. Capital	27.6	.0012	.0331
III. Page makeup:			
A. Labor	5.9	.0263	.1552
IV. Insertion of corrections:			
A. Labor	5.2	.0263	.1368
V. House proof:			
A. Labor	.9	.0263	.0237
VI. Supplies			.1200
Total			1.6585

	Amount	Percent
Cost summary:		
Total capital	$0.0367	2.21
Total labor	1.5018	90.55
Supplies	.1200	7.23
Grand total	1.6585	99.99

PROCESS: MONOTYPE—SAMPLE: PLEISTOCENE

Function	Time	Rate	Cost
I. Input keyboarding:			
A. Labor	37.0	$0.02630	$0.9731
B. Capital	37.0	.00014	.0052
II. Casting:			
A. Labor	30.3	.0182	.5515
B. Capital	30.3	.0012	.0364
III. Page makeup:			
A. Labor	11.0	.0263	.2893
IV. Insertion of corrections:			
A. Labor	5.8	.0263	.1525
V. House proof:			
A. Labor	.9	.0263	.0237
VI. Supplies			.1200
Totals			2.1517

	Amount	Percent
Cost summary:		
Total capital	$0.0416	1.93
Total labor	1.9901	92.48
Supplies	.1200	5.57
Grand total	2.1517	99.98

PROCESS: MONOTYPE—SAMPLE: AMERICAN BAR

Function	Time	Rate	Cost
I. Input keyboarding:			
A. Labor	84.2	$0.02630	$2.2145
B. Capital	84.2	.00014	.0118
II. Casting:			
A. Labor	67.4	.0182	1.2267
B. Capital	67.4	.0012	.0809
III. Page makeup:			
A. Labor	32.2	.0263	.8469
IV. Insertion of corrections:			
A. Labor	11.9	.0263	.3130
V. House proof:			
A. Labor	.9	.0263	.0237
VI. Supplies			.1200
Total			4.8375

	Amount	Percent
Cost summary:		
Total capital	$0.0927	1.91
Total labor	4.6248	95.60
Supplies	.1200	2.48
Grand total	4.8375	99.99

PROCESS: MONOTYPE—SAMPLE: BOOK CATALOG

Function	Time	Rate	Cost
I. Input keyboarding:			
A. Labor	159.2	$0.02630	$4.1870
B. Capital	159.2	.00014	.0223
II. Casting:			
A. Labor	88.9	.0182	1.6180
B. Capital	88.9	.0012	.1067
III. Page makeup:			
A. Labor	15.6	.0263	.4103
IV. Insertion of corrections:			
A. Labor	19.0	.0263	.4997
V. House proof:			
A. Labor	.9	.0263	.0237
VI. Supplies			.1200
Total			6.9877

	Amount	Percent
Cost summary:		
Total capital	$0.1290	1.84
Total labor	6.7387	96.43
Supplies	.1200	1.71
Grand total	6.9877	99.98

PROCESS: MONOTYPE—SAMPLE: HARDWARE DIRECTORY

Function	Time	Rate	Cost
I. Input keyboarding:			
A. Labor	156.7	$0.02630	$4.1212
B. Capital	156.7	.00014	.0219
II. Casting:			
A. Labor	141.3	.0182	2.5717
B. Capital	141.3	.0012	.1696
III. Page makeup: A. Labor	48.1	.0263	1.2650
IV. Inserting of corrections, A. Labor	29.0	.0263	.7627
V. House proof, A. Labor	.9	.0263	.2037
VI. Supplies			.1200
Total			9.0558

	Amount	Percent
Cost summary:		
Total capital	$0.1915	2.11
Total labor	8.7443	96.56
Supplies	.1200	1.32
Grand total	9.0558	99.99

PROCESS: MONOTYPE—SAMPLE: TELEPHONE DIRECTORY

Function	Time	Rate	Cost
I. Input keyboarding:			
A. Labor	270.0	$0.02630	$7.1010
B. Capital	270.0	.00014	.0378
II. Casting:			
A. Labor	200.0	.0182	3.6400
B. Capital	200.0	.0012	.2400
III. Page makeup:			
A. Labor	25.0	.0263	.6575
IV. Insertion of corrections:			
A. Labor	19.5	.0263	.5128
V. House proof:			
A. Labor	.9	.0263	.0237
VI. Supplies			.1200
Total			12.3328

	Amount	Percent
Cost summary:		
Total capital	$0.2778	2.25
Total labor	11.9350	96.77
Supplies	.1200	.97
Grand total	12.3328	99.99

PROCESS: PHOTON 713-ELLIOT 903—SAMPLE: THE GROUP

Function	Time	Rate	Cost
I. Input keyboarding:			
A. Labor	12.0	$0.0263	$0.3156
B. Capital	12.0	.0054	.0648
II. Computer processing:			
A. Labor	.57	.0400	.0228
B. Capital	.57	.0797	.0454
III. Photocomposing:			
A. Labor	2.86	.0297	.0849
B. Capital	2.86	.1136	.3249
C. Capital	2.86	.0094	.0269
IV. Correction keyboarding:			
A. Labor	3.0	.0263	.0789
B. Capital	3.0	.0054	.0162
V. Computer processing:			
A. Labor	.63	.0400	.0252
B. Capital	.63	.0797	.0502
VI. Photocomposing:			
A. Labor	2.22	.0297	.0659
B. Capital	2.22	.1136	.2521
C. Capital	2.22	.0094	.0209
VII. Supplies			.2000
VIII. Page makeup:			
A. Labor	0		0
IX. Computer imbalance			.4644
Totals			2.0591

PROCESS: PHOTON 713-ELLIOT 903—SAMPLE: POLICY

Function	Time	Rate	Cost
I. Input keyboarding:			
A. Labor	12.0	$0.0263	$0.3156
B. Capital	12.0	.0054	.0648
II. Computer processing:			
A. Labor	.69	.0400	.0276
B. Capital	.69	.0797	.0550
III. Photocomposing:			
A. Labor	3.30	.0297	.0980
B. Capital	3.30	.1136	.3749
C. Capital	3.30	.0094	.0310
IV. Correction keyboarding:			
A. Labor	2.0	.0263	.0526
B. Capital	2.0	.0054	.0108
V. Computer processing:			
A. Labor	.67	.0400	.0268
B. Capital	.67	.0797	.0534
VI. Photocomposing:			
A. Labor	2.70	.0297	.0802
B. Capital	2.70	.1136	.3067
C. Capital	2.70	.0094	.0253
VII. Supplies			.2000
VIII. Page makeup:			
A. Labor	0		0
IX. Computer imbalance			.5674
Total			2.2901

PROCESS: PHOTON 713-ELLIOT 903—SAMPLE: PRICES AND PRODUCTION

Function	Time	Rate	Cost
I. Input keyboarding:			
A. Labor	14.0	$0.0263	$0.3682
B. Capital	14.0	.0054	.0756
II. Computer processing:			
A. Labor	.68	.0400	.0272
B. Capital	.68	.0797	.0541
III. Photocomposing:			
A. Labor	2.55	.0297	.0272
B. Capital	2.55	.1136	.2897
C. Capital	2.55	.0094	.0239
IV. Correction keyboarding:			
A. Labor	2.0	.0263	.0526
B. Capital	2.0	.0054	.0108
V. Computer processing:			
A. Labor	.65	.0400	.0260
B. Capital	.65	.0797	.0518
VI. Photocomposing:			
A. Labor	2.55	.0297	.0757
B. Capital	2.55	.1136	.2897
C. Capital	2.55	.0094	.0239
VII. Supplies			.2000
VIII. Page makeup:			
A. Labor	0		0
IX. Computer imbalance			.4513
Total			2.0962

PROCESS: PHOTON 713-ELLIOT 903—SAMPLE: PLEISTOCENE

Function	Time	Rate	Cost
I. Input keyboarding:			
A. Labor	20.0	$0.0263	$0.5260
B. Capital	20.0	.0054	.1080
II. Computer processing:			
A. Labor	.78	.0400	.0312
B. Capital	.78	.0797	.0622
III. Photocomposing:			
A. Labor	3.60	.0297	.1069
B. Capital	3.60	.1136	.4090
C. Capital	3.60	.0094	.0338
IV. Correction keyboarding:			
A. Labor	2.0	.0263	.0526
B. Capital	2.0	.0054	.0108
V. Computer processing:			
A. Labor	.78	.0400	.0312
B. Capital	.78	.0797	.0622
VI. Photocomposing:			
A. Labor	2.93	.0297	.0870
B. Capital	2.93	.1136	.3328
C. Capital	2.93	.0094	.0275
VII. Supplies			.2000
VIII. Page makeup:			
A. Labor	0		0
IX. Computer imbalance			.5949
Total			2.6761

PROCESS: PHOTON 713-ELLIOT 903—SAMPLE: AMERICAN BAR

Function	Time	Rate	Cost
I. Input keyboarding:			
A. Labor	37.0	.0263	.9731
B. Capital	37.0	.0054	.1998
II. Computer processing:			
A. Labor	1.62	.0400	.0648
B. Capital	1.62	.0797	.1291
III. Photocomposing:			
A. Labor	6.95	.0297	.2064
B. Capital	6.95	.1136	.7895
C. Capital	6.95	.0094	.0653
IV. Correction keyboarding:			
A. Labor	5.0	.0263	.1315
B. Capital	5.0	.0054	.0270
V. Computer processing:			
A. Labor	1.71	.0400	.0684
B. Capital	1.71	.0797	.1363
VI. Photocomposing:			
A. Labor	5.60	.0297	.1663
B. Capital	5.60	.1136	.6362
C. Capital	5.60	.0094	.0526
VII. Supplies			.2000
VIII. Page makeup:			
A. Labor	4.0	.0263	.1052
IX. Computer imbalance			1.1036
Total			5.0551

XXV. Results of Equation I—United Kingdom

The difference in labor costs between the United States and the United Kingdom required a change in approach for the execution of Equation I against United Kingdom data. The entry "multiple shifts" is used for many of the samples. In these instances it would be prudent (assuming the existence of the necessary volume of work) to install a computer rather than to buy more than a full shift of computer time from a Service Bureau. Accordingly, the break-even point shown for Equation II should be referred to when the entry "multiple shifts" appears on the Equation I data. It appears quite clear that the scale of operations required of the high speed systems in the United Kingdom will inhibit their application unless sizable reductions in capital costs occur.

The pattern demonstrated in the United States with respect to cost effectiveness holds in the United Kingdom. The degree of difference in results between the RCA 70/45 and RCA 70/35 is, however, less acute. This is due to the difference in labor costs.

Equation I

I. To determine break-even cost per minute of use of CRT photocomposer versus cost of conventional composing process (Assumes necessary computer time can be purchased as required at a given cost per minute). Equation reads:

A Photocomposer cycles in minutes (X photocomposer cost per minute) = B Cost to set sample page by conventional process − C Computer cycles in minutes (C_1 cost of computer configuration per minute) − D Initial keyboarding cycle in minutes (D_1 Labor cost per minute + D_2 capital cost of keyboard per minute) − E correction keyboarding cycle in minutes (D_1 Labor cost per minute + D_2 capital cost of keyboard per minute) − F Supply costs

or

$$A\,(X) = B - C\,(C_1) - D\,(D_1 + D_2) - E\,(D_1 + D_2) - F$$

$$X = \frac{B - C\,(C_1) - D\,(D_1 + D_2) - E\,(D_1 + D_2) - F}{A}$$

II. $$\text{Break-even minutes} = \frac{\text{Photocomposer operating costs per month}^{1}}{X}$$

III. $$\text{Break-even pages} = \frac{\text{Break-even minutes}}{A}$$

IV. $$\text{Break-even keyboards} = \frac{\text{Break-even pages } (D+E)}{\frac{60}{176}}$$

[1] This value is taken from item C in equation II.

U.K. INPUT VALUES FOR EXECUTION OF EQUATION I (LINOTYPE)

	A	B	C	C_1	D	D_1	D_2	E	F
I. M-16 Linotron:									
A. The Group	1.0332	$0.8777	0	0	12.11	$0.0263	$0.0054	.42	$0.2000
B. Policy	1.6000	1.2751	0	0	17.10	.0263	.0054	.55	.2000
C. Prices and Production	1.3000	1.2665	0	0	15.57	.0263	.0054	.48	.2000
D. Pleistocene	2.1000	1.5102	0	0	19.80	.0263	.0054	.62	.2000
E. American Bar	3.0000	2.6503	0	0	35.25	.0263	.0054	1.10	[1].3052
F. Book catalog	24.7610	4.9598	0	0	59.25	.0263	.0054	1.86	[1].3052
G. Hardware directory	5.9320	4.6144	0	0	88.04	.0263	.0054	2.77	[1].3052
H. Telephone directory									
II. 360-50 Linotron 1010:									
A. The Group	.1125	.8777	.1062	$2.0211	12.11	.0263	.0054	.42	.2120
B. Policy	.1166	1.2751	.1394	2.0211	17.10	.0263	.0054	.55	.2156
C. Prices and Production	.1216	1.2665	.1162	2.0211	15.57	.0263	.0054	.48	.2147
D. Pleistocene	.1500	1.5102	.1693	2.0211	19.80	.0263	.0054	.62	.2177
E. American Bar	.2300	2.6503	.2722	2.0211	35.25	.0263	.0054	1.10	.2317
F. Book catalog	.3916	4.9598	.6341	2.0211	59.25	.0263	.0054	1.86	.2533
G. Hardware directory	.3833	4.6144	.3685	2.0211	88.04	.0263	.0054	2.77	.2793
H. Telephone directory	.5833	9.3471	.6108	2.0211	143.80	.0263	.0054	4.52	.3295
III. 360-30 Fototronic CRT:									
A. The Group	.1333	.8777	.1000	1.2771	12.11	.0263	.0054	.52	.2120
B. Policy	.1666	1.2751	.1666	1.2771	17.10	.0263	.0054	.55	.2156
C. Prices and Production	.1666	1.2665	.1666	1.2771	15.57	.0263	.0054	.48	.2147
D. Pleistocene	.1666	1.5102	.3666	1.2771	19.80	.0263	.0054	.62	.2177
E. American Bar	.2500	2.6503	1.0666	1.2771	35.25	.0263	.0054	1.10	.2317
F. Book catalog	.4000	4.9598	2.4000	1.2771	59.25	.0263	.0054	1.86	.2533
G. Hardware directory	.3333	4.6144	2.3666	1.2771	88.04	.0263	.0054	2.77	.2793
H. Telephone directory	.6500	9.3471	4.0666	1.2771	143.80	.0263	.0054	4.52	.3295
IV. RCA 70/45 Videocomp:									
A. The Group	.1117	.8777	.0720	1.7795	12.11	.0263	.0054	.42	.2120
B. Policy	.1300	1.2751	.0787	1.7795	17.10	.0263	.0054	.55	.2156
C. Prices and Production	.1250	1.2665	.0707	1.7795	15.57	.0263	.0054	.48	.2147
D. Pleistocene	.1567	1.5102	.0983	1.7795	19.80	.0263	.0054	.62	.2177
E. American Bar	.2433	2.6503	.1830	1.7795	35.25	.0263	.0054	1.10	.2317
F. Book catalog	.4167	4.9598	.6880	1.7795	59.25	.0263	.0054	1.86	.2533
G. Hardware directory	.4183	4.6144	.4757	1.7795	88.04	.0263	.0054	2.77	.2793
H. Telephone directory	.5467	9.3471	.7313	1.7795	143.80	.0263	.0054	4.52	.3295
V. RCA 70/35 Videocomp:									
A. The Group	.1117	.8777	.1370	1.1630	12.11	.0263	.0054	.42	.2120
B. Policy	.1300	1.2751	.1607	1.1630	17.10	.0263	.0054	.55	.2156
C. Prices and Production	.1250	1.2665	.1507	1.1630	15.57	.0263	.0054	.48	.2147
D. Pleistocene	.1567	1.5102	.1843	1.1620	19.80	.0263	.0054	.62	.2177
E. American Bar	.2433	2.6503	.3620	1.1630	35.25	.0263	.0054	1.10	.2317
F. Book catalog	.4167	4.9598	1.1790	1.1630	59.25	.0263	.0054	1.86	.2533
G. Hardware directory	.4183	4.6144	.9477	1.1630	88.04	.0263	.0054	2.77	.2793
H. Telephone directory	.5467	9.3471	1.4610	1.1630	143.80	.0263	.0054	4.52	.3295

[1] Includes 4 minutes of stripping galleys at $.0263/minute.

Note.—Monthly cost of composing systems: M-16 Linotron 505, $5,084; Linotron 1010, $13,559; Harris Fototronic CRT, $12,344; RCA Videocomp, $12,482.

UNITED KINGDOM COST EQUATION I—BREAK-EVEN RESULTS AGAINST LINOTYPE

System	Minutes [1]	Pages	Keyboards
A. For Sample I—The Group:			
Linotron 505	22,347	21,629	25.66
Linotron 1010	[2]		
Harris Fototronic CRT	[2]		
Videocomp/45	9,932	88,919	105.51
Videocomp/35	[2]		
B. For sample II—Policy:			
Linotron 505	17,598	10,999	18.38
Linotron 1010	7,244	62,125	103.84
Harris Fototronic CRT	7,160	42,976	71.83
Videocomp/45	4,508	34,677	57.96
Videocomp/35	5,182	39,866	66.63
C. For sample III—Prices and Production:			
Linotron 505	12,162	9,355	14.22
Linotron 1010	5,350	43,999	66.87
Harris Fototronic CRT	6,227	37,378	56.81
Videocomp/45	3,740	29,918	45.47
Videocomp/35	4,243	33,941	51.59
D. For sample IV—Pleistocene:			
Linotron 505	18,098	8,618	16.66
Linotron 1010	6,712	44,747	86.53
Harris Fototronic CRT	[2]		
Videocomp/45	4,159	26,543	51.33
Videocomp/35	4,532	28,924	55.93
E. For sample V—American Bar:			
Linotron 505	13,370	4,459	15.35
Linotron 1010	4,355	18,933	65.17
Harris Fototronic CRT	[2]		
Videocomp/45	3,228	13,269	45.68
Videocomp/35	3,593	14,766	50.83
F. For sample VI—Book catalog:			
Linotron 505	[3]		
Linotron 1010	3,569	9,114	52.74

UNITED KINGDOM COST EQUATION I—BREAK-EVEN RESULTS AGAINST LINOTYPE—Continued

Function	Time	Rate	Cost
F. For sample VI—Continued			
Harris Fototronic CRT	[2]		
Videocomp/45	3,366	8,079	46.75
Videocomp/35	3,720	8,928	51.66
G. For sample VII—Hardware directory:			
Linotron 505	26,637	4,492	38.63
Linotron 1010	7,303	19,053	163.84
Harris Fototronic CRT	[2]		
Videocomp/45	8,561	20,465	175.99
Videocomp/35	[2]		
H. For sample VIII—Telephone directory:			
Linotron 505	[4]		
Linotron 1010	2,567	4,400	61.80
Harris Fototronic CRT	[2]		
Videocomp/45	2,264	4,141	58.16
Videocomp/35	2,603	4,770	67.00
I. For Linotype mix—(Each sample 12.5 percent of total volume):			
Linotron 505	[5](390.91)	41,281	7,274 25.10
Linotron 1010	(38.99)	4,117	15,766 75.25
Harris Fototronic CRT		[2]	
Videocomp/45	(33.87)	3,577	13,318 63.57
Videocomp/35	(39.45)	4,167	15,515 74.05

[1] Refers to minutes per month of composer time.
[2] Multiple shifts.
[3] Negative.
[4] Did not set.
[5] Includes 7 samples at 14.28 percent.

Note: Figures in parenthesis represent percentage use of shift to achieve break-even.

UNITED KINGDOM INPUT VALUES FOR EXECUTION OF EQUATION I (MONOTYPE)

	Factors								
	A	*B*	*C*	C_1	*D*	D_1	D_2	*E*	*F*
I. M-16 Linotron:									
A. The Group	1.0332	$1.3793	0	0	12.11	$0.0263	$0.0054	0.42	$0.2000
B. Policy	1.6000	1.7856	0	0	17.10	.0263	.0054	.55	.2000
C. Prices and Production	1.3000	1.6585	0	0	15.57	.0263	.0054	.48	.2000
D. Pleistocene	2.1000	2.1517	0	0	19.80	.0263	.0054	.62	.2000
E. American Bar	3.0000	4.8375	0	0	35.25	.0263	.0054	1.10	[1].3052
F. Book catalog	24.7610	6.9877	0	0	59.25	.0263	.0054	1.86	[1].3052
G. Hardware directory	5.9320	9.0558	0	0	88.04	.0263	.0054	2.77	[1].3052
H. Telephone directory									
II. 360-50 Linotron 1010:									
A. The Group	.1125	1.3793	.1062	$2.0211	12.11	.0263	.0054	.42	.2120
B. Policy	.1166	1.7856	.1394	2.0211	17.10	.0263	.0054	.55	.2156
C. Prices and Production	.1216	1.6585	.1162	2.0211	15.57	.0263	.0054	.48	.2147
D. Pleistocene	.1500	2.1517	.1693	2.0211	19.80	.0263	.0054	.62	.2177
E. American Bar	.2300	4.8375	.2722	2.0211	35.25	.0263	.0054	1.10	.2317
F. Book catalog	.3916	6.9877	.6341	2.0211	59.25	.0263	.0054	1.86	.2533
G. Hardware directory	.3833	9.0558	.3685	2.0211	88.04	.0263	.0054	2.77	.2793
H. Telephone directory	.5833	12.3328	.6108	2.0211	143.80	.0263	.0054	4.52	.3295
III. 360-30 Fototronic CRT:									
A. The Group	.1333	1.3793	.1000	1.2771	12.11	.0263	.0054	.42	.2120
B. Policy	.1666	1.7856	.1666	1.2771	17.10	.0263	.0054	.55	.2156
C. Prices and Production	.1666	1.6585	.1666	1.2771	15.57	.0263	.0054	.48	.2147
D. Pleistocene	.1666	2.1517	.3666	1.2771	19.80	.0263	.0054	.62	.2177
E. American Bar	.2500	4.8375	1.0666	1.2771	35.25	.0263	.0054	1.10	.2317
F. Book catalog	.4000	6.9877	2.4000	1.2771	59.25	.0263	.0054	1.86	.2533
G. Hardware directory	.3333	9.0558	2.3666	1.2771	88.04	.0263	.0054	2.77	.2793
H. Telephone directory	.6500	12.3328	4.0666	1.2771	143.80	.0263	.0054	4.52	.3295
IV. RCA 70/45 Videocomp:									
A. The Group	.1117	1.3793	.0720	1.7795	12.11	.0263	.0054	.42	.2120
B. Policy	.1300	1.7856	.0787	1.7795	17.10	.0263	.0054	.55	.2156
C. Prices and Production	.1250	1.6585	.0707	1.7795	15.57	.0263	.0054	.48	.2147
D. Pleistocene	.1567	2.1517	.0983	1.7795	19.80	.0263	.0054	.62	.2177
E. American Bar	.2433	4.8375	.1830	1.7795	35.25	.0263	.0054	1.10	.2317
F. Book catalog	.4167	6.9877	.6880	1.7795	59.25	.0263	.0054	1.86	.2533
G. Hardware directory	.4183	9.0558	.4757	1.7795	88.04	.0263	.0054	2.77	.2793
H. Telephone directory	.5467	12.3328	.7313	1.7795	143.80	.0263	.0054	4.52	.3295
V. RCA 70/35 Videocomp:									
A. The Group	.1117	1.3793	.1370	1.1630	12.11	.0263	.0054	.42	.2120
B. Policy	.1300	1.7856	.1607	1.1630	17.10	.0263	.0054	.55	.2156
C. Prices and Production	.1250	1.6585	.1507	1.1630	15.57	.0263	.0054	.48	.2147
D. Pleistocene	.1567	2.1517	.1843	1.1630	19.80	.0263	.0054	.62	.2177
E. American Bar	.2433	4.8375	.3620	1.1630	35.25	.0263	.0054	1.10	.2317
F. Book catalog	.4167	6.9877	1.1790	1.1630	59.25	.0263	.0054	1.86	.2533
G. Hardware directory	.4183	9.0558	.9477	1.1630	88.04	.0263	.0054	2.77	.2793
H. Telephone directory	.5467	12.3328	1.4610	1.1630	143.80	.0263	.0054	4.52	.3295

[1] Includes 4 minutes of stripping galleys at $0.0263 per minute.

Note: Monthly cost of composing systems: M-16 Linotron 505, $5,084; Linotron 1010, $13,559; Harris Fototronic CRT, $12,344; RCA Videocomp, $12,482.

UNITED KINGDOM COST EQUATION I—BREAK-EVEN RESULTS AGAINST MONOTYPE

System	Minutes [1]	Pages	Keyboards
A. For sample I—The Group:			
Linotron 505	6,716	6,500	7.71
Linotron 1010	2,746	24,410	28.96
Harris Fototronic CRT	2,561	19,216	22.80
Videocomp/45	2,172	19,443	23.07
Videocomp/35	2,283	20,437	24.25
B. For sample II—Policy:			
Linotron 505	7,298	4,955	8.28
Linotron 1010	2,169	18,606	31.10
Harris Fototronic CRT	2,578	15,474	25.86
Videocomp/45	1,864	14,340	23.97
Videocomp/35	1,970	15,155	25.33
C. For sample III—Prices and Production:			
Linotron 505	6,959	5,353	8.14
Linotron 1010	2,355	19,365	29.43
Harris Fototronic CRT	2,847	17,091	25.98
Videocomp/45	1,928	15,425	23.44
Videocomp/35	2,054	16,429	24.97
D. For sample IV—Pleistocene:			
Linotron 505	8,186	3,898	7.54
Linotron 1010	2,153	14,356	27.76
Harris Fototronic CRT	2,762	15,068	29.14
Videocomp/45	1,758	11,220	21.70
Videocomp/35	1,823	11,632	22.49
E. For sample V—American Bar:			
Linotron 505	4,512	1,504	5.18
Linotron 1010	1,074	4,670	16.08
Harris Fototronic CRT	1,476	5,902	20.32
Videocomp/45	971	3,991	13.74
Videocomp/35	1,001	4,116	14.17
F. For sample VI—Book catalog:			
Linotron 505	38,825	1,568	9.08

UNITED KINGDOM COST EQUATION I—BREAK-EVEN RESULTS AGAINST MONOTYPE—Continued

System	Minutes [1]	Pages	Keyboards
F. For sample VI—Continued			
Linotron 1010	1,510	3,857	22.32
Harris Fototronic CRT	2,318	6,905	40.24
Videocomp/45	1,456	3,494	20.22
Videocomp/35	1,518	3,643	21.08
G. For sample VII—Hardware directory:			
Linotron 505	5,135	866	7.45
Linotron 1010	1,009	2,631	22.63
Harris Fototronic CRT	1,743	4,357	37.45
Videocomp/45	1,034	2,471	21.27
Videocomp/35	1,089	2,603	22.38
H. For sample VIII—Telephone directory:			
Linotron 505	[2]		
Linotron 1010	1,304	2,235	31.39
Harris Fototronic CRT	3,806	5,856	82.24
Videocomp/45	1,137	2,080	29.22
Videocomp/35	1,218	2,228	31.29
I. For Linotype mix—(each sample 12.5 percent of total volume):			
Linotron 505 [3] (107.15)	11,316	1,994	6.88
Linotron 1010 (13.04)	1,377	5,274	25.17
Harris Fototronic CRT (22.47)	2,373	8,377	39.98
Videocomp/45 (11.99)	1,266	4,713	22.50
Videocomp/35 (12.62)	1,333	4,962	23.69

[1] Refers to minutes used per month of composer time.
[2] Did not set.
[3] Includes 7 samples at 14.28 percent.

Note: Figures in parenthesis represent percentage use of shift to achieve break-even.

UNITED KINGDOM INPUT VALUES FOR EXECUTION OF EQUATION I (PHOTON 713—ELLIOT 903)—UNBALANCED SYSTEM

	Factors								
	A	*B*	*C*	C_1	*D*	D_1	D_2	*E*	*F*
I. M-16 Linotron:									
A. The Group	1.0332	$2.0591	0	0	12.11	$0.0263	$0.0054	0.42	$0.2000
B. Policy	1.6000	2.2901	0	0	17.10	.0263	.0054	.55	.2000
C. Prices and Production	1.3000	2.0962	0	0	15.57	.0263	.0054	.48	.2000
D. Pleistocene	2.1000	2.6761	0	0	19.80	.0263	.0054	.62	.2000
E. American Bar	3.0000	5.0551	0	0	35.25	.0263	.0054	1.10	.3052
II. 360-50 Linotron 1010:									
A. The Group	.1125	2.0591	.1062	$2.0211	12.11	.0263	.0054	.42	.2120
B. Policy	.1166	2.2901	.1394	2.0211	17.10	.0263	.0054	.55	.2156
C. Prices and Production	.1216	2.0962	.1162	2.0211	15.57	.0263	.0054	.48	.2147
D. Pleistocene	.1500	2.6761	.1693	2.0211	19.80	.0263	.0054	.62	.2177
E. American Bar	.2300	5.0551	.2722	2.0211	35.25	.0263	.0054	1.10	.2317
III. 360-30 Fototronic CRT:									
A. The Group	.1333	2.0591	.1000	1.2771	12.11	.0263	.0054	.42	.2120
B. Policy	.1666	2.2901	.1666	1.2771	17.10	.0263	.0054	.55	.2156
C. Prices and Production	.1666	2.0962	.1666	1.2771	15.57	.0263	.0054	.48	.2147
D. Pleistocene	.1666	2.6761	.3666	1.2771	19.80	.0263	.0054	.62	.2177
E. American Bar	.2500	5.0551	1.0666	1.2771	35.25	.0263	.0054	1.10	.2317
IV. RCA 70/45 Videocomp:									
A. The Group	.1117	2.0591	.0720	1.7795	12.11	.0263	.0054	.42	.2120
B. Policy	.1300	2.2901	.0787	1.7795	17.10	.0263	.0054	.55	.2156
C. Prices and Production	.1250	2.0962	.0707	1.7795	15.57	.0263	.0054	.48	.2147
D. Pleistocene	.1567	2.6761	.0983	1.7795	19.80	.0263	.0054	.62	.2177
E. American Bar	.2433	5.0551	.1830	1.7795	35.25	.0263	.0054	1.10	.2317
V. RCA 70/35 Videocomp:									
A. The Group	.1117	2.0591	.1370	1.1630	12.11	.0263	.0054	.42	.2120
B. Policy	.1300	2.2901	.1607	1.1630	17.10	.0263	.0054	.55	.2156
C. Prices and Production	.1250	2.0962	.1507	1.1630	15.57	.0263	.0054	.48	.2147
D. Pleistocene	.1567	2.6761	.1843	1.1630	19.80	.0263	.0054	.62	.2177
E. American Bar	.2433	5.0551	.3620	1.1630	35.25	.0263	.0054	1.10	.2317

[1] Includes 4 minutes of stripping galleys at $0.0263 per minute.

Note: Monthly cost of composing systems: M-16 Linotron 505, $5,084; Linotron 1010, $13,559; Harris Fototronic CRT, $12,344; RCA Videocomp, $12,482.

UNITED KINGDOM COST EQUATION I—BREAK-EVEN RESULTS AGAINST PHOTON 713—UNBALANCED [1]

System	Minutes	Pages	Keyboards
A. For sample I—The Group:			
Linotron 505	3,593	3,478	4.13
Linotron 1010	1,235	10,977	13.02
Harris Fototronic CRT	1,245	9,336	11.08
Videocomp/45	1,055	9,443	11.21
Videocomp/35	1,080	9,672	11.48
B. For sample II—Policy:			
Linotron 505	5,315	3,322	5.55
Linotron 1010	1,282	10,994	18.38
Harris Fototronic CRT	1,579	9,479	15.84
Videocomp/45	1,180	9,078	15.17
Videocomp/35	1,221	9,398	15.71
C. For sample III—Prices and Production:			
Linotron 505	4,764	3,664	5.57
Linotron 1010	1,449	11,916	18.11
Harris Fototronic CRT	1,773	10,642	16.17
Videocomp/45	1,251	10,010	15.21
Videocomp/35	1,303	10,424	15.84
D. For sample IV—Pleistocene:			
Linotron 505	5,838	2,780	5.38
Linotron 1010	1,385	9,231	17.85

UNITED KINGDOM COST EQUATION I—BREAK-EVEN RESULTS AGAINST PHOTON 713—UNBALANCED [1]—Continued

System	Minutes	Pages	Keyboards
D. For sample IV—Continued			
Harris Fototronic CRT	1,684	9,187	17.77
Videocomp/45	1,195	7,626	14.75
Videocomp/35	1,224	7,814	15.11
E. For sample V—American Bar:			
Linotron 505	4,239	1,413	4.86
Linotron 1010	999	4,344	14.95
Harris Fototronic CRT	1,337	5,346	18.40
Videocomp/45	1,908	3,731	12.84
Videocomp/35	1,934	3,840	13.22
F. For Photon mix—(20 percent of volume for each of 5 samples):			
Linotron 505 (44.34)	4,683	2,592	5.06
Linotron 1010 (11.45)	1,209	8,271	16.14
Harris Fototronic CRT (13.88)	1,466	8,299	16.19
Videocomp/45 (10.15)	1,072	6,992	13.64
Videocomp/35 (10.46)	1,105	7,204	14.05

[1] Cost of computer-composer imbalance included.

Note: Figures in parentheses represent percentage use of shift to achieve break-even.

UNITED KINGDOM INPUT VALUES FOR EXECUTION OF EQUATION I (PHOTON 713—ELLIOT 903)—BALANCED SYSTEM

	Factors								
	A	*B*	*C*	C_1	*D*	D_1	D_2	*E*	*F*
I. M-16 Linotron:									
A. The Group	1.0332	$1.5947	0	0	12.11	$0.0263	$0.0054	0.42	$0.2000
B. Policy	1.6000	1.7227	0	0	17.10	.0263	.0054	.55	.2000
C. Prices and Production	1.3000	1.6449	0	0	15.57	.0263	.0054	.48	.2000
D. Pleistocene	2.1000	2.0812	0	0	19.80	.0263	.0054	.62	.2000
E. American Bar	3.0000	3.9515	0	0	35.25	.0263	.0054	1.10	[1].3052
II. 360-50 Linotron 1010:									
A. The Group	.1125	1.5947	0.1062	$2.0211	12.11	.0263	.0054	.42	.2120
B. Policy	.1166	1.7227	.1394	2.0211	17.10	.0263	.0054	.55	.2156
C. Prices and Production	.1216	1.6449	.1162	2.0211	15.57	.0263	.0054	.48	.2147
D. Pleistocene	.1500	2.0812	.1693	2.0211	19.80	.0263	.0054	.62	.2177
E. American Bar	.2300	3.9515	.2722	2.0211	35.25	.0263	0054	1.10	.2317
III. 360-30 Fototronic CRT:									
A. The Group	.1333	1.5947	.1000	1.2771	12.11	.0263	.0054	.42	.2120
B. Policy	.1666	1.7227	.1666	1.2771	17.10	.0263	.0054	.55	.2156
C. Prices and Production	.1666	1.6449	.1666	1.2771	15.57	.0263	.0054	.48	.2147
D. Pleistocene	.1666	2.0812	.3666	1.2771	19.80	.0263	.0054	.62	.2177
E. American Bar	.2500	3.9515	1.0666	1.2771	35.25	.0263	.0054	1.10	.2317
IV. RCA 70/45 Videocomp:									
A. The Group	.1117	1.5947	.0720	1.7795	12.11	.0263	.0054	.42	.2120
B. Policy	.1300	1.7227	.0787	1.7795	17.10	.0263	.0054	.55	.2156
C. Prices and Production	.1250	1.6449	.0707	1.7795	15.57	.0263	.0054	.48	.2147
D. Pleistocene	.1567	2.0812	.0983	1.7795	19.80	.0263	0054	.62	.2177
E. American Bar	.2433	3.9515	.1830	1.7795	35.25	.0263	.0054	1.10	.2317
V. RCA 70/35 Videocomp:									
A. The Group	.1117	1.5947	.1370	1.1630	12.11	.0263	.0054	.42	.2126
B. Policy	.1300	1.7227	.1607	1.1630	17.10	.0263	.0054	.55	.2150
C. Prices and Production	.1250	1.6449	.1507	1.1630	15.57	.0263	.0054	.48	.2147
D. Pleistocene	.1567	2.0812	.1843	1.1630	19.80	.0623	.0054	.62	.2177
E. American Bar	.2433	3.9515	.3620	1.1630	35.25	.0263	.0054	1.10	.2317

[1] Includes 4 minutes of stripping galleys at $0.0263 per minute.

Note.—Monthly cost of composing systems: M-16 Linotron 505, $5,084; Linotron 1010, $13,559; Harris Fototronic CRT, $12,344; RCA Videocomp, $12,482.

UNITED KINGDOM COST, EQUATION I—BREAK-EVEN RESULTS AGAINST PHOTON 713—BALANCED [1]

System	Minutes	Pages	Keyboards
A. For sample I—The Group:			
Linotron 505	5,266	5,097	6.05
Linotron 1010	1,978	17,589	20.87
Harris Fototronic CRT	1,918	14,390	17.08
Videocomp/45	1,626	14,558	17.27
Videocomp/35	1,688	15,108	17.93
B. For sample II—Policy:			
Linotron 505	8,445	5,278	8.82
Linotron 1010	2,374	20,363	34.04
Harris Fototronic CRT	2,799	16,798	28.08
Videocomp/45	2,009	15,457	25.83
Videocomp/35	2,113	16,409	27.43
C. For Sample III—Prices and Production:			
Linotron 505	7,060	5,431	8.25
Linotron 1010	2,401	19,749	30.02
Harris Fototronic CRT	2,902	17,419	26.47
Videocomp/45	1,961	15,689	23.85
Videocomp/35	2,091	16,729	25.43
D. For Sample IV—Pleistocene:			
Linotron 505	8,652	4,120	7.97
Linotron 1010	2,327	15,513	30.00
Harris Fototronic CRT	3,022	16,487	31.88
Videocomp/45	1,877	11,979	23.16
Videocomp/35	1,951	12,450	24.08
E. For sample V—American Bar:			
Linotron 505	6,114	3,038	7.02
Linotron 1010	1,546	6,721	23.14
Harris Fototronic CRT	2,560	10,241	35.25
Videocomp/45	1,355	5,568	19.17
Videocomp/35	1,415	5,815	20.02
F. For Photon mix—(20 percent of volume for each of 5 samples):			
Linotron 505 (65.64)	6,932	3,837	7.49
Linotron 1010 (18.71)	1,976	13,519	26.37
Harris Fototronic CRT (24.26)	2,562	14,504	28.29
Videocomp/45 (15.78)	1,666	10,865	21.19
Videocomp/35 (16.53)	1,746	11,384	22.21

[1] Cost of computer-composer imbalance excluded.

Note: Figures in parenthesis represent percentage use of shift to achieve break-even.

XXVI. Results of Equation II—United Kingdom

The break-even points computed by Equation II appear to be well beyond practical limits for non data bank type applications for the high speed systems. Even for the lowest cost system, the non standard Linotron 505 installed at the University of Newcastle-upon-Tyne, the break-even volumes are substantially higher than the typical firm in the United Kingdom is now producing.

Break-even variance between the United Kingdom and the United States of America appears to be roughly proportional to the variance in basic labor costs used in the analysis. As with the United States data, computer costs are a significant portion of total costs.

The general pattern observed in the United States with respect to breakeven being closely correlated to the cost of the computing system employed also holds true in the United Kingdom.

The same situation observed for the execution of Equation I with respect to the cost effectiveness on certain samples of the lower speed computer also occurs here. As with Equation I this is a result of the lower cost of labor assigned to the computers in the United Kingdom.

Equation II–A and II–B

To determine break-even volume of pages to amortize operating costs of CRT photocomposer and supporting computer configuration versus cost of conventional composing process (assumes that computer time cannot be purchased from service bureau and costs must be covered by use solely in composing process).

Equation II–A reads: Cost of producing sample by conventional process (A) (unknown number of pages (X)) =

Total monthly one shift operating costs of computer (B) + Total monthly one shift operating costs of photocomposer (C) +

(Initial keyboarding cycle in minutes (D) (labor cost per minute (D_1) + capital cost of keyboard per minute (D_2)))

(unknown number of pages (X)) + correction keyboarding cycle in minutes (E) (labor cost per minute (D_1) +

capital cost of keyboard per minute (D_2)) (unknown number of pages (X)) + supply costs (F) (unknown number of pages (X))

or $A(X) = B + C + (D(D_1 + D_2)(X) + E(D_1 + D_2)(X) + F(X)$.

When value of X is equal to or less than 10,560 minutes divided by the computer cycles for the page involved (or the composer cycles when the composer is limiting) X = breakeven.

Equation II–B: When value of X exceeds 10,560 minutes divided by the cycle time of the limiting element the equation must be modified to reflect extra shift cost as follows:

$$A(G) + T(X) = H + I + [H_1(H_2(G - J)] + [H_1(H_2)(X)] + [I_1(I_2)(X)] + F(G) + F(X) + [D(D_1 + D_2)G] + [D(D_1 + D_2)(X)] + [E(D_1 + D_2)G] + [E(D_1 + D_2)X].$$

Where A = cost of producing page by conventional process.

G = maximum number of pages capable of production in a single shift by limiting component (when both the computer and composer cannot produce the initial X value in a single shift the higher of the page limits will be the value of G).

H = monthly single shift operating costs of limiting component (when both components are limited H = the lower limit).

I = monthly single shift operating costs of nonlimiting component.

H_1 = cycle times of limiting component.

H_2 = extra shift cost per minute of limiting component.

J = one shift monthly limit in pages of limiting component (10,560 divided by limiting cycle times) (when both components cannot produce the X value of pages in a single shift the lower limit will be the value of J).

I_1 = cycle times of nonlimiting component (I_1 will have a value of 0 when value of X in equation II–A can be achieved in one shift by this component.

I_2 = extra shift cost per minute of nonliniting component.

F = supply cost per page.

D = time in minutes to key page.

D_1 = labor cost per minute.

D_2 = capital cost of keyboard per minute.

E = time in minutes to key corrections.

X = increment to value of G to achieve break-even.

When $X + G$ exceeds the number of pages capable of production in one shift by the initially nonlimiting component the value of I_1 must be inserted into equation II–B and a new X value computed.

UNITED KINGDOM

UNITED KINGDOM INPUT VALUES FOR EXECUTION OF EQUATION II: LINOTYPE

	Factors							
	A	*B*	*C*	*D*	D_1	D_2	*E*	*F*
I. M-16 Linotron 505:								
A. The Group	$0.8777	0	$5,084	12.11	$0.0263	$0.0054	0.42	$0.2000
B. Policy	1.2751	0	5,084	17.10	.0263	.0054	.55	.2000
C. Prices and Production	1.2665	0	5,084	15.57	.0263	.0054	.48	.2000
D. Pleistocene	1.5102	0	5,084	19.80	.0263	.0054	.62	.2000
E. American Bar	2.6503	0	5,084	35.25	.0263	.0054	1.10	[1].3052
F. Book catalog	4.9598	0	5,084	59.25	.0263	.0054	1.86	[1].3052
G. Hardware directory	4.6144	0	5,084	88.04	.0263	.0054	2.77	[1].3052
H. Telephone directory								
II. 360-50 Linotron 1010:								
A. The Group	.8777	$27,747	13,559	12.11	.0263	.0054	.42	.20
B. Policy	1.2751	27,747	13,559	17.10	.0263	.0054	.55	.20
C. Prices and Production	1.2665	27,747	13,559	15.57	.0263	.0054	.48	.20
D. Pleistocene	1.5102	27,747	13,559	19.80	.0263	.0054	.62	.20
E. American Bar	2.6503	27,747	13,559	35.25	.0263	.0054	1.10	.20
F. Book catalog	4.9598	27,747	13,559	59.25	.0263	.0054	1.86	.20
G. Hardware directory	4.6144	27,747	13,559	88.04	.0263	.0054	2.77	.20
H. Telephone directory	9.3471	27,747	13,559	143.80	.0263	.0054	4.52	.20
III. 360-30 Fototronic CRT:								
A. The Group	.8777	13,889	12,344	12.11	.0263	.0054	.42	.20
B. Policy	1.2751	13,889	12,344	17.10	.0263	.0054	.55	.20
C. Prices and Production	1.2665	13,889	12,344	15.57	.0263	.0054	.48	.20
D. Pleistocene	1.5102	13,889	12,344	19.80	.0263	.0054	.62	.20
E. American Bar	2.6503	13,889	12,344	35.25	.0263	.0054	1.10	.20
F. Book catalog	4.9598	13,889	12,344	59.25	.0263	.0054	1.86	.20
G. Hardware directory	4.6144	13,889	12,344	88.04	.0263	.0054	2.77	.20
H. Telephone directory	9.3471	13,889	12,344	143.80	.0263	.0054	4.52	.20
IV. RCA 70/45 Videocomp:								
A. The Group	.8777	18,792	12,482	12.11	.0263	.0054	.42	.20
B. Policy	1.2751	18,792	12,482	17.10	.0263	.0054	.55	.20
C. Prices and Production	1.2665	18,792	12,482	15.57	.0263	.0054	.48	.20
D. Pleistocene	1.5102	18,792	12,482	19.80	.0263	.0054	.62	.20
E. American Bar	2.6503	18,792	12,482	35.25	.0263	.0540	1.10	.20
F. Book catalog	4.9598	18,792	12,482	59.25	.0263	.0054	1.86	.20
G. Hardware directory	4.6144	18,792	12,482	88.04	.0263	.0054	2.77	.20
H. Telephone directory	9.3471	18,792	12,482	143.80	.0263	.0054	4.52	.20
V. RCA 70/35 Videocomp:								
A. The Group	.8777	12,281	12,482	12.11	.0263	.0054	.42	.20
B. Policy	1.2751	12,281	12,482	17.10	.0263	.0054	.55	.20
C. Prices and Production	1.2665	12,281	12,482	15.57	.0263	.0054	.48	.20
D. Pleistocene	1.5102	12,281	12,482	19.80	.0263	.0054	.62	.20
E. American Bar	2.6503	12,281	12,482	35.25	.0263	.0054	1.10	.20
F. Book catalog	4.9598	12,281	12,482	59.25	.0263	.0054	1.86	.20
G. Hardware directory	4.6144	12,281	12,482	88.04	.0263	.0054	2.55	.20
H. Telephone directory	9.3471	12,281	12,482	143.80	.0263	.0054	4.52	.20

[1] Charged with 4 minutes to strip galleys at $0.0263 per minute.

UNITED KINGDOM COST, EQUATION II—BREAK-EVEN RESULTS AGAINST LINOTYPE

System	Minutes [1]	Pages	Keyboards
A. For sample I—The Group:			
Linotron 505	22,347	21,629	25.66
Linotron 1010	17,679	157,151	186.47
Harris Fototronic CRT	9,411	94,113	111.67
Videocomp/45	12,737	114,027	135.30
Videocomp/35	12,450	90,875	107.83
B. For sample II—Policy:			
Linotron 505	17,598	10,999	18.38
Linotron 1010	11,338	81,333	135.94
Harris Fototronic CRT	8,476	50,879	85.04
Videocomp/45	8,019	61,682	103.10
Videocomp/35	7,883	49,054	81.99
C. For sample III—Prices and Production:			
Linotron 505	12,162	9,355	14.22
Linotron 1010	9,094	74,786	113.67
Harris Fototronic CRT	7,836	47.036	71.49
Videocomp/45	7,128	57,023	86.67
Videocomp/35	6,834	45,349	68.93
D. For sample IV—Pleistocene:			
Linotron 505	18,098	8,618	16.66
Linotron 1010	10,660	62,965	121.76
Harris Fototronic CRT	14,903	40,653	78.61
Videocomp/45	7,518	47.977	92.77
Videocomp/35	7,032	38,154	73.78
E. For sample V—American Bar:			
Linotron 505	13,377	4,459	15.35
Linotron 1010	8,747	32,134	110.61
Harris Fototronic CRT	23,277	21,824	75.12
Videocomp/45	5,961	24,501	84.34
Videocomp/35	7,054	19,485	67.07
F. For sample VI—Book catalog:			
Linotron 505	[2]		
Linotron 1010	9,370	14,777	85.51

UNITED KINGDOM COST, EQUATION II—BREAK-EVEN RESULTS AGAINST LINOTYPE—Continued

System	Minutes [1]	Pages	Keyboards
F. For sample VI—Continued			
Harris Fototronic CRT	24,163	10,068	58.26
Videocomp/45	7,752	11,267	65.20
Videocomp/35	10,564	8,960	51.85
G. For sample VII—Hardware directory:			
Linotron 505	26,646	4,492	38.63
Linotron 1010	10,410	27,159	233.56
Harris Fototronic CRT	50,827	21,477	184.69
Videocomp/45	9,851	20,709	178.08
Videocomp/35	15,958	16,838	144.80
H. For Sample VIII—Telephone directory:			
Linotron 505	[3]		
Linotron 1010	5,731	9,383	131.78
Harris Fototronic CRT	26,380	6,487	91.12
Videocomp/45	5,232	7,154	100.48
Videocomp/35	7,436	5,689	79.91
I. For Linotype mix—(Each sample 12.5 percent of total volume):			
Linotron 505 [4] (390.91)	41,281	7,274	25.10
Linotron 1010 (78.77)	8,318	27,535	131.43
Harris Fototronic CRT (243.37)	25,700	18,921	90.31
Videocomp/45 (66.15)	6,985	20,995	100.21
Videocomp/35 (90.57)	9,564	16,697	79.70

[1] Refers to minutes of use per month of lower speed component which is generally the computer.
[2] Negative.
[3] Did not set.
[4] Includes 7 samples at 14.28 percent.
Note: Figures in parentheses represent percentage use of shift to achieve break-even.

UNITED KINGOOM INPUT VALUES FOR EXECUTION OF EQUATION II: MONOTYPE

	Factors							
	A	*B*	*C*	*D*	D_1	D_2	*E*	*F*
I. M-16 Linotron 505:								
A. The Group	$1.3793	0	$5,084	12.11	$0.0263	$0.0054	0.42	$0.2000
B. Policy	1.7856	0	5,084	17.10	.0263	.0054	.55	.2000
C. Prices and Production	1.6585	0	5,084	15.57	.0263	.0054	.48	.2000
D. Pleistocene	2.1517	0	5,084	19.80	.0263	.0054	.62	.2000
E. American Bar	4.8375	0	5,084	35.25	.0263	.0054	1.10	[1].3052
F. Book catalog	6.9877	0	5,084	59.25	.0263	.0054	1.86	[1].3052
G. Hardware directory	9.0558	0	5,084	88.04	.0263	.0054	2.77	[1].3052
H. Telephone directory								
II. 360-50 Linotron 1010:								
A. The Group	1.3793	$27,747	13,559	12.11	.0263	.0054	.42	.20
B. Policy	1.7856	27,747	13,559	17.10	.0263	.0054	.55	.20
C. Prices and Production	1.6585	27,747	13,559	15.57	.0263	.0054	.48	.20
D. Pleistocene	2.1517	27,747	13,559	19.80	.0263	.0054	.62	.20
E. American Bar	4.8375	27,747	13,559	35.25	.0263	.0054	1.10	.20
F. Book catalog	6.9877	27,747	13,559	59.25	.0263	.0054	1.86	.20
G. Hardware directory	9.0558	27,747	13,559	88.04	.0263	.0054	2.77	.20
H. Telephone directory	12.3328	27,747	13,559	143.80	.0263	.0054	4.52	.20
III. 360-30 Fototronic CRT:								
A. The Group	1.3793	13,889	12,344	12.11	.0263	.0054	.42	.20
B. Policy	1.7856	13,889	12,344	17.10	.0263	.0054	.55	.20
C. Prices and Production	1.6585	13,889	12,344	15.57	.0263	.0054	.48	.20
D. Pleistocene	2.1517	13,889	12,344	19.80	.0263	.0054	.62	.20
E. American Bar	4.8375	13,889	12,344	35.25	.0263	.0054	1.10	.20
F. Book catalog	6.9877	13,889	12,344	59.25	.0263	.0054	1.86	.20
G. Hardware directory	9.0558	13,889	12,344	88.04	.0263	.0054	2.77	.20
H. Telephone directory	12.3328	13,889	12,344	143.80	.0263	.0054	4.52	.20
IV. RCA 70/45 Videocomp:								
A. The Group	1.3793	18,792	12,482	12.11	.0263	.0054	.42	.20
B. Policy	1.7856	18,792	12,482	17.10	.0263	.0054	.55	.20
C. Prices and Production	1.6585	18,792	12,482	15.57	.0263	.0054	.48	.20
D. Pleistocene	2.1517	18,792	12,482	19.80	.0263	.0054	.62	.20
E. American Bar	4.8375	18,792	12,482	35.25	.0263	.0054	1.10	.20
F. Book catalog	6.9877	18,792	12,482	59.25	.0263	.0054	1.86	.20
G. Hardware directory	9.0558	18,792	12,482	88.04	.0263	.0054	2.77	.20
H. Telephone directory	12.3328	18,792	12,482	143.80	.0263	.0054	4.52	.20
V. RCA 70/35 Videocomp:								
A. The Group	1.3793	12,281	12,482	12.11	.0263	.0054	.42	.20
B. Policy	1.7856	12,281	12,482	17.10	.0263	.0054	.55	.20
C. Prices and Production	1.6585	12,281	12,482	15.57	.0263	.0054	.48	.20
D. Pleistocene	2.1517	12,281	12,482	19.30	.0263	.0054	.62	.20
E. American Bar	4.8375	12,281	12,482	35.25	.0263	.0054	1.10	.20
F. Book catalog	6.9877	12,281	12,482	59.25	.0263	.0054	1.86	.20
G. Hardware directory	9.0558	12,281	12,482	88.04	.0263	.0054	2.77	.20
H. Telephone directory	12.3328	12,281	12,482	143.80	.0263	0054	4.52	.20

[1] Charged with 4 minutes to strip galleys at $0.0263 per minute.

UNITED KINGOOM COST EQUATION II—BREAK-EVEN RESULTS AGAINST MONOTYPE

System	Minutes [1]	Pages	Keyboards
A. For sample I—The Group:			
Linotron 505	6,716	6,500	7.71
Linotron 1010	5,600	53,330	63.28
Harris Fototronic CRT	3,354	33,542	39.80
Videocomp/45	4,542	40,664	48.25
Videocomp/35	4,430	32,339	38.37
B. For sample II—Policy:			
Linotron 505	7,928	4,955	8.28
Linotron 1010	5,666	40,649	67.94
Harris Fototronic CRT	4,259	25,566	42.73
Videocomp/45	4,029	30,994	51.80
Videocomp/35	3,961	24,649	41.20
C. For sample III—Prices and Production:			
Linotron 505	6,959	5,353	8.14
Linotron 1010	5,340	43,918	66.75
Harris Fototronic CRT	4,608	27,622	41.98
Videocomp/45	4,186	33,487	50.90
Videocomp/35	4,013	26,631	40.48
D. For sample IV—Pleistocene:			
Linotron 505	8,185	3,898	7.54
Linotron 1010	5,414	31,976	61.83
Harris Fototronic CRT	7,373	20,111	38.89
Videocomp/45	3,821	24,382	47.15
Videocomp/35	3,574	19,390	37.49
E. For sample V—American Bar:			
Linotron 505	4,512	1,504	5.18
Linotron 1010	3,258	11,968	41.20
Harris Fototronic CRT	8,028	7,527	25.91
Videocomp/45	2,220	9,125	31.41
Videocomp/35	2,627	7,257	24.98

UNITED KINGDOM COST EQUATION II—BREAK-EVEN RESULTS AGAINST MONOTYPE—Continued

System	Minutes [1]	Pages	Keyboards
F. For sample VI—Book catalog:			
Linotron 505	38,825	1,568	9.08
Linotron 1010	5,453	8,599	49.76
Harris Fototronic CRT	13,178	5,491	31.78
Videocomp/45	4,511	6,557	37.94
Videocomp/35	6,147	5,214	30.17
G. For sample VII—Hardware directory:			
Linotron 505	5,137	866	7.45
Linotron 1010	2,675	6,978	60.01
Harris Fototronic CRT	10,387	4,389	37.74
Videocomp/45	2,531	5,321	45.76
Videocomp/35	4,010	4,231	36.39
H. For sample VIII—Telephone directory:			
Linotron 505			
Linotron 1010	3,428	5,613	78.84
Harris Fototronic CRT	14.733	3,623	50.88
Videocomp/45	3,130	4,280	60.11
Videocomp/35	4,973	3,404	47.80
I. For Monotype mix—(Each sample 12.5 percent of total volume):			
Linotron 505 [2] (107.16)	11,316	1,944	6.88
Linotron 1010 (36.99)	3,906	12,930	61.72
Harris Fototronic CRT (103.22)	10,903	8,150	38.90
Videocomp/45 (31.06)	3,280	9,859	47.06
Videocomp/35 (42.53)	4,491	7,841	37.42

[1] Refers to minutes of use per month of lower speed component which is generally the computer.

[2] Includes 7 samples at 14.28 percent.

Note.—Figures in parentheses represent percentage use of shift to achieve break-even.

UNITED KINGDOM INPUT VALUES FOR EXECUTION OF EQUATION II: PHOTON 713—ELLIOT 903 (UNBALANCED)

	Factors							
	A	*B*	*C*	*D*	D_1	D_2	*E*	*F*
I. M-16 Linotron 505:								
A. The Group	$2.0591	0	$5,084	12.11	$0.0263	$0.0054	0.42	$0.2000
B. Policy	2.2901	0	5,084	17.10	.0263	.0054	.55	.2000
C. Prices and Production	2.0962	0	5,084	15.57	.0263	.0054	.48	.2000
D. Pleistocene	2.6761	0	5,084	19.80	.0263	.0054	.62	.2000
E. American Bar	5.0551	0	5,084	35.25	.0263	.0054	1.10	[1].3052
II. 360-50 Linotron 1010:								
A. The Group	2.0591	$27,747	13,559	12.11	.0263	.0054	.42	.20
B. Policy	2.2901	27,747	13,559	17.10	.0263	.0054	.55	.20
C. Prices and Production	2.0962	27,747	13,559	15.57	.0263	.0054	.48	.20
D. Pleistocene	2.6761	27,747	13,559	19.80	.0263	.0054	.62	.20
E. American Bar	5.0551	27,747	13,559	35.25	.0263	.0054	1.10	.20
III. 360-30 Fototronic CRT:								
A. The Group	2.0591	13,889	12,344	12.11	.0263	.0054	.42	.20
B. Policy	2.2901	13,889	12,344	17.10	.0263	.0054	.55	.20
C. Prices and Production	2.0962	13,889	12,344	15.57	.0263	.0054	.48	.20
D. Pleistocene	2.6761	13,889	12,344	19.80	.0263	.0054	.62	.20
E. American Bar	5.0551	13,889	12,344	35.25	.0263	.0054	1.10	.20
V. RCA 70/45 Videocomp:								
A. The Group	2.0591	18,792	12,482.00	12.11	.0263	.0054	.42	.20
B. Policy	2.2901	18,792	12,482.00	17.10	.0263	.0054	.55	.20
C. Prices and Production	2.0962	18,792	12,482.00	15.57	.0263	.0054	.48	.20
D. Pleistocene	2.6761	18,792	12,482.00	19.80	.0263	.0054	.62	.20
E. American Bar	5.0551	18,792	12,482.00	35.25	.0263	.0054	1.10	.20
V. RCA 70/35 Videocomp:								
A. The Group	2.0591	12,281	12,482.00	12.11	.0263	.0054	.42	.20
B. Policy	2.2901	12,281	12,482.00	17.10	.0263	.0054	.55	.20
C. Prices and Production	2.0962	12,281	12,482.00	15.57	.0263	.0054	.48	.20
D. Pleistocene	2.6761	12,281	12,482.00	19.80	.0263	.0054	.62	.20
E. American Bar	5.0551	12,281	12,482.00	35.25	.0263	.0054	1.10	.20

[1] Charged with 4 minutes to strip galleys at $0.0263 per minute.

UNITED KINGDOM COST, EQUATION II—BREAK-EVEN RESULTS AGAINST PHOTON 713—UNBALANCED SYSTEM[1]

System	Minutes[2]	Pages	Keyboards
A. For sample I—The Group:			
Linotron 505	3,593	3,478	4.13
Linotron 1010	3,210	28,531	33.85
Harris Fototronic CRT	1,794	17,944	21.29
Videocomp/45	2,430	21,755	25.81
Videocomp/35	2,370	17,301	20.53
B. For sample II—Policy:			
Linotron 505	5,315	3,322	5.55
Linotron 1010	3,799	27,251	45.55
Harris Fototronic CRT	2,855	17,139	28.65
Videocomp/45	2,701	20,778	34.73
Videocomp/35	2,655	16,524	27.62
C. For sample III—Prices and Production:			
Linotron 505	4,763	3,664	5.57
Linotron 1010	3,656	30,063	45.69
Harris Fototronic CRT	3,150	18,908	28.74
Videocomp/45	2,865	22,922	34.84
Videocomp/35	2,747	18,230	27.71
D. For sample IV—Pleistocene:			
Linotron 505	5,838	2,780	5.38
Linotron 1010	3,861	22,807	44.10
Harris Fototronic CRT	5,259	14,345	27.74
Videocomp/45	2,725	17,390	33.63
Videocomp/35	2,547	13,830	26.74

UNITED KINGDOM COST, EQUATION II—BREAK-EVEN RESULTS AGAINST PHOTON 713—UNBALANCED SYSTEM[1]—Continued

System	Minutes	Pages	Keyboards
E. For sample V—American Bar:			
Linotron 505	4,239	1,413	4.86
Linotron 1010	3,066	11,264	38.77
Harris Fototronic CRT	7,557	7,085	24.39
Videocomp/45	2,090	8,589	29.56
Videocomp/35	2,472	6,830	23.51
F. For Photon mix—(20 percent of volume for each of 5 samples):			
Linotron 505 (44.34)	4,683	2,592	5.06
Linotron 1010 (32.02)	3,381	21,041	41.05
Harris Fototronic CRT (46.77)	4,939	13,234	25.82
Videocomp/45 (23.30)	2,460	16,044	31.30
Videocomp/35 (23.69)	2,502	12,759	24.89

[1] Cost of computer composer imbalance included.
[2] Refers to minutes of use per month of lower speed component.

Note: Figures in parentheses represent percentage use of shift to achieve break-even.

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UNITED KINGDOM INPUT VALUES FOR EXECUTION OF EQUATION II: PHOTON 713—ELLIOT 903 (BALANCED)

	Factors							
	A	*B*	*C*	*D*	D_1	D_2	*E*	*F*
I. M-16 Linotron 505:								
A. The Group	$1.5947	0	$5,084	12.11	$0.0263	$0.0054	0.42	$0.2000
B. Policy	1.7227	0	5,084	17.10	.0263	.0054	.55	.2000
C. Prices and Production	1.6449	0	5,084	15.57	.0263	.0054	.48	.2000
D. Pleistocene	2.0812	0	5,084	19.80	.0263	.0054	.62	.2000
E. American Bar	3.9515	0	5,084	35.25	.0263	.0054	1.10	.3052
II. 360-50 Linotron 1010:								
A. The Group	1.5947	$27,747	13,559	12.11	.0263	.0054	.42	.20
B. Policy	1.7227	27,747	13,559	17.10	.0263	.0054	.55	.20
C. Prices and Production	1.6449	27,747	13,559	15.57	.0263	.0054	.48	.20
D. Pleistocene	2.0812	27,747	13,559	19.80	.0263	.0054	.62	.20
E. American Bar	3.9515	27,747	13,559	35.25	.0263	.0054	1.10	.20
III. 360-30 Fototronic CRT:								
A. The Group	1.5947	13,889	12,344	12.11	.0263	.0054	.42	.20
B. Policy	1.7227	13,889	12,344	17.10	.0263	.0054	.55	.20
C. Prices and Production	1.6449	13,889	12,344	15.57	.0263	.0054	.48	.20
D. Pleistocene	2.0812	13,889	12,344	19.80	.0263	.0054	.62	.20
E. American Bar	3.9515	13,889	12,344	35.25	.0263	.0054	1.10	.20
IV. RCA 70/45 Videocomp:								
A. The roup	1.5947	18,792	12,482	12.11	.0263	.0054	.42	.20
B. Policy	1.7227	18,792	12,482	17.10	.0263	.0054	.55	.20
C. Prices and Production	1.6449	18,792	12,482	15.57	.0263	.0054	.48	.20
D. Pleistocene	2.0812	18,792	12,482	19.80	.0263	.0054	.62	.20
E. American Bar	3.9515	18,792	12,482	35.25	.0263	.0054	1.10	.20
V. RCA 70/35 Videocomp:								
A. The Group	1.5947	12,281	12,482	12.11	.0263	.0054	.42	.20
B. Policy	1.7227	12,281	12,482	17.10	.0263	.0054	.55	.20
C. Prices and Production	1.6449	12,281	12,482	15.57	.0263	.0054	.48	.20
D. Pleistocene	2.0812	12,281	12,482	19.80	.0263	.0054	.62	.20
E. American Bar	3.9515	12,281	12,482	35.25	.0263	.0054	1.10	.20

[1] Charged with 4 minutes to strip galleys at $0.0263 per minute.

UNITED KINGDOM COST EQUATION II—BREAK-EVEN RESULTS AGAINST PHOTON 713—BALANCED SYSTEM [1]

System	Minutes [2]	Pages	Keyboards
A. For sample I—The Group:			
Linotron 505	5,266	5,097	6.05
Linotron 1010	4,704	41,814	49.61
Harris Fototronic CRT	2,630	26,299	31.20
Videocomp/45	3,561	31,883	37.83
Videocomp/35	3,474	25,355	30.09
B. For sample II—Policy:			
Linotron 505	8,445	5,278	8.82
Linotron 1010	6,036	43,303	72.38
Harris Fototronic CRT	4,537	27,235	45.52
Videocomp/45	4,292	33,018	55.19
Videocomp/35	4,220	26,258	43.89
C. For sample III—Prices and Production:			
Linotron 505	7,060	5,431	8.25
Linotron 1010	5,418	44,556	67.72
Harris Fototronic CRT	7,794	28,023	42.59
Videocomp/45	4,247	33,973	51.64
Videocomp/35	4,072	27,018	41.06
D. For sample IV—Pleistocene:			
Linotron 505	8,652	4,120	7.97
Linotron 1010	5,723	33,803	65.37
Harris Fototronic CRT	7,794	21,260	41.11
Videocomp/45	4,039	25,775	49.84
Videocomp/35	3,778	20,497	39.64
E. For sample V—American Bar:			
Linotron 505	6,114	2,038	7.02
Linotron 1010	4,368	16,047	55.24
Harris Fototronic CRT	10,779	10,106	34.79
Videocomp/45	2,977	12,236	42.12
Videocomp/35	3,523	9,731	33.50
F. For Photon mix (20 percent of volume for each of 5 samples):			
Linotron 505 (65.64)	6,932	3,837	7.49
Linotron 1010 (47.16)	4,980	30,988	60.45
Harris Fototronic CRT (68.88)	7,274	19,490	38.02
Videocomp/45 (34.30)	3,622	23,628	46.09
Videocomp/35 (35.39)	3,737	18,790	36.66

[1] Cost of computer-composer imbalance excluded.
[2] Refers to minutes of use per month of lower speed component.

Note: Figures in parenthesis represent percentage use of shift to achieve break-even.

XXVII. Conclusions

The scale of production required to achieve a break-even situation over conventional processes for one time typesetting applications is quite high. These points are generally higher than the typical composing firm encounters.

It appears that initial inroads will be made on materials that demand high quality typography.

At the present stage of development of this technology, it is quite clear that the computer process is far more costly than the output composer. The generalized computer programs offered as adjuncts to the composing devices are quite slow in relative terms and may, therefore, be supplanted in practice by specialized programs for repetitive work that lends itself to electronic composition.

Given the high production capacities of all of the high speed CRT devices reviewed, it may be more economic to apply specialized computer systems to the field. The initial experience of the U.S. Air Force which uses a specialized computer (known as a "Format Processor") to produce magnetic tape for input to the Linotron 1010 buttresses this observation.

The problem of "systems balance" is partially addressed in this analysis by comparing an unbalanced Photon 713—Elliot 903 system to a balanced system. The unused computer time in an unbalanced system is costly and should not be overlooked.

A major cost factor that suffers from a paucity of data is input keyboarding. Observed practice in British firms was to allow 6% additional time for line justification at the keyboard. Since the control codes necessary to operate the computer add close to 10% to the keyboarding input load of simple pages, e.g., The Group, it becomes highly improbable that electronic composition of this type of page purely to achieve line justification and hyphenation will be economic.

Within the past two decades computer speeds have increased at tremendous rates while computing costs have declined markedly. This augurs well for electronic composition; however, it must be remembered that sociological change lags behind technological change. It has been held in some quarters that the full potential of Univac I had not been realized when it became an exhibit at the Smithsonian Institution.

"Time sharing" is a vogue term at this writing as it applies to the use of a large and fast computer by a number of users equipped with remote terminals. Initial experience indicates that we have not yet learned to cope with the human limits to full exploitation of this aspect of computer technology. Operating systems that monitor these programs are still in a rudimentary stage and the overhead, in terms of scarce and still costly primary storage, is quite substantial.

Say what we will about the human and organizational problems surrounding this technology, it is a fact. It will not go away. A rational and economic man must anticipate it making itself felt in the composition industry.

The capital investment required by this technology and the necessary development of human skills necessitate careful examination of all of its parameters prior to commitment. Such an intensive review of operations will produce by-products also of value.

APPENDIXES

APPENDIX I. WAGE DATA

A. Bureau of Labor Statistics, U.S. Department of Labor—Union Scales of Wages and Hours in the Printing Trades—Washington, D.C., August, 1968.

B. Bureau of Labor Statistics, U.S. Department of Labor, Salaries of Electronic Data Processing Operations, October, 1969.

C. British Federation of Master Printers Wage Data, October, 1969.

UNION SCALES OF WAGES AND HOURS IN THE PRINTING TRADES, WASHINGTON, D.C., JULY 1, 1967, AND JULY 1, 1968

[Hours are the same for both years unless otherwise indicated]

Trade or occupation	July 1, 1967—rate per hour	July 1, 1968			
		Rate per hour	Hours per week	Employer contribution to fund [1]	
				Insurance [2]	Pension
BOOK AND JOB					
Bindery women	$2.395	$2.620	37½	$0.04	$0.12
Bookbinders	3.937	[3] 4.267	37½	[4] .18	.12
Compositors, hand	4.000	[3] 4.267	37½	[5] .20	.12
Electrotypers	4.110	[6] 4.180	37½		
Machine operators	4.000	[3] 4.267	37½	[5] .20	.12
Machine tenders (machinists)	4.000	[3] 4.267	37½	[5] .20	.12
Mailers	3.730	[7] 3.730	37½	.20	.07
Photoengravers	4.600	4.914	35	.24	[8]
Press assistants and feeders:					
Cylinder	3.400	[9] 3.670	37½	.17	.10
2-color or perfector	3.430	[9] 3.700	37½	.17	.10
Miller T.W. 21 by 28 inches 2-color printing numbering machine; 2-color sheet-fed Cottrell rotary; 4-color McKee	3.520	[9] 3.790	37½	.17	.10
5-color McKee (running 4-color)	3.570	[9] 3.840	37½	.17	.10
5-color McKee	3.640	[9] 3.910	37½	.17	.10
2 Miehle 41 inches or Miller Major 41 inches; 1 Miehle 41 inches or Miller Major 41 inches with smaller press	3.500	[9] 3.770	37½	.17	.10
Single-color:					
32 inches up to and including 50 inches	3.400	[9] 3.670	37½	.17	.10
42 by 58 inches	3.460	[9] 3.730	37½	.17	.10
2-color and perfecting offset 24 by 42 inches	3.460	[9] 3.730	37½	.17	.10
Perfector 38 by 53 inches and 41 by 54 inches	3.460	[9] 3.730	37½	.17	.10
2-color:					
Up to and including 50 inches	3.530	[9] 3.800	37½	.17	.10
Up to and including 60 inches	3.460	[9] 3.730	37½	.17	.10
4-color sheet-fed, 25 by 38 inches	3.420	[9] 3.790	37½	.17	.10
Royal Zenith:					
2-color, 23 by 30 inches	3.460	[9] 3.730	37½	.17	.10
2-unit web	3.570	[9] 3.840	37½	.17	.10
4-color sheet-fed, 43 by 60 inches	3.500	[9] 3.770	37½	.17	.10
Webendorfer, double folder offset, web fed	3.570	[9] 3.840	37½	.17	.10
Web:					
Single-color	3.400	[9] 3.670	37½	.17	.10
2-color	3.480	[9] 3.750	37½	.17	.10
Web (high speed) and web offset up to and including 40 inches	3.620	[9] 3.890	37½	.17	.10
Pressmen, cylinder:					
Job automatic, 1 or 2 hand or auto-fed not over 65 inches, 1 flatbed over 65 inches	3.910	[9] 4.180	37½	.17	.10
1 4-color Cottrell McKee	4.320	[9] 4.590	37½	.17	.10
1 2-color sheet-fed Cottrell rotary	4.060	[9] 4.330	37½	.17	.10
Diddle-Glasser tandem—4 unit web	4.750	[9] 5.020	37½	.17	.10
1 5-color:					
Cottrell McKee running 4 colors	4.370	[9] 4.640	37½	.17	.10
Cottrell 36 by 48 inches, sheet-fed rotary with pile feeder running 2 colors	4.160	[9] 4.430	37½	.17	.10

See footnotes at end of table, p. 48.

UNION SCALES OF WAGES AND HOURS IN THE PRINTING TRADES, WASHINGTON, D.C., JULY 1, 1967, AND JULY 1, 1968—Continued

[Hours are the same for both years unless otherwise indicated]

Trade or occupation	July 1, 1967—rate per hour	July 1, 1968			
		Rate per hour	Hours per week	Employer contribution to fund [1]	
				Insurance [2]	Pension
BOOK AND JOB—Continued					
Pressmen, cylinder—Continued					
1 5-color—Continued					
Cottrell 36 by 48 inches, sheet-fed rotary with pile feeder running more than 2 colors	4.310	[9] 4.580	37½	.17	.10
Cottrell McKee running 5 colors	4.450	[9] 4.720	37½	.17	.10
1 perfector, 1 2-color	4.010	[9] 4.280	37½	.17	.10
1 or 2 vertical Miehle; 1 or 2 Kelly; any cylinder press 20 inches or under; 1 or 2 Miller (high speed); any combination of above	3.910	[9] 4.180	37½	.17	.10
Offset:					
1-color:					
Up to 17 inches	3.290	[9] 3.560	37½	.17	.10
17 to 20 inches	3.390	[9] 3.660	37½	.17	.10
20 to 24 inches	3.910	[9] 4.180	37½	.17	.10
24 to 42 inches	4.010	[9] 4.280	37½	.17	.10
35 to 45 inches	4.060	[9] 4.330	37½	.17	.10
42 to 58 inches	4.120	[9] 4.390	37½	.17	.10
2-color:					
Attachment, running 2 colors up to 17 inches	3.390	[9] 3.660	37½	.17	.10
Up to and including 60 inches	4.340	[9] 4.610	37½	.17	.10
Perfecting 24 to 42 inches	4.210	[9] 4.480	37½	.17	.10
Up to and including 50 inches	4.260	[9] 4.530	37½	.17	.10
Royal Zenith:					
2-color, 23 by 30 inches	4.210	[9] 4.480	37½	.17	.10
2-unit web	4.380	[9] 4.650	37½	.17	.10
4-color sheet-fed:					
43 by 60 inches:					
Head	4.430	[9] 4.700	37½	.17	.10
Second	4.020	[9] 4.290	37½	.17	.10
25 by 38 inches:					
Head	4.360	[9] 4.630	37½	.17	.10
Second	3.950	[9] 4.220	37½	.17	.10
2-color, 17½ by 24⅜ inches	4.430	[9] 4.700	37½	.17	.10
Perfector 38 t 53 inches and 41 by 54 inches	4.360	[9] 4.630	37½	.17	.10
Foreign patent proof press	3.480	[9] 3.750	37½	.17	.10
Webendorfer:					
1st	4.380	[9] 4.650	37½	.17	.10
2d	4.010	[9] 4.280	37½	.17	.10
Perfecting web-offset up to and including 40 inches:					
1st	4.530	[9] 4.800	37½	.17	.10
2d	4.060	[9] 4.330	37½	.17	.10
Web:					
Magazine web, 2-color with folder:					
1st	4.280	[9] 4.550	37½	.17	.10
2d (with presses over 46 inches)	4.080	[9] 4.350	37½	.17	.10
High speed magazine web, 2-color with folder:					
1st	4.480	[9] 4.750	37½	.17	.10
2d	4.180	[9] 4.450	37½	.17	.10
Single-roll web:					
46 inches or under	4.150	[9] 4.420	37½	.17	.10
Over 46 inches	4.200	[9] 4.470	37½	.17	.10
Second man on web press (required on single-roll running 60 inches or over)	4.000	[9] 4.270	37½	.17	.10
Pressmen, platen:					
1, 2, or 3 hand-fed	3.680	[9] 3.950	37½	.17	.10
1 or 2 hand-fed and 1 automatic	3.760	4.030	37½	.17	.10
2 automatic and 1 hand-fed	3.820	4.090	37½	.17	.10
Stereotypers	4.180	4.400	37½	[10]	

UNION SCALES OF WAGES AND HOURS IN THE PRINTING TRADES, WASHINGTON, D.C., JULY 1, 1967, AND JULY 1, 1968—Continued

[Hours are the same for both years unless otherwise indicated]

Trade or occupation	July 1, 1967—rate per hour	July 1, 1968			
		Rate per hour	Hours per week	Employer contribution to fund[1]	
				Insurance[2]	Pension
NEWSPAPER					
Compositors, hand, daywork	4.510	[11] 4.829	35	[12] .06⅜	.07⅞
Compositors, hand, nightwork	4.680	[11] 5.000	35	[12] .06⅜	.07⅞
Machine operators, daywork	4.510	[11] 4.829	35	[12] .06⅜	.07⅞
Machine operators, nightwork	4.680	[11] 5.000	35	[12] .06⅜	.07⅞
Machine tenders (machinists), daywork	4.510	[11] 4.829	35	[12] .06⅜	.07⅞
Machine tenders (machinists), nightwork	4.680	[11] 5.000	35	[12] .06⅜	.07⅞
Mailers, daywork	4.086	[13] 4.257	35	[12] .05⅝	
Mailers, nightwork	4.229	[13] 4.400	35	[12] .05⅝	
Photoengravers, daywork	4.692	[11] 5.007	35	.06⅜	
Photoengravers, nightwork	4.850	[11] 5.164	35	.06⅜	
Pressmen, web, daywork	4.310	4.480	35	.04⅜	.14⅜
Off-side colormen	4.453	4.624	35	.04⅜	.14⅜
Web	4.310	4.481	35	.04⅜	.14⅜
Pressmen, web, nightwork	4.453	4.624	35	.04⅜	.14⅜
Off-side colormen	4.596	4.767	35	.04⅜	.14⅜
Pressmen-in-charge, daywork	4.596	4.767	35	.04⅜	.14⅜
Pressmen-in-charge, nightwork	4.739	4.910	35	.04⅜	.14⅜
Stereotypers, daywork	4.099	4.304	36¼	[10]	
Stereotypers, nightwork	4.615	4.815	32½	[10]	
LITHOGRAPHY					
Artists	4.880	[14] 5.070	35	[13] .18⅜	[16]
Cameramen:					
Black and white	4.280	[14] 4.470	35	[13] .18⅜	[16]
Color	4.880	[14] 5.070	35	[13] .18⅜	[16]
Platemakers:					
Photocomposers	4.360	[14] 4.550	35	[13] .18⅜	[16]
Vacuum frame	4.210	[14] 4.400	35	[13] .18⅜	[16]
Press assistants and feeders:					
Sheet-fed:					
1-color:					
Up to and including 50 inches	3.320	[17] 3.470	35	[13] .18⅜	[16]
Over 50 inches	3.370	[17] 3.520	35	[13] .18⅜	[16]
2-color:					
Up to and including 50 inches	3.420	[17] 3.570	35	[13] .18⅜	[16]
Over 50 and including 60 inches:					
1st	3.500	[17] 3.650	35	[13] .18⅜	[16]
2d	2.640	[17] 2.790	35	[13] .18⅜	[16]
Over 60 inches:					
1st	3.500	[17] 3.650	35	[13] .18⅜	[16]
2d	2.740	[17] 2.890	35	[13] .18⅜	[16]
4-color:					
Over 40 inches:					
1st	3.610	[17] 3.760	35	[13] .18⅜	[16]
2d	2.830	[17] 2.980	35	[13] .18⅜	[16]
Mill sheeter	3.500	[17] 3.650	35	[13] .18⅜	[16]
Web:					
4-plate, perfecting 36 inches	3.580	[17] 3.730	35	[13] .18⅜	[16]
12-plate, 1-roll 38 inches:					
1st	4.020	[17] 4.170	35	[13] .18⅜	[16]
2d	3.540	[17] 3.690	35	[13] .18⅜	[16]

UNION SCALES OF WAGES AND HOURS IN THE PRINTING TRADES, WASHINGTON, D.C., JULY 1, 1967, AND JULY 1, 1968—Continued

[Hours are the same for both years unless otherwise indicated]

Trade or occupation	July 1, 1967—rate per hour	July 1, 1968			
		Rate per hour	Hours per week	Employer contribution to fund[1]	
				Insurance[2]	Pension
LITHOGRAPHY—Continued					
Press assistants and feeders—Continued					
Web—Continued					
16-plate, 2-roll with double folder 38 inches:					
1st	4.020	[17] 4.170	35	[13] .18⅜	[16]
2d	3.540	[17] 3.690	35	[13] .18⅜	[16]
Pressmen, offset:					
Sheet-fed:					
1-color:					
Up to 30 inches	3.970	[17] 4.120	35	[13] .18⅜	[16]
Up to 60 inches	4.230	[14] 4.420	35	[13] .18⅜	[16]
2-color:					
Up to 60 inches	4.760	[14] 4.950	35	[13] .18⅜	[16]
Over 60 inches	5.030	[14] 5.220	35	[13] .18⅜	[16]
4-color:					
Over 40 inches:					
1st	5.450	[14] 5.640	35	[13] .18⅜	[16]
2d	4.560	[14] 4.750	35	[13] .18⅜	[16]
Web:					
4-plate, perfecting 36 inches:					
1st	5.170	[14] 5.360	35	[13] .18⅜	[16]
2d	4.280	[14] 4.470	35	[13] .18⅜	[16]
12-plate, 1-roll 38 inches:					
1st	5.860	[14] 6.050	35	[13] .18⅜	[16]
2d	4.750	[14] 4.940	35	[13] .18⅜	[16]
16-plate, 2-roll with double folder 38 inches:					
1st	5.860	[14] 6.050	35	[13] .18⅜	[16]
2d	4.750	[14] 4.940	35	[13] .18⅜	[16]
3d	4.750	[14] 4.940	35	[13] .18⅜	[16]
Strippers:					
Black and white	4.100	[17] 4.250	35	[13] .18⅜	[16]
Color	4.360	[14] 4.550	35	[13] .18⅜	[16]

[1] Shown in terms of cents per hour or as percent of rate; in actual practice, however, some employer payments are calculated on the basis of total hours or gross payroll. These variations in method of computation are not indicated in the above tabulation.

[2] Includes life insurance, hospitalization, and other types of health and welfare benefits; excludes payments into holiday, vacation, and unemployment funds when such programs have been negotiated.

[3] Additional increase of 26 ⅞ cents effective Mar. 31, 1969.

[4] Additional increase of 2 cents effective Apr. 1, 1969.

[5] Additional increase of 2 cents effective Jan. 1, 1969.

[6] Additional increase of 8 cents effective Nov. 19, 1968.

[7] This rate in effect prior to July 1, 1968; new scale in negotiation at time of survey.

[8] 1 percent.

[9] Additional increase of 26 cents effective Mar. 11, 1969.

[10] Agreement provides for this benefit; amount of payment not reported separately.

[11] Additional increase of 31⅜ cents effective Oct. 1, 1968.

[12] Additional increase of 2 ⅝ cents effective Oct. 1, 1968.

[13] Additional increase of 8⅜ cents effective Oct. 1, 1968.

[14] Additional increase of 17 cents effective Dec. 1, 1968.

[15] Additional increase of 1⅞ cents effective Mar. 1, 1969.

[16] 2 percent. Additional increase of 1 percent effective Dec. 1, 1968.

[17] Additional increase of 14 cents effective Dec. 1, 1968.

Advance Summary

Salaries of Electronic Data Processing Occupations 10 Areas—1968–69

UNITED STATES DEPARTMENT OF LABOR — BUREAU OF LABOR STATISTICS

The attached table provides weekly earnings data for nine electronic-data-processing occupational classifications in 10 metropolitan areas surveyed by the Bureau of Labor Statistics between September 1968 and April 1969. The occupational classifications include three levels each for systems analysts, business; programers, business; and digital-computer operators. The data were obtained in a test survey to determine the feasibility of developing meaningful wage-rate information for such classifications on an area basis. Because of the apparent success of the test and the widespread interest in wage data for such jobs, preliminary basic findings are provided here. A more detailed report is planned for a later date.

The 10 areas were chosen from the 90 surveyed annually because they offered the best opportunity to conduct the test within the limits of time and resources available for this purpose. They should not be considered as representative of other areas, nor as an attempt to include those areas where such work is most important. Many of the larger areas in the program were excluded from the test because their position in the Bureau's time schedule was not favorable.

Data for each of the areas relate to establishments in six broad industry divisions: Manufacturing; transportation, communications, and other public utilities; wholesale trade; retail trade; finance, insurance, and real estate; and services. Major industry groups excluded from these surveys were government operations and the construction and extractive industries. Establishments with fewer than a specified number of workers also were excluded. Among the test areas, the minimum establishment size was 50 employees, except for the manufacturing, public utilities, and retail trade industries in Boston, Chicago, Cleveland, Los Angeles, and St. Louis where the minimum was 100.

Classification of workers, according to the occupational levels studied, was determined by the Bureau's staff through personal interviews in the establishments visited, using previously prepared definitions. These definitions were developed through conversations with a number of establishments known to have electronic-data-processing

equipment. One of the primary purposes of the test was to determine whether these definitions were appropriate for survey work. As indicated previously, three levels were established for each general occupational classification. These levels were established in recognition of the wide variation in duties and responsibilities that exist in this field. In actual practice, some companies had more and some had fewer than the three levels established for survey purposes. The BLS definitions, therefore, may not have strict relevance in any but a few companies. Copies of the BLS descriptions used in the test are provided in this report.

Salary information in the accompanying table is presented for each area and job classification for men and women combined and separately for men. Separate data were obtained for women but are not presented in this report, since in most areas they accounted for only a relatively small part of the occupational employments. Information is provided, where possible, for all industries within scope of the surveys and separately for manufacturing and nonmanufacturing industries.

Electronic Data Processing Occupational Descriptions

The primary purpose of preparing job descriptions for the Bureau's wage surveys is to assist its field staff in classifying into appropriate occupations workers who are employed under a variety of payroll titles and different work arrangements from establishment to establishment and from area to area. This permits the grouping of occupational wage rates representing comparable job content. Because of this emphasis on interestablishment and interarea comparability of occupational content, the Bureau's job descriptions may differ significantly from those in use in individual establishments or those prepared for other purposes. In applying these job descriptions, the Bureau's field economists are instructed to exclude working supervisors, apprentices, learners, beginners, trainees, and handicapped, part-time, temporary, and probationary workers.

SYSTEMS ANALYST, BUSINESS

Analyzes business problems to formulate procedures for solving them by use of electronic data processing equipment. Develops a complete description of all specifications needed to enable programers to prepare required digital computer programs. Work

SYSTEMS ANALYST, BUSINESS—Continued

involves most of the following: Analyzes subject-matter operations to be automated and identifies conditions and criteria required to achieve satisfactory results; specifies number and types of records, files, and documents to be used; outlines actions to be performed by personnel and computers in sufficient detail for presentation to management and for programing (typically this involves preparation of work and data flow charts); coordinates the development of test problems and participates in trial runs of new and revised systems; recommends equipment changes to obtain more effective overall operations. (NOTE: Workers performing both systems analysis and programing should be classified as systems analysts as this is the skill used to determine their pay.)

Does not include employees primarily responsible for the management or supervision of other EDP employees, or systems analysts primarily concerned with scientific or engineering problems.

For wage study purposes, systems analysts are classified as follows:

Class A. Works independently or under only general direction on complex problems involving all phases of systems analysis. Problems are complex because of diverse sources of input data and multiple-use requirements of output data. (For example, develops an integrated production scheduling, inventory control, cost analysis, and sales analysis record in which every item of each type is automatically processed through the full system of records and appropriate followup actions are initiated by the computer.) Confers with persons concerned to determine the data processing problems and advises subject-matter personnel on the implications of new or revised systems of data processing operations. Makes recommendations, if needed, for approval of major systems installations or changes and for obtaining equipment.

May provide functional direction to lower level systems analysts who are assigned to assist.

Class B. Works independently or under only general direction on problems that are relatively uncomplicated to analyze, plan, program, and operate. Problems are of limited complexity because sources of input data are homogeneous and the output data are closely related. (For example, develops systems for maintaining depositor accounts in a bank, maintaining accounts receivable in a retail establishment, or maintaining inventory

SYSTEMS ANALYST, BUSINESS—Continued

accounts in a manufacturing or wholesale establishment.) Confers with persons concerned to determine the data processing problems and advises subject-matter personnel on the implications of the data processing systems to be applied.

OR

Works on a segment of a complex data processing scheme or system, as described for "class A." Works independently on routine assignments and receives instruction and guidance on complex assignments. Work is reviewed for accuracy of judgment, compliance with instructions, and to insure proper alinement with the overall system.

Class C. Works under immediate supervision, carrying out analyses as assigned, usually of a single activity. Assignments are designed to develop and expand his practical experience in the application of procedures and skills required for systems analysis work. For example, may assist a higher level systems analyst by preparing the detailed specifications required by programers from information developed by the higher level analyst.

PROGRAMER, BUSINESS

(Digital-computer programer)

Converts statements of business problems, typically prepared by a systems analyst, into a sequence of detailed instructions which are required to solve the problems by means of automatic data processing equipment. Working from charts or diagrams, the programer develops the precise instructions which, when entered into the computer system in coded language, cause the manipulation of data to achieve desired results. Work involves most of the following: Applies knowledge of computer capabilities, mathematics, logic employed by computers, and particular subject matter involved to analyze charts and diagrams of the problem to be programed. Develops sequence of program steps, writes detailed flow charts to show order in which data will be processed; converts these charts to coded instructions for machine to follow; tests and corrects programs; prepares instructions for operating personnel during production run; analyzes, reviews, and alters programs to increase operating efficiency or adapt to new requirements; and maintains record of program development and revisions. (NOTE: Workers performing both systems analysis and programing should be classified as systems analysts if this is the skill used to determine their pay.)

PROGRAMER, BUSINESS—Continued

Does not include employees primarily responsible for the management or supervision of other EDP employees or programers primarily concerned with scientific and/or engineering problems.

For wage study purposes, programers are classified as follows:

Class A. Works independently or under only general direction on complex problems which require competence in all phases of programing concepts and practices. Working from diagrams and charts which identify the nature of desired results, major processing steps to be accomplished, and the relationships between various steps of the problem solving routine, plans the full range of programing actions needed to efficiently utilize the computer system in achieving desired end products.

At this level, programing is difficult because computer equipment must be organized to produce several interrelated but diverse products from numerous and diverse data elements. A wide variety and extensive number of internal processing actions must occur. This requires actions such as development of common operations which can be reused, establishment of linkage points between operations, adjustments to data when program requirements exceed computer storage capacity, and substantial manipulation and resequencing of data elements to form a highly integrated program.

May provide functional direction to lower level programers who are assigned to assist.

Class B. Works independently or under only general direction on relatively simple programs, or on simple segments of complex programs. Programs (or segments) usually process information to produce data in two or three varied sequences or formats. Reports and listings are produced by refining, adapting, arraying, or making minor additions to or deletions from input data which are readily available. Although numerous records may be processed, the data have been refined in prior actions so that the accuracy and sequencing of data can be tested by using a few routine checks. Typically, the program deals with routine recordkeeping type operations.

OR

Works on complex programs (as described for class A) under close direction of a higher level programer or supervisor. May assist higher level programer by independently performing less difficult tasks assigned, and performing more difficult tasks under fairly close direction.

PROGRAMER, BUSINESS—Continued

May give some guidance or instruction to lower level programers.

Class C. Makes practical applications of programing practices and concepts usually learned in formal training courses. Assignments are designed to develop competence in the application of standard procedures to routine problems. Receives close supervision on new aspects of assignments, and work is reviewed to verify its accuracy and conformance with required procedures.

DIGITAL-COMPUTER OPERATOR

Monitors and operates the control console of a digital computer to process data according to operating instructions, usually prepared by a programer. Work includes most of the following: Studies instructions to determine equipment setup and operation; loads equipment with required items (tape reels, cards, etc.); switches necessary auxiliary equipment into circuit, and starts and operates computer; makes adjustments to computer to correct operating problems and meet special conditions; reviews errors made during operation and determines cause or refers problem to supervisor or programer; and maintains operating records. May test and assist in correcting program.

For wage study purposes, digital-computer operators are classified as follows:

Class A. Operates independently, or under only general direction, computer running programs with most of the following characteristics: New programs frequently are tested and introduced; scheduling requirements are of critical importance to minimize downtime; the programs are of complex design so that identification of error source often requires a working knowledge of the total program, and alternate programs may not be available. May give direction and guidance to lower level operators.

Class B. Operates independently, or under only general direction, computer running programs with most of the following characteristics: Most of the programs are established production runs, typically run on a regularly recurring basis; there is little or no testing of new programs required; alternate programs are provided in case original program needs major change or cannot

DIGITAL-COMPUTER OPERATOR—Continued

be corrected within a reasonable time. In common error situations, diagnoses cause and takes corrective action. This usually involves applying previously programed corrective steps, or using standard correction techniques.

OR

Operates under direct supervision of computer running programs or segments of programs with the characteristics described for class A. May assist a higher level operator by independently performing less difficult tasks assigned and performing difficult tasks following detailed instructions and with frequent review of operations performed.

Class C. Works on routine programs under close supervision. Is expected to develop working knowledge of the computer equipment used and ability to detect problems involved in running routine programs. Usually has received some formal training in computer operation. May assist higher level operator on complex programs.

Electronic Data Processing Occupations—Earnings in 10 Areas

(Average straight-time weekly hours and earnings of workers in selected occupations by industry division in 10 areas studied between September 1968 and April 1969)

Sex, occupation, and industry division	Boston, September 1968					Buffalo, November 1968					Chicago, April 1969				
	Number of workers	Average weekly hours 1/ (standard)	Weekly earnings 1/ (standard)			Number of workers	Average weekly hours 1/ (standard)	Weekly earnings 1/ (standard)			Number of workers	Average weekly hours 1/ (standard)	Weekly earnings 1/ (standard)		
			Mean 2/	Median 2/	Middle range 2/			Mean 2/	Median 2/	Middle range 2/			Mean 2/	Median 2/	Middle range 2/
Men and women combined															
Systems analysts, business, class A	272	38.5	$240.00	$234.00	$219.50-$266.50	-	-	-	-	- -	717	39.0	$251.50	$252.00	$231.00-$271.00
Manufacturing	118	39.5	236.50	233.00	214.00- 252.00	-	-	-	-	- -	256	38.5	251.00	252.50	232.50- 270.50
Nonmanufacturing	154	38.0	242.50	235.00	220.50- 271.00	-	-	-	-	- -	461	39.0	251.50	251.50	229.00- 271.00
Systems analysts, business, class B	268	38.5	203.50	206.00	185.50- 217.50	-	-	-	-	- -	821	38.5	213.00	212.00	193.50- 232.50
Manufacturing	101	39.0	213.00	214.00	198.00- 221.00	-	-	-	-	- -	385	38.5	216.50	212.50	197.00- 239.50
Nonmanufacturing	167	38.0	197.50	198.50	179.00- 212.00	-	-	-	-	- -	436	39.0	210.00	211.50	188.50- 227.00
Systems analysts, business, class C	124	38.0	162.50	156.50	149.00- 169.00	-	-	-	-	- -	326	39.0	179.00	174.50	162.50- 194.50
Manufacturing	-	-	-	-	- -	-	-	-	-	- -	132	39.0	189.00	183.00	170.50- 208.50
Nonmanufacturing	102	37.5	157.00	154.50	148.50- 164.50	-	-	-	-	- -	194	38.5	172.50	172.00	150.00- 184.50
Programers, business, class A	502	39.0	212.50	209.00	193.00- 224.50	74	39.5	$179.50	$177.50	$160.00-$186.00	843	38.5	202.50	200.00	180.00- 223.00
Manufacturing	117	39.5	198.00	204.00	171.00- 220.00	51	40.0	183.50	181.00	159.00- 197.50	341	38.0	202.00	203.00	179.00- 223.50
Nonmanufacturing	385	39.0	216.50	209.50	201.00- 228.00	-	-	-	-	- -	502	39.0	203.50	198.00	180.00- 222.00
Programers, business, class B	652	38.5	176.50	167.50	158.50- 183.00	60	38.5	158.00	151.00	136.00- 184.50	1,143	38.5	175.50	172.00	155.00- 192.50
Manufacturing	157	39.5	175.00	176.50	162.00- 190.00	-	-	-	-	- -	427	39.0	172.00	172.50	153.00- 190.00
Nonmanufacturing	495	38.5	177.00	165.00	157.50- 179.00	-	-	-	-	- -	716	38.5	177.50	171.50	155.50- 196.50
Programers, business, class C	441	38.5	139.00	138.00	132.00- 146.50	65	39.0	127.50	125.00	117.00- 137.50	767	38.5	148.50	144.00	133.50- 163.00
Manufacturing	102	39.5	145.50	149.00	138.50- 160.00	-	-	-	-	- -	239	38.0	146.50	145.50	132.00- 163.00
Nonmanufacturing	339	38.0	137.00	137.00	131.50- 142.00	-	-	-	-	- -	528	39.0	149.50	144.00	134.00- 163.00
Digital-computer operators, class A	164	39.0	140.00	136.50	126.50- 154.50	78	39.5	135.00	129.00	118.00- 153.00	798	39.0	159.50	160.00	144.50- 172.50
Manufacturing	63	39.5	142.00	139.00	127.00- 158.50	61	40.0	139.00	133.50	126.00- 161.00	211	39.0	151.50	152.00	139.50- 161.50
Nonmanufacturing	101	38.5	139.00	136.00	126.50- 152.50	-	-	-	-	- -	587	39.0	162.50	165.50	149.50- 174.00
Digital-computer operators, class B	541	39.0	127.50	126.50	111.00- 142.50	98	39.5	118.50	109.50	100.00- 132.00	1,340	38.5	136.00	137.00	121.00- 148.00
Manufacturing	235	39.5	118.00	116.00	106.50- 128.50	53	39.5	130.00	117.50	103.50- 151.00	460	38.5	131.50	130.50	117.50- 144.00
Nonmanufacturing	306	38.5	135.00	137.50	121.00- 149.50	-	-	-	-	- -	880	39.0	138.00	138.50	126.00- 149.00
Digital-computer operators, class C	197	38.0	113.50	113.50	106.00- 124.00	88	38.5	102.50	95.50	88.50- 111.50	606	39.0	116.00	119.00	103.00- 128.00
Manufacturing	-	-	-	-	- -	-	-	-	-	- -	173	38.5	123.50	122.00	110.50- 133.50
Nonmanufacturing	160	37.5	115.00	115.00	107.50- 126.50	56	38.0	97.00	93.50	86.50- 109.50	433	39.0	113.00	108.00	101.50- 126.00
Men															
Syatems analysts, business, class A	265	39.0	240.50	224.00	195.00- 250.00	-	-	-	-	- -	629	39.0	250.00	249.00	230.50- 271.00
Manufacturing	118	39.5	236.50	233.00	214.00- 252.00	-	-	-	-	- -	254	38.5	251.00	252.00	232.50- 271.00
Nonmanufacturing	147	39.0	243.50	206.50	197.00- 248.00	-	-	-	-	- -	375	39.0	249.00	248.00	227.00- 271.00
Systems analysts, business, class B	259	38.0	204.50	204.50	184.00- 221.50	-	-	-	-	- -	704	38.5	214.50	214.50	195.50- 234.00
Manufacturing	99	39.0	213.50	214.00	198.50- 221.50	-	-	-	-	- -	333	38.5	219.50	216.50	200.00- 241.00
Nonmanufacturing	160	37.0	199.00	192.00	175.00- 223.00	-	-	-	-	- -	371	39.0	210.00	212.50	189.00- 225.50
Syatems analysts, business, class C	98	37.5	163.50	162.00	152.50- 183.00	-	-	-	-	- -	252	39.0	183.50	178.00	166.00- 201.50
Manufacturing	-	-	-	-	- -	-	-	-	-	- -	113	39.0	190.50	186.00	170.00- 212.50
Nonmanufacturing	79	36.5	157.00	159.50	150.50- 171.50	-	-	-	-	- -	139	39.0	178.00	174.50	165.00- 189.00
Programers, business, class A	477	39.0	214.00	210.00	199.50- 227.00	74	39.5	179.50	177.50	160.00- 186.00	700	39.0	205.00	202.50	182.50- 227.00
Manufacturing	105	40.0	201.00	210.00	175.50- 224.00	51	40.0	183.50	181.00	159.00- 197.50	297	38.5	202.00	203.00	177.50- 224.00
Nonmanufacturing	372	39.0	218.00	210.00	201.50- 233.00	-	-	-	-	- -	403	39.0	207.00	202.00	185.50- 229.50
Programers, business, class B	594	39.0	179.00	169.00	160.50- 184.50	59	38.5	158.00	150.00	136.00- 185.00	851	39.0	177.00	174.00	159.00- 193.50
Manufacturing	143	39.5	177.50	179.50	164.50- 191.50	-	-	-	-	- -	326	39.0	175.50	176.00	159.50- 192.00
Nonmanufacturing	451	38.5	179.50	166.00	160.50- 179.50	-	-	-	-	- -	525	38.5	178.00	173.00	159.00- 196.00
Programers, business, class C	335	39.0	140.50	138.50	135.00- 148.00	-	-	-	-	- -	460	38.5	150.50	147.50	135.50- 164.00
Manufacturing	96	39.5	147.50	150.00	140.00- 160.50	-	-	-	-	- -	161	38.5	153.50	152.00	138.50- 168.00
Nonmanufacturing	239	38.5	137.50	137.50	133.50- 141.00	-	-	-	-	- -	299	38.5	148.50	145.00	134.00- 161.50
Digital-computer operators, class A	164	39.5	140.00	124.00	112.00- 142.50	62	39.5	129.50	127.00	114.50- 137.00	741	39.0	160.50	161.00	145.00- 173.00
Manufacturing	63	40.0	142.00	116.00	107.00- 129.50	-	-	-	-	- -	192	39.0	151.50	152.00	139.00- 162.00
Nonmanufacturing	101	38.5	139.00	136.00	126.50- 152.50	-	-	-	-	- -	549	39.0	163.50	166.50	150.00- 174.50
Digital-computer operators, class B	508	39.0	128.50	136.50	121.50- 147.50	75	39.0	122.50	114.00	99.00- 140.00	1,094	38.5	137.50	137.50	122.00- 148.50
Manufacturing	215	39.0	119.00	130.50	120.50- 142.00	-	-	-	-	- -	418	38.5	131.00	129.50	117.50- 143.50
Nonmanufacturing	293	39.0	136.00	138.00	122.50- 150.00	-	-	-	-	- -	676	39.0	141.50	141.00	127.50- 150.50
Digital-computer operators, class C	168	38.0	114.00	114.00	106.50- 123.50	-	-	-	-	- -	451	39.0	118.50	117.50	104.50- 129.50
Manufacturing	-	-	-	-	- -	-	-	-	-	- -	127	39.0	124.00	122.50	110.50- 135.00
Nonmanufacturing	140	37.5	115.00	114.50	107.50- 124.50	-	-	-	-	- -	324	39.0	116.00	115.00	103.00- 128.50

See footnotes at end of table.

Electronic Data Processing Occupations—Earnings in 10 Areas—Continued

(Average straight-time weekly hours and earnings of workers in selected occupations by industry division in 10 areas studied between September 1968 and April 1969)

Sex, occupation, and industry division	Cincinnati, March 1969					Cleveland, September 1968					Dallas, November 1968				
	Number of workers	Average weekly hours 1/ (standard)	Weekly earnings 1/ (standard)			Number of workers	Average weekly hours 1/ (standard)	Weekly earnings 1/ (standard)			Number of workers	Average weekly hours 1/ (standard)	Weekly earnings 1/ (standard)		
			Mean 2/	Median 2/	Middle range 2/			Mean 2/	Median 2/	Middle range 2/			Mean 2/	Median 2/	Middle range 2/
Men and women combined															
Systems analysts, business, class A	71	39.0	$224.00	$222.00	$213.50-$233.50	232	39.5	$231.50	$232.00	$206.00-$253.50	88	39.5	$223.00	$222.00	$206.50-$237.50
Manufacturing	-	-	-	-	-	123	39.5	224.00	228.00	200.50- 243.00	-	-	-	-	-
Nonmanufacturing	-	-	-	-	-	109	39.5	239.50	247.50	216.00- 266.50	59	39.0	221.50	219.50	206.00- 235.50
Systems analysts, business, class B	87	39.5	192.00	189.00	174.00- 202.50	179	39.5	197.00	199.00	177.50- 215.00	83	39.5	187.00	184.00	172.00- 205.00
Manufacturing	-	-	-	-	-	85	39.0	188.00	187.50	161.00- 212.00	-	-	-	-	-
Nonmanufacturing	51	39.0	189.00	190.00	180.50- 196.00	94	39.5	205.50	202.50	188.00- 227.00	64	39.0	181.50	181.50	167.00- 200.50
Systems analysts, business, class C	-	-	-	-	-	80	40.0	174.50	174.50	159.00- 197.00	-	-	-	-	-
Manufacturing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nonmanufacturing	-	-	-	-	-	63	40.0	170.00	171.00	155.50- 195.00	-	-	-	-	-
Programers, business, class A	78	39.5	164.00	164.50	146.00- 177.50	161	39.5	201.50	200.50	177.50- 217.00	112	40.0	194.50	195.50	169.50- 218.50
Manufacturing	-	-	-	-	-	94	39.5	196.50	202.00	178.00- 214.50	-	-	-	-	-
Nonmanufacturing	53	39.0	158.50	161.00	143.00- 175.50	67	39.0	208.00	195.00	177.00- 245.00	63	39.5	186.50	178.00	163.50- 215.00
Programers, business, class B	179	39.0	159.00	159.50	142.00- 178.00	244	39.5	161.50	162.00	139.00- 179.00	211	39.5	158.50	155.00	143.50- 179.00
Manufacturing	69	40.0	158.50	160.00	138.00- 177.00	144	40.0	167.50	169.00	149.00- 187.50	52	40.0	159.00	167.50	137.00- 190.50
Nonmanufacturing	110	38.5	159.00	159.50	144.50- 180.50	100	38.5	152.50	151.00	132.00- 167.00	159	39.5	158.50	153.50	145.00- 173.50
Programers, business, class C	68	39.5	132.50	132.00	120.50- 142.00	104	39.0	134.50	133.00	117.50- 151.50	79	39.5	140.50	134.50	127.50- 152.50
Manufacturing	-	-	-	-	-	60	39.5	148.00	147.50	133.00- 161.00	-	-	-	-	-
Nonmanufacturing	53	39.0	129.00	130.50	118.50- 138.00	-	-	-	-	-	71	39.5	136.50	133.50	127.00- 148.50
Digital-computer operators, class A	69	39.0	145.50	146.50	134.00- 157.50	98	39.0	147.50	145.50	127.50- 169.00	97	40.0	133.50	132.00	115.00- 160.00
Manufacturing	-	-	-	-	-	61	39.5	149.00	146.00	126.50- 166.50	-	-	-	-	-
Nonmanufacturing	-	-	-	-	-	-	-	-	-	-	66	39.5	133.00	128.00	111.00- 161.50
Digital-computer operators, class B	240	39.0	124.00	127.50	110.00- 136.50	302	39.0	126.00	124.50	107.00- 144.50	264	39.5	117.00	113.50	104.00- 127.00
Manufacturing	98	40.0	130.00	133.00	114.00- 140.50	165	39.5	137.00	136.00	118.50- 150.50	54	40.0	124.50	121.00	104.50- 131.50
Nonmanufacturing	142	39.0	120.00	120.00	108.00- 133.50	137	39.0	113.00	109.00	93.50- 131.00	210	39.5	115.00	112.50	104.00- 126.00
Digital-computer operators, class C	167	39.0	102.00	99.00	86.00- 114.00	109	39.5	113.00	113.00	102.50- 122.00	89	40.0	104.00	103.00	93.50- 118.50
Manufacturing	63	38.5	113.50	107.00	98.50- 135.50	68	40.0	117.00	116.00	108.00- 125.00	-	-	-	-	-
Nonmanufacturing	104	39.5	95.00	91.00	82.00- 104.50	-	-	-	-	-	70	40.0	101.00	100.50	90.50- 116.50
Men															
Systems analysts, business, class A	68	39.0	225.00	223.00	214.50- 234.00	216	39.5	232.50	232.50	207.50- 254.00	83	39.5	224.50	223.50	207.00- 238.00
Manufacturing	-	-	-	-	-	120	39.5	225.00	229.00	201.50- 243.50	-	-	-	-	-
Nonmanufacturing	-	-	-	-	-	96	39.5	242.00	250.00	217.00- 269.00	54	39.0	223.50	221.00	206.50- 236.50
Systems analysts, business, class B	85	39.5	192.50	189.00	173.50- 204.00	150	39.5	198.00	200.00	179.00- 217.00	82	39.5	187.50	184.50	172.50- 205.50
Manufacturing	-	-	-	-	-	81	39.5	188.50	189.00	159.00- 212.50	-	-	-	-	-
Nonmanufacturing	50	39.0	189.50	190.00	180.50- 196.50	69	39.5	209.50	204.50	196.00- 236.00	63	39.0	181.50	182.00	168.50- 201.00
Systems analysts, business, class C	-	-	-	-	-	53	40.0	177.00	175.00	162.00- 197.00	-	-	-	-	-
Manufacturing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nonmanufacturing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Programers, business, class A	65	39.5	164.50	164.00	146.00- 177.00	138	39.5	203.50	202.00	180.50- 217.00	103	40.0	196.50	197.00	174.00- 218.50
Manufacturing	-	-	-	-	-	86	39.5	197.00	202.00	179.00- 214.00	-	-	-	-	-
Nonmanufacturing	-	-	-	-	-	52	39.0	213.50	202.50	181.50- 235.00	54	39.5	188.00	181.00	165.00- 215.50
Programers, business, class B	152	39.5	161.50	162.50	143.50- 181.00	183	39.5	164.50	164.50	144.50- 181.50	173	39.5	160.00	153.00	145.00- 180.00
Manufacturing	67	40.0	158.50	160.00	138.00- 177.50	119	40.0	169.50	171.00	153.50- 189.50	-	-	-	-	-
Nonmanufacturing	85	39.0	163.50	167.50	148.00- 187.50	64	39.0	155.50	160.00	140.00- 168.00	132	39.5	157.00	149.50	144.50- 173.00
Programers, business, class C	-	-	-	-	-	71	39.0	142.50	145.00	126.50- 160.00	60	39.5	142.50	139.50	127.50- 161.00
Manufacturing	-	-	-	-	-	52	39.5	151.00	150.50	138.00- 162.50	-	-	-	-	-
Nonmanufacturing	-	-	-	-	-	-	-	-	-	-	52	39.0	137.50	134.50	126.00- 149.00
Digital-computer operators, class A	66	39.0	147.00	147.00	135.00- 157.50	92	39.0	149.50	146.00	129.00- 170.50	96	40.0	133.50	132.00	115.00- 160.00
Manufacturing	-	-	-	-	-	58	39.5	150.00	147.00	127.50- 167.00	-	-	-	-	-
Nonmanufacturing	-	-	-	-	-	-	-	-	-	-	65	39.5	133.00	128.50	111.00- 161.50
Digital-computer operators, class B	188	39.0	126.50	130.50	114.50- 138.50	221	39.5	133.00	130.50	116.00- 147.00	214	39.5	118.50	118.50	103.50- 128.50
Manufacturing	79	40.0	132.50	136.00	120.00- 142.50	148	39.5	136.50	132.50	118.00- 151.00	-	-	-	-	-
Nonmanufacturing	109	38.5	122.50	127.00	110.50- 135.00	73	39.0	125.50	130.50	111.50- 135.50	165	39.0	116.50	117.50	101.50- 128.50
Digital-computer operators, class C	111	38.5	107.50	103.50	92.50- 121.00	76	40.0	115.00	114.50	102.00- 125.00	86	40.0	104.50	104.00	95.00- 119.00
Manufacturing	59	38.5	114.50	108.50	99.00- 136.00	57	40.0	118.50	119.50	106.00- 127.00	-	-	-	-	-
Nonmanufacturing	52	39.0	99.50	99.00	87.50- 114.00	-	-	-	-	-	67	40.0	102.00	101.00	92.00- 117.00

See footnotes at end of table.

Electronic Data Processing Occupations—Earnings in 10 Areas—Continued

Average straight-time weekly hours and earnings of workers in selected occupations by industry division in 10 areas studied between September 1968 and April 1969)

Sex, occupation, and industry division	Jacksonville, January 1969					Los Angeles-Long Beach and Anaheim-Santa Ana-Garden Grove, March 1969					New Orleans, February 1969				
	Number of workers	Average weekly hours 1/ (standard)	Weekly earnings 1/ (standard)			Number of workers	Average weekly hours 1/ (standard)	Weekly earnings 1/ (standard)			Number of workers	Average weekly hours 1/ (standard)	Weekly earnings 1/ (standard)		
			Mean 2/	Median 2/	Middle range 2/			Mean 2/	Median 2/	Middle range 2/			Mean 2/	Median 2/	Middle range 2/
Men and women combined															
Systems analysts, business, class A	38	38.5	$203.00	$194.50	$184.50-$227.00	1,163	40.0	$275.50	$270.50	$249.00-$273.00	-	-	-	-	-
Manufacturing	-	-	-	-	-	399	40.0	275.50	270.00	248.50- 272.50	-	-	-	-	-
Nonmanufacturing	37	38.5	203.50	194.50	184.50- 227.00	764	40.0	275.50	271.00	250.00- 273.00	-	-	-	-	-
Systems analysts, business, class B	-	-	-	-	-	1,049	40.0	215.00	212.50	190.50- 235.50	-	-	-	-	-
Manufacturing	-	-	-	-	-	544	40.0	226.00	223.50	203.50- 249.00	-	-	-	-	-
Nonmanufacturing	-	-	-	-	-	505	40.0	203.50	199.00	180.00- 220.50	-	-	-	-	-
Systems analysts, business, class C	-	-	-	-	-	362	40.0	181.50	178.50	163.00- 204.00	-	-	-	-	-
Manufacturing	-	-	-	-	-	187	40.0	197.50	196.50	180.00- 219.00	-	-	-	-	-
Nonmanufacturing	-	-	-	-	-	175	40.0	164.50	165.00	147.50- 177.00	-	-	-	-	-
Programers, business, class A	44	38.5	172.00	170.50	145.50- 194.00	426	39.5	228.00	231.50	205.50- 250.00	44	39.5	$190.50	$197.50	$168.00-$214.50
Manufacturing	-	-	-	-	-	201	40.0	246.00	249.00	229.00- 267.00	32	40.0	196.00	201.00	175.50- 219.50
Nonmanufacturing	43	38.5	172.50	171.00	146.50- 200.00	225	39.5	211.50	209.00	194.50- 233.00	-	-	-	-	-
Programers, business, class B	58	38.5	155.00	154.00	135.50- 173.00	998	39.5	186.50	185.50	166.00- 207.00	81	39.5	152.00	156.50	138.00- 167.00
Manufacturing	-	-	-	-	-	478	40.0	197.00	197.00	177.50- 217.50	-	-	-	-	-
Nonmanufacturing	52	38.5	153.50	153.00	134.00- 174.50	520	39.0	177.00	173.00	159.50- 197.00	61	39.5	148.50	150.00	138.00- 164.50
Programers, business, class C	34	38.5	128.50	129.50	114.00- 143.00	434	40.0	158.00	157.00	141.50- 172.50	-	-	-	-	-
Manufacturing	-	-	-	-	-	262	40.0	168.50	167.50	157.00- 179.00	-	-	-	-	-
Nonmanufacturing	33	38.5	128.50	130.00	112.50- 143.00	172	39.5	141.50	139.00	127.00- 151.00	-	-	-	-	-
Digital-computer operators, class A	29	39.0	148.00	150.50	137.50- 165.00	816	40.0	158.00	158.50	143.50- 171.50	32	40.0	137.50	133.00	131.00- 139.00
Manufacturing	-	-	-	-	-	481	40.0	159.50	160.50	146.00- 172.00	-	-	-	-	-
Nonmanufacturing	27	39.0	150.00	151.50	141.00- 172.50	335	39.5	156.50	156.00	140.50- 170.50	27	40.0	133.50	132.50	131.00- 134.00
Digital-computer operators, class B	108	38.5	118.00	123.00	100.00- 137.00	1,263	40.0	142.50	140.50	128.50- 157.00	116	39.5	120.00	116.50	104.00- 133.00
Manufacturing	-	-	-	-	-	585	40.0	146.50	146.50	131.00- 162.00	-	-	-	-	-
Nonmanufacturing	99	38.5	118.00	123.00	99.50- 138.00	678	39.5	139.50	136.00	128.00- 146.50	96	39.0	117.50	112.00	102.50- 131.00
Digital-computer operators, class C	38	39.5	93.00	92.50	81.00- 103.50	445	39.5	119.00	117.50	107.00- 128.50	35	40.0	100.50	95.00	92.00- 104.00
Manufacturing	-	-	-	-	-	144	40.0	121.50	119.50	111.00- 135.00	-	-	-	-	-
Nonmanufacturing	37	39.5	93.50	96.00	81.00- 104.00	301	39.5	117.50	117.00	107.00- 126.00	-	-	-	-	-
Men															
Systems analysts, business, class A	37	38.5	204.00	194.50	187.50- 227.00	1,130	40.0	276.50	270.50	250.00- 273.00	-	-	-	-	-
Manufacturing	-	-	-	-	-	374	40.0	276.50	270.50	249.00- 272.50	-	-	-	-	-
Nonmanufacturing	36	38.5	204.00	195.00	186.00- 227.00	756	40.0	276.50	271.00	250.50- 273.00	-	-	-	-	-
Systems analysts, business, class B	-	-	-	-	-	954	40.0	217.00	215.00	193.00- 237.50	-	-	-	-	-
Manufacturing	-	-	-	-	-	488	40.0	229.00	226.00	206.50- 252.50	-	-	-	-	-
Nonmanufacturing	-	-	-	-	-	466	40.0	205.00	200.50	181.50- 221.50	-	-	-	-	-
Systems analysts, business, class C	-	-	-	-	-	306	40.0	183.00	180.00	165.00- 207.00	-	-	-	-	-
Manufacturing	-	-	-	-	-	153	40.0	200.50	203.50	183.00- 221.00	-	-	-	-	-
Nonmanufacturing	-	-	-	-	-	153	40.0	166.00	167.00	149.00- 178.00	-	-	-	-	-
Programers, business, class A	37	38.5	176.50	175.00	149.00- 206.00	379	39.5	226.50	231.50	204.50- 247.50	41	39.5	191.50	200.00	169.50- 216.00
Manufacturing	-	-	-	-	-	164	40.0	245.50	248.00	229.50- 266.00	32	40.0	196.00	201.00	175.50- 219.50
Nonmanufacturing	36	38.5	177.00	177.50	151.00- 207.00	215	39.5	212.00	209.50	195.50- 233.50	-	-	-	-	-
Programers, business, class B	51	38.5	156.50	156.00	136.00- 182.50	882	39.5	187.50	187.00	167.50- 207.50	74	39.5	154.50	160.50	139.00- 167.50
Manufacturing	-	-	-	-	-	424	40.0	197.00	196.00	177.00- 218.50	-	-	-	-	-
Nonmanufacturing	45	38.5	155.50	156.00	134.00- 184.00	458	39.0	178.50	176.00	160.00- 199.50	58	39.5	148.50	154.00	137.50- 164.50
Programers, business, class C	29	38.5	130.00	131.50	121.00- 143.00	349	40.0	158.00	156.50	143.50- 171.50	-	-	-	-	-
Manufacturing	-	-	-	-	-	216	40.0	167.50	166.50	155.50- 177.00	-	-	-	-	-
Nonmanufacturing	28	38.5	130.50	132.50	121.00- 143.50	133	39.5	143.00	142.50	129.50- 151.50	-	-	-	-	-
Digital-computer operators, class A	27	39.0	148.50	151.50	135.00- 172.50	771	39.5	158.00	158.00	143.00- 171.50	32	40.0	137.50	133.00	131.00- 139.00
Manufacturing	-	-	-	-	-	445	40.0	159.00	159.50	145.00- 171.50	-	-	-	-	-
Nonmanufacturing	25	39.0	151.00	152.00	142.50- 174.00	326	39.5	156.50	156.00	140.50- 171.00	27	40.0	133.50	132.50	131.00- 134.00
Digital-computer operators, class B	91	39.0	122.00	125.50	107.00- 140.00	1,116	39.5	144.00	142.00	130.50- 158.50	95	39.5	118.00	114.00	101.50- 131.00
Manufacturing	-	-	-	-	-	531	40.0	147.50	150.00	132.00- 162.50	-	-	-	-	-
Nonmanufacturing	84	39.0	122.50	125.50	106.50- 140.50	585	39.5	141.00	139.50	129.50- 148.00	83	39.5	115.50	111.00	100.00- 129.00
Digital-computer operators, class C	37	39.5	93.50	96.00	81.00- 104.00	422	39.5	119.00	117.50	107.50- 129.00	-	-	-	-	-
Manufacturing	-	-	-	-	-	136	39.5	121.00	119.50	110.50- 133.50	-	-	-	-	-
Nonmanufacturing	37	39.5	93.50	96.00	81.00- 104.00	286	39.5	118.00	117.00	107.50- 127.00	-	-	-	-	-

See footnotes at end of table.

Electronic Data Processing Occupations—Earnings in 10 Areas—Continued

Average straight-time weekly hours and earnings of workers in selected occupations by industry division in 10 areas studied between September 1968 and April 1969)

Sex, occupation, and industry division	St. Louis, March 1969					Sex, occupation, and industry division	St. Louis, March 1969--Continued				
	Number of workers	Average weekly hours 1/ (standard)	Weekly earnings 1/ (standard)				Number of workers	Average weekly hours 1/ (standard)	Weekly earnings 1/ (standard)		
			Mean 2/	Median 2/	Middle range 2/				Mean 2/	Median 2/	Middle range 2/
Men and women combined						Men					
Systems analysts, business, class A	111	39.5	$222.00	$216.00	$201.00-$242.50	Systems analysts, business, class A	106	40.0	$222.50	$218.00	$201.00-$243.50
Manufacturing	76	40.0	218.50	216.50	198.50- 234.50	Manufacturing	74	40.0	219.00	217.00	199.00- 234.50
Nonmanufacturing	-	-	-	-	- -	Nonmanufacturing	-	-	-	-	- -
Systems analysts, business, class B	156	40.0	196.00	191.50	177.50- 213.00	Systems analysts, business, class B	148	40.0	197.50	193.00	179.50- 214.00
Manufacturing	97	40.0	192.50	187.50	177.00- 207.50	Manufacturing	89	40.0	194.50	189.00	178.50- 209.50
Nonmanufacturing	59	39.5	201.50	201.50	185.00- 223.50	Nonmanufacturing	59	39.5	201.50	201.50	185.00- 223.50
Systems analysts, business, class C	57	40.0	160.00	164.00	142.50- 176.00	Systems analysts, business, class C	53	40.0	160.00	163.50	142.50- 177.00
Manufacturing	-	-	-	-	- -	Manufacturing	-	-	-	-	- -
Nonmanufacturing	-	-	-	-	- -	Nonmanufacturing	-	-	-	-	- -
Programers, business, class A	182	39.5	189.50	187.00	178.00- 199.00	Programers, business, class A	158	39.5	189.50	187.00	178.00- 198.50
Manufacturing	113	40.0	194.00	193.00	184.00- 203.00	Manufacturing	103	40.0	194.00	193.50	183.50- 204.00
Nonmanufacturing	69	39.0	182.00	179.00	175.00- 187.50	Nonmanufacturing	55	39.0	180.50	179.00	176.00- 184.50
Programers, business, class B	381	39.5	164.00	163.00	155.00- 177.50	Programers, business, class B	302	39.5	165.50	164.00	156.00- 180.00
Manufacturing	263	40.0	168.50	165.00	159.00- 180.00	Manufacturing	203	40.0	170.50	169.50	160.50- 182.50
Nonmanufacturing	118	39.0	153.50	152.50	139.00- 165.00	Nonmanufacturing	99	39.0	155.00	154.50	139.50- 170.00
Programers, business, class C	129	39.5	144.00	147.00	132.00- 161.00	Programers, business, class C	97	39.5	146.50	150.50	133.00- 162.00
Manufacturing	77	39.5	155.50	158.50	150.00- 165.50	Manufacturing	64	39.5	155.00	158.00	150.00- 168.50
Nonmanufacturing	52	39.5	127.50	134.50	116.00- 142.00	Nonmanufacturing	-	-	-	-	- -
Digital-computer operators, class A	154	40.0	152.50	146.50	138.50- 163.50	Digital-computer operators, class A	137	39.5	155.50	148.00	141.50- 166.00
Manufacturing	102	40.0	150.00	146.00	140.00- 150.00	Manufacturing	87	40.0	154.00	147.00	142.50- 153.00
Nonmanufacturing	52	39.5	156.50	162.00	134.00- 179.50	Nonmanufacturing	50	39.5	157.50	162.50	136.00- 181.00
Digital-computer operators, class B	316	39.5	124.00	122.00	110.00- 134.50	Digital-computer operators, class B	248	39.5	127.50	125.50	115.50- 138.00
Manufacturing	157	40.0	124.00	123.00	115.50- 133.50	Manufacturing	128	40.0	129.00	125.50	119.00- 135.50
Nonmanufacturing	159	39.0	123.50	121.00	106.00- 137.00	Nonmanufacturing	120	39.5	126.00	125.50	103.50- 150.50
Digital-computer operators, class C	159	39.5	109.00	105.00	97.50- 118.00	Digital-computer operators, class C	125	39.5	109.00	104.00	96.50- 119.00
Manufacturing	98	40.0	110.00	110.50	100.50- 119.50	Manufacturing	80	40.0	110.50	109.00	100.50- 120.00
Nonmanufacturing	61	39.5	107.00	101.00	95.50- 116.00	Nonmanufacturing	-	-	-	-	- -

1/ Standard hours reflect the workweek for which employees receive their regular straight-time salaries (exclusive of pay for overtime at regular and/or premium rates), and the earnings correspond to these weekly hours.

2/ The mean is computed for each job by totaling the earnings of all workers and dividing by the number of workers. The median designates position--half of the employees surveyed receive more than the rate shown; half receive less than the rate shown. The middle range is defined by 2 rates of pay; one-fourth of the workers earn less than the lower of these rates and one-fourth earn more than the higher rate.

NOTE: Dashes indicate no data reported or data that do not meet publication criteria.

49-852 O - 70 - 5

BRITISH FEDERATION OF MASTER PRINTERS,
London, October 21, 1969.

Re computer typesetting survey.

E. R. LANNON, ESQ.,
Assistant Administrator for Administration, Computer Typesetting Research Project, The University, Newcastle-upon-Tyne.

DEAR MR. LANNON: You have asked for details of the national averages for certain craft operations. As you well know averages can mask a fairly wide variation but I hope, nevertheless, that the following figures will be helpful to you.

1. Linotype operator; e.g., Models 79 and 78	£20.
2. Monotype keyboard operator	£20.
3. TTS perforator operators	£18.
4. Casting machine attendants	£19.
5. Proof press operators	£19.
6. Page makeup compositors	£19.10s. 0d.
7. Photocomposer operators; e.g., Photon 500 series	£26.

These rates are for single shift operation and include basic rate plus merit money.

I regret that I shall be unable to attend your meeting at HMSO on 29th October. I do hope your project is going well.

Kind regards.

Yours sincerely,

HENRY KENDALL,
Head of Management Services Division.

APPENDIX II. MANUFACTURERS' ANALYSES

A. RCA Graphic Systems Division.
B. Harris Intertype Corporation.
C. Mergenthaler Linotype Company.

AN ANALYSIS OF THE RCA PAGE-1 COMPOSITION SYSTEM AS APPLIED TO SEVERAL SAMPLES

(Prepared by J. D. Vragel, Manager, Systems Development and Acceptance, RCA Graphic Systems, Dayton, N.J.)

INTRODUCTION

Any analysis of timing in the use of electronic equipment must take into consideration those variables which can have considerable influence on the results. In arriving at any conclusions the items listed below must be recognized as factors affecting these results.

Hardware

1. The RCA Page-1 Composition System can be processed on the following models. The time will vary with each model.
   Spectra 70/35.
   Spectra 70/45.
   Spectra 70/55.

2. During the first quarter of 1970 RCA will announce the availability of a Page-1 Composition System for processing on the IBM–360. The time will vary with each model and will in all probability be different from the Spectra timings.

3. The system requires a memory of 65K and is designed to take advantage of 131K or larger. The larger memory will require less time.

4. Tape speeds must be considered. Both 30KB and 60KB can be utilized.

5. A minimum of four tape stations is required. The system is designed to take advantage of 6 or 8 tape drives. This becomes important where multi-reel jobs are required. Rewind time can add considerably to job running times if tape stations are not available.

6. Line printer details have several options in the systems depending upon the user's requirements. All lines or partial printing can be requested for various conditions. No line printer copy may also be specified. Individual line printing requirements will vary with the job, correction cycle and user's procedures.

Software

The RCA Page-1 Composition System was written in Assembly language under the Spectra 70 Primary Operating System. Other systems may be written in Cobol, Fortran or some other language. Each will result in a different time, on the computer, for the job. The advantages of each may be realized in some other area than in time alone.

During the third quarter of 1970 RCA will announce a composition system for the Spectra 70 operating under the Tape, Disc Operating System. This will allow composition in a multi-programing mode, provided peripherals are available. The RCA Composition System is a General Purpose program which provides the user with the ability to compose almost any required type-setting job. As with any general purpose program the operation may not be the most efficient for any particular job. Custom programs, where frequent updating is required, will result in faster processing. The telephone page included in these samples is a good illustration of this. The most effective program for this kind of work would be one that is designed and written exclusively for telephone directories.

Applications

1. The types of fonts used can affect timing greatly.
   A. Sans-Serif faces require less storage than Serif faces.
   B. Smaller size ranges are faster than larger.
      (1) Size range I is 4 to 8 points.
      (2) Size range II is 8 to 16 points.
      (3) Size range III is 16 to 32 points.
      (4) Size range IV is 32 to 64 points.
      (5) Size range V is 64 to 96 points.
   C. The stroking mode of the fonts used can affect the time. A mode "A" font has twice the number of strokes than a mode "B" thus the time will be doubled. The resolution of a mode "A" is of course much higher than a mode "B".
   D. Where several fonts are used single character loading may be more advantageous than total font loading.
   E. The frequent use of font subsets with their many special characters can affect font loading time.

2. The experience of the individual applying the codes can seriously affect the timing. One who becomes sophisticated in any programming or coding techniques can produce more efficient results than can a trainee.

3. In the RCA Composition System the use of proven, composition oriented formats will result in less computer time than will job oriented synonyms which must be analyzed and stored before they can be used. If all formats or synonyms used in a job start with the same initial letter, they are stored on one disc track and disc accesses are minimized.

4. The use of "suppress setting" in composition provides a look-ahead capability for composition decision making within the system. This will add time to composition but will substantially reduce corrections cycles which will be required without the use of this technique.

5. The setting of several pages in a job will require different coding than one would use if setting a single page as a sample. For example, most text material will have an opening page with titles, text pages with heads and folios set for odd and even pages, and the last page may require balanced columns, references, or other composition. These four basic pages apply to almost every kind of composition. The Page–1 Composition System provides the coding to cover all pages with complete pagination. This, of course, will result in a more efficient process with entirely different coding than one would apply to a single page sample.

6. All computer programs and hardware require certain housekeeping routines which will apply to a single initial page with no additional time for the pages which follow. A sample item such as the console printout at the start of the job results in the total housekeeping time being added to the single page rather than being included in the time for many pages. Systems initialization time at the start of a job remains the same whether there be 1 page or 100 pages. There are, therefore, artificially higher times for a single page

for both the computer composition and the VideoComp typesetting than there would be on a typical job.

To summarize, the multiplication of the time shown for each sample by a number of projected pages will result in erroneous time. Actual time will always vary from any calculation obtained in this manner.

For this reason we have indicated what the overhead and running times are for the VideoComp typesetting pages.

SAMPLES PREPARED

The samples included in this report are briefly described below. Detailed specifications follow.

1. "The Group"—One column, 3½ by 6 inch print region.
2. "Prices and the Production Plan"—One column, 4¼ by 6½ inch print region.
3. "Policy"—One column, 4½ by 7¾ inch print region.
4. "Pleistocene"—One column with footnotes, 4½ by 7½ inch print region.
5. "The American Bar"—Three columns, 6 by 9 inch print region, all fonts in size range II.
6. "Book Catalog Index"—Three columns, 6¾ by 11⅛ inch print region. All titles Oblique.
7. "Hardware Age"—Three columns, 7½ by 10¼ inch print region.
8. "Telephone Book Page"—Four column, 8¼ by 10⅛ inch print region.
9. "The American Bar"—Three columns, 6 by 9 inch print region, point size 8 in size range I.
10. "Book Catalog Index"—Three columns, 6¾ by 11⅛ inch print region. All titles in true Italic.

SUMMARY OF COMPOSITION TIME (SECONDS) [1]

Page	Spectra 70/35, 65K. 30KB tapes for a VideoComp with 65K memory	
	Internal elapsed time clock	Stopwatch
1. The Group	10.8	15.8
2. Prices and Production	12.6	17.5
3. Policy	11.8	17.0
4. Pleistocene	17.2	22.6
5. The American Bar (SRII)	19.0	24.0
6. Book catalog (oblique)	44.6	49.8
7. Hardware age	35.2	40.5
8. Telephone book page	51.8	56.5
9. The American Bar (SRI)	18.3	22.6
10. Book catalog (italic)	44.2	49.5
Total seconds	265.5	315.8

[1] These times are for a single page and include overhead that would be attributable to a job rather than to a page.

SUMMARY OF COMPOSITION TIME (SECONDS) [1]

Page	Spectra 70/45, 131K, 60KB tapes for a VideoComp with 65K memory	
	Internal elapsed time clock	Stopwatch
1. The Group	6.1	11.2
2. Prices and Production	7.5	12.4
3. Policy	6.8	12.1
4. Pleistocene	10.4	15.4
5. The American Bar (SRII)	11.1	16.0
6. Book catalog (oblique)	25.9	30.2
7. Hardware age	18.0	22.8
8. Telephone book page	27.0	31.8
9. The American Bar (SRI)	10.4	15.2
10. Book catalog (italic)	26.2	30.8
Total seconds	149.4	197.9

[1] These times are for a single page and include overhead that would be attributable to a job rather than to a page.

SUMMARY OF SETTING TIME [1] (SECONDS PER A STOPWATCH)

Page	VideoComp 70/800 series (65K)					
	Proof mode			Final mode		
	Overhead	Running	Total	Overhead	Running	Total
1. The Group	1.1	5.7	6.8	1.1	4.9	6.0
2. Prices and Production	1.1	6.9	8.0	1.1	6.3	7.4
3. Policy	2.0	5.2	7.2	2.0	4.6	6.6
4. Pleistocene	2.7	8.4	11.1	2.7	7.7	10.4
5. The American Bar (SRII)	2.1	9.7	11.8	2.1	8.9	11.0
6. Book catalog (oblique)	2.5	15.1	17.6	2.5	14.1	16.6
7. Hardware age	1.0	14.2	15.2	1.0	13.6	14.6
8. Telephone book page	2.2	20.2	22.4	2.2	19.0	21.2
9. The American Bar (SRI)	1.6	7.8	9.4	1.6	7.4	9.0
10. Book catalog (italic)	2.5	14.9	17.4	2.5	13.7	16.2
Total seconds	18.8	108.1	126.9	18.8	100.2	119.0

[1] These times reflect 2 cycles of high resolution time and include overhead that is attributable to a job rather than to a page.

Note: The overhead time represents the initial font-loading time.

RCA SPECTRA 70 COMPOSITION AND OVERHEAD CALCULATIONS—STOPWATCH TIME IN SECONDS

	1 page 70/45 (A)	1 page 70/35 (B)	10 pages 70/45 (C)	10 pages 70/35 (D)	(1) 70/45 1 page composition (E)	(2) 70/45 Overhead (F)	(3) 70/35 1 page composition (G)	(4) 70/35 Overhead (H)	(5) 70/45, 2 cycles, processing, minutes (I)	(6) 70/35, 2 cycles, processing, minutes (J)
1. The Group	11.2	15.8	30.7	52.8	2.16	9.04	4.11	11.69	0.0720	0.1370
2. Prices	12.4	17.5	31.5	58.2	2.12	10.28	4.52	12.98	.0706	.1506
3. Policy	12.1	17.0	33.4	60.4	2.36	9.74	4.82	12.18	.0786	.1606
4. Pleistocene	15.4	22.6	42.0	72.4	2.95	12.45	5.53	17.07	.0983	.1843
5. American Bar	16.0	24.0	65.4	121.8	5.49	10.51	10.86	13.14	.1830	.3620
6. Catalog	30.2	49.8	216.0	368.2	20.64	9.56	35.37	14.43	.6880	1.1790
7. Directory	22.8	40.5	151.3	296.4	14.27	8.53	28.43	12.07	.4756	.9474
8. Telephone	31.8	56.5	229.3	451.0	21.94	9.86	43.83	12.67	.7313	1.4610
Total	151.9	243.7	799.6	1,481.2	71.93	79.97	137.47	106.23	2.3974	4.5821

Note: Col. (1) $\frac{C-A}{9}=E$; Col. (2) $A-E=F$; Col. (3) $\frac{D-B}{9}=G$; Col. (4) $B-G=H$; Col. (5) $\frac{2E}{60}=I$; Col. (6) $\frac{2G}{60}=J$.

RCA VIOEOCOMP TYPESETTING AND FONT LOAD CALCULATIONS—STOPWATCH TIME IN SECONDS

	10 page, high resolution (A)	10 page, low resolution (B)	Total (C)	Font load, high (D)	Font load, low (E)	2 cycles, 1 proof, 1 final (F)	2 cycles, composition, minutes (G)
1. The Group	38.8	29.4	69.2	1.1	0.55	6.7	0.1116
2. Prices	43.4	33.0	78.4	1.1	.55	7.5	.1250
3. Policy	46.2	35.2	81.4	2.0	1.0	7.8	.1300
4. Pleistocene	51.0	46.7	97.7	2.7	1.3	9.4	.1566
5. American Bar	84.0	64.9	148.9	2.1	1.0	14.6	.2433
6. Catalog	140.5	113.0	253.5	2.5	1.2	25.0	.4166
7. Directory	126.6	126.2	252.8	1.0	.5	25.1	.4183
8. Telephone	166.0	165.5	331.5	2.2	1.1	32.8	.5466
Total	696.5	613.9	1,310.4	14.7	7.2	128.9	2.1480

Note: Col. C=A and B; Col. F=$\frac{C-(D \text{ and } E)}{10}$; Col. G=$\frac{F}{60}$.

VIOEOCOMP SYSTEMS—MINIMUM SPECTRA 70 CONFIGURATION

Model	Description	Unit price: Purchase	Unit price: Lease	Units required	Total price: Purchase	Total price: Lease	Monthly maintenance charge
70/35E	Processor (65K)	$203,700	$3,731	1	$203,700	$3,731	$324.50
70/97-20	Console	17,250	343	1	17,250	343	27.50
5002-35	Elapsed time clock	2,450	49	1	2,450	49	3.00
5031	Selector channel	13,400	266	1	13,400	266	17.00
70/551	Random access controller	25,500	497	1	25,500	497	54.25
5501-14	I/O attachment for 70/564	(1)	(1)	1			(1)
70/564	Disk storage unit	25,510	535	1	25,510	535	68.75
506	Disk pack	360	12	3	1,018	36	(2)
70/221-11	Paper tape reader	25,500	424	1	25,500	424	145.00
5219-11	Advanced sprocket read	2,250	36	1	2,250	36	12.25
70/472-108	Magnetic tape controller (single channel)	33,950	663	1	33,950	663	72.00
70/432-1	Magnetic tape unit	27,350	509	2	54,700	1,018	277.00
70/242-30	Printer (625 lpm)	46,100	530	1	46,100	530	237.50
70/237-10	Card reader (1435 cpm)	31,550	526	1	31,550	536	180.00
	Total minimum charge				482,878	8,654	1,418.75

[1] No charge.
[2] Time and material.

SPECTRA 70/45 CONFIGURATION

Model	Description	Unit price: Purchase	Unit price: Lease	Units required	Total price: Purchase	Total price: Lease	Monthly maintenance charge
70/45F	Processor (131K)	$339,500	$6,778	1	$339,500	$6,778	$540
70/97-20	Console	17,250	343	1	17,250	343	27
5002-45	Elapsed time clock	2,450	49	1	2,450	49	3
5016	Selector channel	18,250	362	1	18,250	362	23
70/551	Random access controller	25,000	497	1	25,500	497	54
5501-24	I/O attachment for 70/564	(1)	(1)	1			(1)
70/564	Disc storage unit	25,510	535	1	25,510	535	68
506	Disc pack	360	12	3	1,018	36	
70/221-11	Paper tape reader	25,500	424	1	25,500	424	145
5219-11	Advanced sprocket read	2,250	36	1	2,250	36	12
70/473-208	Magnetic tape controller (2 ch.)	51,000	994	1	5,100	994	108
70/442	Magnetic tape unit (60KB)	41,050	716	4	164,200	2,864	825
70/237	Card reader (1425 CPM)	31,550	526	1	31,550	526	186
70/243	Printer (1250)	40,950	873	1	50,950	873	258
	Total charge				709,028	14,316	2,249

[1] No charge.

PRICE SCHEDULE, 70/800 VIDEOCOMP SERIES

Model or feature No.	Description	Sales price	Monthly lease	Monthly [1] maintenance
70/800	Basic system 32K memory	$341,775	$8,100	$1,215
	Additional 32K memory	38,250	850	130
803	Console typewriter	10,000	200	30
F8009	Full-face writing	10,200	225	30
F8010	35mm. microimage	9,600	225	35
F8011	Disc storage	32,710	750	115
F8013	Image rotation	10,000	225	35
F8014	Drawing write	20,000	500	60
F8015	Drawing scan	24,000	600	75
Accessories:				
	A 8042A Light-tight box [2]		595	
	A 8051A Universal film cassette		795	

[1] Applies only to systems sold outright.
[2] 1 light-tight box and 2 universal output material cassettes are included in the basic system. Additional quantities are available at the above prices.

Stabilization paper may be purchased from RCA at the following prices for 200 foot rolls:

Width (MM):	Price
70	$13.95
100	17.95
150	24.95
250	37.50
310	45.25

Activator, 2½ gal. cubitainer, $13.60.
Stabilizer, 2½ gal. cubitainer, $21.60.
Phototypesetting film and phototypesetting paper may be purchased from several manufacturers.

OUTPUT MATERIAL WIDTHS

Film width		Maximum line width		
Mm.	Inches	Mm.	Inches	Picas
35	1.12	22	.86	5.16
70	2.75	58	2.28	13.68
100	3.94	88	3.47	20.80
150	5.90	138	5.43	32.50
250	9.84	231	9.10	54.60
310	12.15	300	11.80	70 80

Note: The length of the stabilization paper can be specified, in points, by the composition program from a minimum of 12 inches to a maximum of 23 inches.

SPECIFICATIONS

1. The Group

Provided by PIA:
1 Column of 21 picas.
10/11 type, 41 lines deep, 1 line for running head.
Total text type: 1,025 10 pt. ems.
Typefaces:
10 pt. Roman.
10 pt. Roman capitals and small caps, once on page.
10 pt. Italic, once on page.

RCA Graphic Systems:
Column width, 252 points.
Typeface 4, Times Roman, SR IIC, 14,452 bytes, point size 10.
Body lead 11.
40 lines.
Characters:

Composition code characters	204
Text characters	2,333
Total characters	2,537

2. Prices and the Production Plan

Provided by PIA:
1 Column of 25½ picas.
32 lines of 10/12 text (980 cms).
8 lines of 8/10 footnote (304 ems).
1 line of running head.
Typefaces:
8 and 10 point Roman.
10 point Italic—four times on page.
8 and 10 point superiors—twice on page.
10 point small caps—once on page.
10 point bold—once on page.
10 point special symbols for prime mark.

RCA Graphic Systems:
Column width, 306 points.
Typeface 4, Times Roman, SR IIC, 14,452 bytes, point size 10.
Body lead, 12.
38 lines
Characters:

Composition code characters	352
Text characters	4,740
Total characters	[1]5,092

[1] Above character count corrected by RCA on May 15, 1970, as follows:

Composition code characters	368
Text characters	2,744
Total characters	3,113

3. Policy

Provided by PIA:
1 Column of 27½ picas.
10/12 type 45 lines to text depth—(1,485 ems) (actually, 40 lines of type—1,320 ems—plus 1 line for running head).
Typefaces:
10 point Roman.
10 point Italic—three times on page.
8 point Sans-serif roman—once on page.
10 point Sans-serif bold—three times on page.

RCA Graphic Systems:
Column width, 330 points.
Typeface 4, Times Roman, SR IIC, 14,452 bytes, point size 10.
Typeface 10, Gothic, SR IIC, 12,968 bytes, point size 8 and 10.
Body lead, 12.
40 lines
Characters:

Composition code characters	318
Text characters	2,929
Total characters	3,287

4. Pleistocene

Provided by PIA:
1 Column 27 by 43 picas (1,400 10pt. cms) plus running head.
31 lines of 10/12 type (1,010 ems).
3 lines of 6 point (162 ems).
8 lines of 8 point, including running head (324 ems).
Typefaces:
6, 8 and 10 point Roman.
6 and 10 point Roman superiors.
6, 8 and 10 point Italic (21 times).
Brackets in 10 point Roman (1 time).
8 point cap and small cap (3 times on page).
8 point Roman accents (2 times on page).
8 point bold (1 time on page).

4. Pleistocene

RCA Graphic Systems:
Column width, 324 points.
Typeface 4, Times Roman, SR IIC, 14,452 bytes point size 8, 10.
Typeface 5, Times Roman, SR IB, 8,064 bytes, point size 6.
Typeface 6, Times Bold, SR IIC, 14,008 bytes, point size 8.
Body lead, 12.
40 lines.
Characters:

Composition code characters	625
Text characters	3,097
Total characters	3,722

5. The American Bar

Provided by PIA:
2 Columns 17½ by 52½ picas each (8,800 8 pt. ems) plus running head of 36 picas.
Actual text-average 67 lines/column (3,600 8 pt. ems).
Typefaces:
8 and 14 pt. Roman.
8, 12 and 14 pt. Bold (10 times on page).
8 point bold Italic—may be obliqued.

RCA Graphic Systems:
Column Width, 210 points.
Typeface 6, Times Bold, SR IIC, 14,008 bytes, point size 8, 12 and 14.
Typeface 4, Times Roman, SR IIC, 14,452 bytes, point size 8.
Body lead, 8.
Characters:

Composition code characters	1,114
Text characters	5,547
Total characters	6,661

6. Book Catalog Index

Provided by PIA:
3 Columns, 41 by 66⅔ picas.
100 lines of 8 point type (6,150 ems).
Typefaces:
8 point bold Italic (may be obliqued).
8 point Roman.
8 point Sans serif medium.

RCA Graphic Systems:
Column width, 156 points.
Typeface 4, Times Roman, SR IIC, 14,452 bytes, point size 8.
Typeface 13, Technica Medium, SR IB, 6,224 bytes, point size 8.
Typeface 6, Times Bold, SR IIC, 14,008 bytes, point size 8.
Body lead, 8.
Characters:

Composition code characters	2,353
Text characters	8,843
Total characters	11,196

7. Hardware Age

Provided by PIA:
3 Columns, 13⅓ picas by 61¼ picas.
Average, 100 lines/column (2,700 6 pt. ems/column).
Overall page size 41 picas (8,200 6 pt. ems/page).
Typefaces:
6 point medium.
6 point bold.
8 point bold.
6 point bold star.

RCA Graphic Systems:
Column width 162 points.
Typeface 13, Technica Medium, SR IB, 6, 224 bytes, point size 6.
Typeface 3, Gothic Bold, SR IB, 7,600 bytes, point size 6 and 8.
Body lead, 8.
315 lines.
Characters:

Composition code characters	1,964
Text characters	14,673
Total characters	16,637

8. Telephone Book Page

Provided by PIA:
4 Columns of 12 picas each, 120 lines deep (2,880 6 pt. ems).
Overall width 50 picas—12,000 6 pt. ems/page.
Typefaces:
Roman and bold (Bold can be cap only) plus 12 point bold for head.

RCA Graphic Systems:
Column width, 144 points.
Typeface 5, Times Roman, SR IB, 8,064 bytes, point size 6.
Typeface 3, Gothic Bold, SR IB, 7,600 bytes, point size 6.
Typeface 6, Times Bold, SR IIC, 14,008 bytes, point size 12.
Body load, 6.
483 lines.
Characters:

Composition code characters	4,407
Text characters	22,768
Total characters	27,175

9. The American Bar

Provided by PIA:
Same as item 5 except that the 8 point text is to be in size range I rather than size range II.

RCA Graphic Systems:
Typeface 5, Times Roman, SR IB, 8,064 bytes, point size 8.

10. Book Catalog Index

Provided by PIA:
Same as item 6 except that a true Italic is to be used rather than oblique.

RCA Graphic Systems:
Typeface 88, Times Bold Italic, SR IIC, 13,128 bytes, point size 8.

RCA
Graphic
Systems

70/800 Series
VideoComp
System

Data Sheets

First Printing: December 1969
Second Printing
(Revision Level 1): April 1970

BASIC 70/800 VIDEOCOMP SYSTEM

GENERAL DESCRIPTION	The Basic 70/800 Series VideoComp System composes text of graphic arts quality in a wide variety of typefaces.
INPUT	Text and Control data recorded at 800 bpi on industry-standard, nine-level magnetic tape. This data is interpreted by an internal program which controls the generation of images on photosensitive material. The control data consists of commands which are listed in Appendix B.
OUTPUT	Composed text is produced in widths up to 70 picas, written in line-by-line mode in either a right-reading or wrong-reading direction. The number of lines can be as many as necessary to form the desired depth.
FONTS[1]	Accepts either Type I or Type II fonts. Type I fonts are capable of generating eight point sizes per font. (Refer to Appendix C.) Type I fonts are available in up to five size ranges covering point sizes 4 to 96. For each point size a number of different character widths may be selected electronically, permitting expanded and condensed versions of the typeface to be composed. In addition, characters may be composed in a slanted, or "pseudo-italic" manner. Type II fonts generate one point size per font, but are otherwise similar to Type I fonts.
FONT RESOLUTION AND GRANULARITY[1]	The 70/800 will accept fonts in a number of different granularity modes. Refer to Appendix D for details.
FONT STORAGE REQUIREMENTS	Varies with size range, point size, and granularity mode. Measured in bytes/character. Typical requirements are shown in Appendix E.
TYPOGRAPHIC PRECISION	Vertical positioning can be effected to 1/32 of a point and horizontally to 1/50 of a point.
TIMING	Device times for a variety of compositional situations are listed in Appendix I.
OUTPUT MATERIALS	Stabilization paper processed on-line; phototypesetting paper or film; or paper offset plate. All of the output media except the stabilization paper can be collected in cassette or cut sheet form. Refer to Appendix G for details.

[1]Capabilities stated are hardware capabilities and depend functionally upon availability of fonts.

BASIC SYSTEM COMPONENTS	1600 Processor (optionally 32K or 65K)
	70/432-1 Magnetic Tape Unit (2 drives)
	70/432-1 Magnetic Tape Control Electronics (2 rows[1])
	70/800 Photocopy Unit
	70/800 Photocopy Control Electronics (4 rows[1])
	803 Console Typewriter
	803 Console Typewriter Control Electronics (1 row[1])
OPTIONAL PERIPHERAL DEVICES	70/564 Disc Storage Unit (1 to 4 units)
	70/564 Disc Control Electronics (2 rows[1])
	70/432-1 Magnetic Tape Unit (2 drives)
	70/432-1 Magnetic Tape Control Electronics (2 rows[1])
PHYSICAL CHARACTERISTICS	Refer to Appendix A

[1]The Basic System will accommodate up to nine rows of control electronics. Additional control electronics capacity may be acquired if desired. Refer to Feature F8018 for details.

FULL-FACE WRITING FEATURE F8009

EXPANDED CAPABILITY

Enables output of a full page (up to 42 picas wide by 54 picas high) without advancing the transport carrying the output media. Additionally, this feature enables the output to be written in a window-by-window mode. In this mode, the output dimensions of the window are any combination of height and width within the limits of a maximum diagonal of 70 picas and a maximum usable height of 54 picas.

In conjunction with Feature F8010 (Secondary Lens, 35mm.), this feature enables the output to be produced on 35mm. film (up to 42 picas wide and 54 picas high true size equivalent).

Feature F8009 further enhances the flexibility of the 70/800 System, since it is a requirement for many of the expanded capabilities achieved by the addition of other features.

OTHER FEATURES REQUIRED

None.

SECONDARY LENS (35mm.) FEATURE F8010

EXPANDED CAPABILITIES

Enables the output of the basic system to be recorded on 35-mm. film at nominally 1/8 size. Appendix G lists the applicable film specifications.

This feature is required for the scanning, digitizing and storing of line-drawings provided by the Drawing Scanning Feature, F8015.

Additionally with this feature all the compositional flexibility provided by the Full-Face Writing Feature, F8009, is available.

OTHER FEATURES REQUIRED

F8009 (Full-Face Writing).

MOVABLE-HEAD DISC STORAGE FEATURE F8011

EXPANDED CAPABILITIES

Provides for random-access storage and retrieval of fonts, frequently used line-drawings (e.g., logotypes), forms, and system programs. With fonts, forms and/or logos stored on disc, and text and commands on the input magnetic tape, the output may be any combination of pages of text, forms, and/or logos in proper position.

To write logotypes, this feature is used in conjunction with the Full-Face Writing Feature, F8009. To write output in micro-size, this feature is used in conjunction with Secondary-Lens Feature, F8010.

The disc storage system is comprised of Disc Control Electronics, one to four 70/564 Disc Storage Units, and the 70/563 Interchangeable Disc Pack.

OTHER FEATURES REQUIRED

None.

WRITING ORIENTATION ROTATION FEATURE F8013

EXPANDED CAPABILITIES

Permits rotation of writing orientation with respect to film/paper transport direction in 90-degree increments.

OTHER FEATURES REQUIRED

F8009 (Full-Face Writing).

DRAWING WRITING FEATURE F8014

EXPANDED CAPABILITIES

Permits system to write drawings in true size, or microsize (with Secondary Lens, Feature F8010), in response to digitized drawing-stroking data. Refer to Appendix F for the modes in which drawings can be written.

Drawing stroking data may be combined in-line with text stroking data on a magnetic tape, or stored separately on a secondary magnetic tape.

OTHER FEATURES REQUIRED

F8009 (Full-Face Writing).

DRAWING SCANNING FEATURE F8015

EXPANDED CAPABILITY

Enables the 70/800 VideoComp to scan and digitize line drawings from 35mm. microfilm, and to store the resultant data in a compacted form on magnetic tape. Refer to Appendix F for the storage requirements of typical drawings scanned in each of the three modes available.

To implement this feature, the input must be on 35mm. film in a cassette, complete with reference marks and coded drawing number within the scanning aperture. Appendix II contains the format of the 35mm. film image.

OTHER FEATURES REQUIRED

F8009 (Full-Face Writing)

F8010 (Secondary Lens).

EXPANSION RACK FEATURE F8018	
EXPANDED CAPABILITY	Provides seven additional rows of mounting space and power for control electronics. The control electronics for any one peripheral device must be completely contained in either the rack of the basic system or in the Expansion Rack.
OTHER FEATURES REQUIRED	None.

APPENDICES

APPENDIX A
BASIC 70/800 SERIES PHYSICAL CHARACTERISTICS

COMPONENT	HEIGHT (Inches)	WIDTH (Inches)	DEPTH (Inches)	WEIGHT (Lbs.)	POWER (KVA)[1]	HEAT LOAD (Btu/Hr.)
Photocopy Unit	67	137	28	2,500	8	20,000[2]
Controller	62	50	25	600	3	6,600
Magnetic Tape Unit	62	50	25	650	3	6,600
Console Typewriter	39	40	24	225	0.22	300
Disc Unit	38	30	24	390	0.75	2,000

TEMPERATURE

Operating Range	65 to 80 F.
Recommended	73 ± 2 F.

RELATIVE HUMIDITY

Operating Range	30 to 60%
Recommended	50% ± 5%

MAXIMUM CABLE LENGTHS

Control Unit to Photocopy Unit	100 feet
Control Unit to Magnetic Tape Unit	35 feet

[1] 208 Volt, 3 Phase, 60 Hertz.
[2] 10,000 if dryer exhausts to outside.

APPENDIX B
VIDEOCOMP COMMAND SET

CODE[1]	COMMAND NAME
1	Width
2	Up/Down
3	End of Page
4	Roman
5	Oblique
7	Set Horizontal Position
8	Conditional Ignore
9	Consider
10	Repeat Character
11	Advance
13	Space Backward SSI[3]
15	Space Forward SSI[3]
16	Font Select
17	Font Load
18	Font Select Single
19	Font Load Single
20	Font Call
21	Job Number Display
23	End of Record
25	Test Character
26	Ignore
27	Letter Spacing
29	Space Backward HCI[2]
30	Page Orientation (Requires Feature F8013)
31	Space Forward HCI[2]
32	Horizontal and Vertical Rules
34	String Call (Requires Feature F8011)
37	Drawing Write MT[4] (Requires Feature 8014)
38	Drawing Write Disc (Requires Features F8014 & F8011)
40	Set Vertical Position
41	New Line
42	Define Writing Block
46	Console Typewriter Output

---

[1] Decimal equivalent of the hexadecimal command code.
[2] HCI - Horizontal Counting Increment.
[3] SSI - Stroke Spacing Increment.
[4] MT - Magnetic Tape.

APPENDIX C
CHARACTER POINT SIZES

SIZE RANGE	SIZE GROUP							
	A	B	C	D	E	F	G	H
I	4	4-1/2	5	5-1/2	6	6-1/2	7	8
II	8	9	10	11	12	13	14	16
III	16	18	20	22	24	26	28	32
IV	32	36	40	44	48	52	56	64
V	64	72	80	88	96	--	--	--

APPENDIX D
CHARACTER RESOLUTION AND GRANULARITIES (SIZE RANGE)[1]

FONT TYPE I

GRANULARITY MODE	GRANULARITY[2]		EQUIVALENT RESOLUTION[2]	
	HORIZONTAL (Strokes/Em)	VERTICAL (Increments/ Em)	HORIZONTAL (Strokes/Inch)	VERTICAL (Increments/ Inch)
A	100	120	1800-900	2160-1080
B	50	120	900-450	2160-1080
C	50	60	900-450	1080-540
D	25	60	450-225	1080-540
FONT TYPE II[3]				
A	50-100	60-120	900	1080
B	25-50	60-120	450	1080
C	25-50	30-60	450	540
D	12.5-25	30-60	225	540

[1]Character sizes, font types, and granularities indicated are hardware capabilities only. Use of these capabilities depends upon availability of the necessary font files.

[2]For Type I fonts in a given mode, granularity remains constant over a size range and the resolution varies. Values indicated are for Size Range I. Granularities for other size ranges are calculated by doubling the Horizontal Strokes/Em and Vertical Increments/Em values of the previous size range.

[3]For Type II fonts granularity varies within a size range, but the resolution remains constant for a given mode.

APPENDIX E
AVERAGE CHARACTER STORAGE REQUIREMENTS [1]

TYPE I					
SIZE RANGE	POINT SIZE	BYTES/CHARACTER GRANULARITY MODES			
		A	B	C	D
I	4-8	180	100	90	55
II	8-16	375	200	180	100
III	16-32	835	425	375	200
IV	32-64	1850	930	830	425
V	64-96	3000 (est.)	2000	1850	930

TYPE II				
POINT SIZE	BYTES/CHARACTER GRANULARITY MODES			
	A	B	C	D
4	90	50	50	25
6	135	75	75	38
8	180	100	100	50
12	280	150	150	75
16	375	200	200	100
24	625	320	320	150
32	835	425	425	200
48	1400	700	700	320
64	1850	930	930	425
96	2300 (est.)	1500	1500	700

[1] These are average values based on several typefaces. Refer to the specimen sheet provided with each font file for specific values. Character sizes, font types, and granularities indicated are hardware capabilities only. Use of these capabilities depends upon availability of the necessary font files.

APPENDIX F
TYPICAL DRAWING SCANNING MODES AND STORAGE REQUIREMENTS

SCANNING MODE	STROKING DENSITY			
	TRUE SIZE		1/8 SIZE	
	HORIZONTAL (Strokes/Inch)	VERTICAL (Increments/ Inch)	HORIZONTAL (Strokes/Inch)	VERTICAL (Increments/ Inch)
L	225	270	1800	2160
M	300	360	2400	2880
H	450	540	3600	4320

SCANNING MODE	BYTES PER DRAWING		
	SIMPLE	MEDIUM	COMPLEX
L	19,400	45,500	107,500
M	28,300	65,000	165,100
H	44,700	103,900	308,700

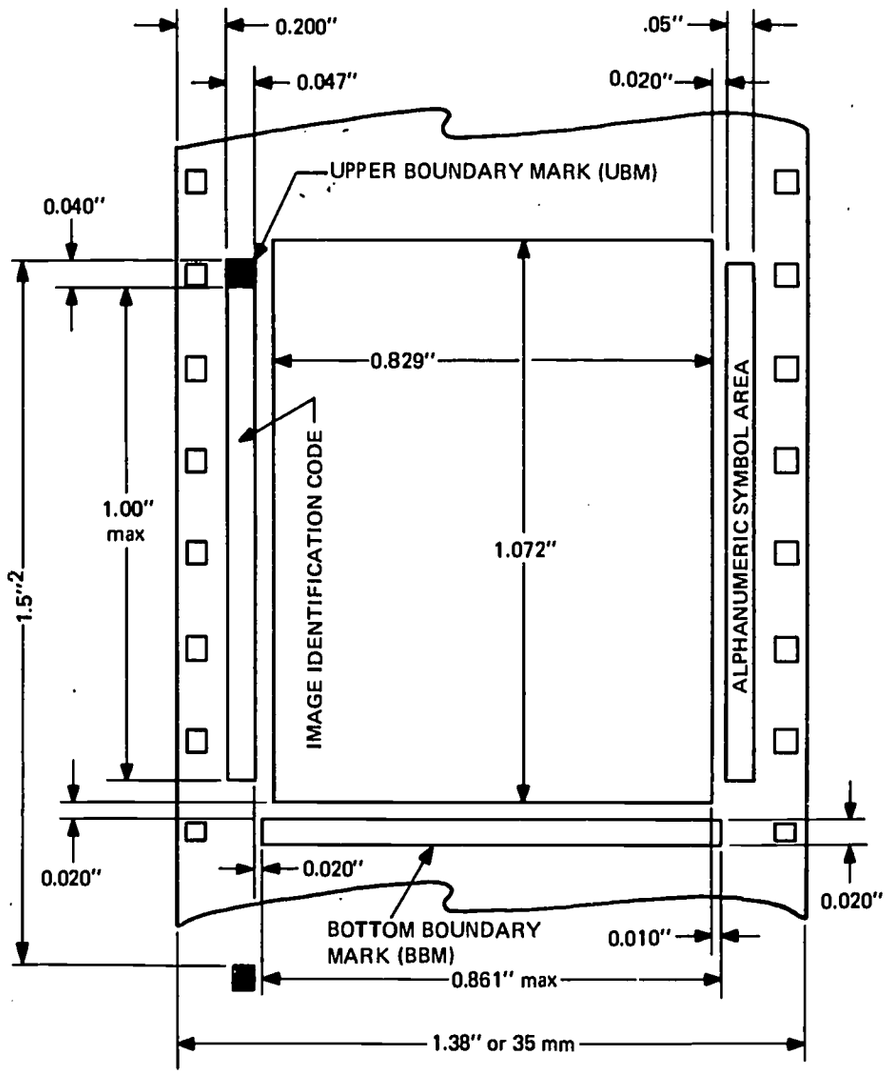
APPENDIX G
OUTPUT MATERIAL TYPES AND CASSETTE CAPACITY

FOR 70 mm THROUGH 310mm OUTPUT VIA PRIMARY LENS			
MATERIAL	RCA Spec.	THICKNESS (Mils)	MAXIMUM CAPACITY (Ft.)
Typesetting Film-Acetate	2200034	5.10-5.53	275
Typesetting Film-Acetate	2200034	3.60-3.86	400
Typesetting Film-Polyester[1]	2200034	4.27-4.67	325
Typesetting Paper	2200035	3.55-4.19	350
Stabilization Paper-Heavy	2200036	5.50-6.50	235
Stabilization Paper-Normal	2200147	4.00-4.60	350
Paper Plate Material	2200075	7.80-8.60	175
FOR 35mm MATERIAL OUTPUT VIA SECONDARY LENS (FEATURE F8010)			
MATERIAL	RCA Spec.	THICKNESS (Mils)	MAXIMUM CAPACITY (Ft.)
Typesetting Film-Acetate	2200178	5.10-5.53	275
Typesetting Film-Acetate	2200178	3.60-3.86	400
Typesetting Film-Polyester	2200178	4.27-4.67	325

MATERIAL SIZES	
MATERIAL WIDTH (mm)	MAXIMUM NOMINAL PRINTED LINE LENGTH (Picas)
35[2]	42 (with 8x enlargement)
70	13.5
100	20.5
150	32.5
250	56
310	70

[1] Not recommended for continuous processing.
[2] Requires Secondary Lens Feature, F8010.

APPENDIX H
SCAN INPUT FILM FORMAT[1]



[1]Drawing is not to scale and tolerances are not shown. All dimensions are given in inches.

[2]Frame-to-frame spacing, measured from top of UBM of one frame to top of UBM of next frame. This 1.5-inch distance represents eight sprocket holes.

APPENDIX I
SYSTEM TIMINGS

System throughput times are based upon, and vary with page size, character mix, typeface, point size, size range, granularity mode, line length, font mix, core storage size and features utilized.

The following timing charts are provided as an aid to estimating system throughput:

TIMING CHARTS

AVERAGE ELECTRONIC WRITING TIME PER CHARACTER[1]

TYPE I					
SIZE RANGE	POINT[2] SIZE	GRANULARITY MODES			
		A	B	C	D
I	4-8	0.76	0.40	0.30 - 0.40	0.17 - 0.22
II	8-16	2.30	1.17	0.76 - 1.17	0.40 - 0.61
III	16-32	8.57	4.30	2.65 - 4.30	1.35 - 2.17
IV	32-64	30.30	15.17	8.57 - 15.17	4.30 - 7.60
V	64-96	113.39	56.71	30.30 - 43.51	15.17 - 21.77

TYPE II				
POINT SIZE[2]	GRANULARITY MODES			
	A	B	C	D
4	0.30	0.17	0.17	0.13
6	0.50	0.27	0.27	0.16
8	0.76	0.40	0.40	0.22
12	1.43	0.73	0.73	0.39
16	2.30	1.17	1.17	0.61
24	5.20	2.62	2.62	1.33
32	8.57	4.30	4.30	2.17
48	17.78	8.91	8.91	4.48
64	30.30	15.17	15.17	7.60
96	65.24	32.64	32.64	16.34

[1] Times are in milliseconds, and are for true-size output.

[2] Time for an intermediate point size may be obtained by interpolation. The exact time per character depends upon the specific character being written. The values indicated here are for a typical character with an image area of 0.425 em high by 0.437 em wide. Character speeds in Type I Modes A and B are constant within a size range.

FUNCTION TIMINGS - MAGNETIC TAPE

READ FUNCTION	AVERAGE READ TIME
Start and Stop Time	16 msec.
Data Transfer	30K Bytes/Sec.
Time/Block	16 ± N/30 (N = Number of characters in thousands per block)

FUNCTION TIMINGS - FILM/PAPER ADVANCE

ADVANCING FUNCTION	AVERAGE TIMING
Per Point Advanced	1.6 msec.
35mm. Frame Advance	190 msec.
12 in. Page Advance	1400 msec.
Start and Stop	12.5 msec.

FUNCTION TIMINGS - COMPOSITION OF RULES

HORIZONTAL RULES	AVERAGE WRITING SPEED
1 Point	3.5 msec. per inch
2 Point	4.4 msec. per inch
VERTICAL RULES	
1 Point	0.9 msec. per inch
2 Point	1.7 msec. per inch

FUNCTION TIMINGS - DISC

FUNCTION	AVERAGE TIMING
Seek Time (Average)	75 msec.
Adjacent Cylinder Seek Time (Average)	25 msec.
Latency Time (Average)	12.5 msec.
Data Transfer Time (Per 1000 Bytes)	7 msec.

FUNCTION TIMINGS - DRAWING COMPOSITION

MODE	RESOLUTION	MSEC./SQ. INCH	SEC./MAX. AREA DRAWING*
	HORIZONTAL Strokes/Inch (True Size)		
H	450	93	5.2
M	300	63	3.5
L	225	47	2.6

FUNCTION TIMINGS - DRAWING SCAN

MODE	RESOLUTION		SCANNING TIME (Seconds)	
	HORIZONTAL (Strokes/Inch)	VERTICAL (Increments/Inch)	PER SQ. IN.	MAX. AREA
H	3600	4320	2.1	120
M	2400	2880	1.4	80
L	1800	2160	1.05	60

[1]Maximum drawing area is 57 sq. inches (approx.).

An Analysis of the Harris Composition System as Applied to Eight Sample Pages

(Prepared under the direction of Dr. Edwin R. Kolb, General Manager, Fototronic, CRT Operations, Intertype, a Division of Harris-Intertype Corporation, Cleveland, Ohio)

INTRODUCTION

The following sections provide timings and supporting information relative to the Fototronic-CRT samples produced for PIA.

Original text, sans format calls, was provided by RCA. Format calls were embedded within the text and composition performed via the Harris Composition System (HCS). The software was executed on an IBM 360/30. The exact configuration used, plus a cost break-down for a basic configuration are included.

SAMPLE TIMINGS

The chart below indicates actual computer and CRT timings for the samples provided. The following remarks should be considered when reviewing sample timings:

1. The experience level of the "programmer" responsible for developing the formats used, will materially affect timings.
2. In general, very high volume, single format jobs (i.e., telephone directories) will be run under specialized software designed to optimize thru-put rather than composed on a general purpose composition system.
3. The following procedure was used to remove the effect of "overhead" from the sample timings detected: Each sample was run in its entirety. Next, a single phrase of the text was run through the system to obtain timings for "overhead". This figure was then subtracted from the total time to provide a more meaningful per page time.

TIMINGS FOR SAMPLES (SEC./PAGE)

PIA sample	360/30 time[1]	CRT "proof" time	CRT run time
1. The Group	3	3	5
2. Prices and Production	5	4	6
3. Policy	5	4	6
4. Pleistocene	11	4	6
5. American Bar	32	6	9
6. Book catalog	71	8	12
7. Directory	72	9	15
8. Telephone directory	122	15	24

[1] Composition execution time will typically be reduced ⅓ when run on a 360/40 with similar peripherals.

Note: Items 1–4 proof with 7-point master, run with 10-point master; items 5–8 proof with 5-point master, run with 7-point master.

HARRIS COMPOSITION SYSTEM

The Harris Composition System used to generate the samples is a high level page oriented general composition system. It operates under DOS with an IBM 360/30, 65K system or larger. The basic programs comprising the system are written in BAL. Assuming an appropriate computer configuration, HCS operates in a multiprogramming environment. Harris has scheduled HCS operational under OS/360 for release in the second quarter of 1970. This will allow HCS to be interfaced in the most sophisticated of environments.

The following paragraphs describe the principle programs comprising HCS:

The following paragraphs describe the principle programs comprising HCS:

TABTXT

TABTXT is a general-purpose program providing a preprocessing or interfacing function for the composition processor HCLP. TABTXT accepts data in the form of cards or magnetic tape and accomplishes field selection, translation, and macro embedding functions. Output in a new master magnetic tape with logical page and line numbers suitable for listing and updating. Currently, up to 20 different record types containing up to 10 data fields per record may be "preprocessed" automatically. Multiple file processing is a standard feature.

EDIT

Existing magnetic tapes can be updated using this program to add, to delete or to modify information. Magnetic tapes generated by the TABTXT preprocessor are immediately available for updating using EDIT. The corrections may be input on either cards or magnetic tape. Pertinent diagnostics and statistics are listed for the programmer's attention.

PTMT

PTMT is a general-purpose translation program that will convert a magnetic tape which contains paper tape images to a manuscript standard tape with EBCDIC coding.

Harris Composition Language Program (HCLP)

HCLP follows the "macro concept". Unique typographic events are identified by name and position by the placement of "macros" within the input stream. Macros consist of an alphabetic character (A–Z) followed by a digit (1–9) both enclosed within delimiters; e.g., <A1>, <B6> or <Z9>. These macros may represent lengthy control and/or text strings. In fact, a single macro may be up to 500 characters in length. The macro technique allows input tapes to be generated, updated and manipulated independent of composition considerations. However, at composition time the meaning or definition of these macros must be made clear, and it is in the definition of macros that page layout, type styles, etc., decisions are made. Definition of a macro consists of instructing the system what set of language primitives are to be executed at the time or place the macro occurs. HCPL language primitives or opcodes always consist of two alphabetic characters; e.g., NL, PG, HR, VM, etc., followed by an argument list, if required by the opcode.

Phase one (HCLP–1) of the composition system has responsibility for macro definitions and input preparation. Phase one will produce an output tape which no longer contains macros. Each occurrence of a macro has now been replaced by its definition.

Information contained on this output tape consists of language primitives and characters to be typeset.

Phase two (HCLP–2) of the composition system is always executed following phase one and has the responsibility for line composition (including hyphenation and justification). Language primitives are executed in phase two. Output from phase two consists of a magnetic tape containing line segments, page records, and block information. The line segment records consist of block number, line number, vertical justification flag, X and Y positions, and coded character strings representing characters to be displaced or device controls to be performed. Page records consist of page flag, page number, page width, page depth. Block information records consist of block origin and boundary information. Sufficient information is thus available for "page makeup" which is done in phase three.

Phase three has the responsibility for page makeup including vertical justification and translation of data controls.

All phases are coded in assembly language.

Error messages and statistics are listed by HCLP when and where appropriate.

In addition to "standard" typographical functions, the Harris Composition Language also provides a complete logical arithmetic capability. A simple example of the use of this capability is the generation of page numbers, and the determination if the current page is a left-hand or right-hand page.

COMPUTER CONFIGURATION

The minimum hardware required to run the Harris Composition Language Processor is as follows:

1. A System/360 CPU Model 30, 40, 44 (with the full 360 instruction set), 50, 65, 67 (in Model 65 mode), 75, 85, or 195.

2. Commercial Instruction Set and Scientific Instruction Set.
3. At least 65, 536 bytes of core storage.
4. At least one 2311 or one 2314 Disk Storage Unit.
5. At least two magnetic tape drives, one of which must write tape in a format acceptable to the Fototronic-CRT 9 track, 800 bpi.
6. A 1052 console typewriter for operator communication.
7. A card reader, type 2501, 2520B1, 1442N1, or 2540. An additional tape unit or a disk extent may be substituted for the reader.
8. A line printer, type 1403, 1404, 1443, or 1445. An additional tape unit or a disk extent may be substituted for the printer. A 1403 with the Universal Character Set (UCS) and a TN chain/train is recommended.
9. The Interval Timer is required if the HCLP checkpoint/restart facilities are to be utilized.
10. The Storage Protection feature is required if the program is to operate in a multiprogramming environment.

The following charts indicate the minimum and actual 360/30 configurations:

HCS—MINIMUM IBM CONFIGURATION

Type	Description	Units	Lease	Purchase	Maintenance
2030F	CPU 65K (single channel)	1	$4,304	$190,990	$162.00
1051	Control unit	1	83	4,285	11.75
1052	Keyboard	1	63	2,704	17.00
2821	Unit record control unit	1	692	30,730	36.50
1403 Mod 2	Printer 1185 LPM w/TN train	1	982	43,320	184.75
2501	Cardreader	1	260	14,590	51.50
2841	Disk storage control	1	525	25,635	56.00
2311	Disk storage drives	1	570	24,745	55.00
2404 Mod 1	Tape storage control	1	930	43,940	40.00
2401 Mod 1	Mag tape units (30 KB)	2	670	30,300	124.00
	Total		9,079	411,239	738.50

Note: (1) Essential extra-cost features are included with the price of the item to which they pertain. (2) Figures are standard IBM prices in effect as of Jan. 1, 1970.

Type	Description	Units	Lease	Purchase
6961 [1]	2d selector channel	1	$185	$7,430
2311 [1]	2d disk drive	1	570	24,745
2401 [2]	60 KC tape units	3	1,455	66,060
	Total		10,619	479,174

[1] Add to minimum configuration.
[2] Replace 2-3- KB tapes.

FOTOTRONIC-CRT PRICING

	Purchase	Lease
A. Fototronic-CRT:		
1. Standard 69-pica machine W/256 character memory	$322,500	$8,700
B. Options:		
1. Each 256-character memory unit	22,500	600
2. Darkroom	10,000	270
3. Extra film reel spools	125	
4. Fonts (per standard character)	[1] 12	
5. Fonts (special characters, artwork customer supplied)	[1] 50	
6. 100-pica capacity	65,000	1,855
7. Software, book package (PAGATEXT)	[1] 25,000	
8. Software, general purpose compiler (HCS)	[1] 40,000	550
9. Yearly maintenance agreement contract, per month (included in leased price)	1,500	
10. Video screen monitor	3,500	95

[1] Paid-up license only.

FOTOTRONIC SYSTEM

Film and photographic paper specifications and prices.[1]—Fototronic photographic material prices have been revised to afford substantial savings to customers who anticipate requirements and order volume quantities of each size whenever possible. (Kodak price increases on photographic paper are reflected below.)

[1] All prices are subject to change without notice.

Intertype part number	Width (picas)	Price per 100-foot roll: 1 to 9 rolls	10 to 19 rolls	20 to 49 rolls	50 or more
Regular film:					
P-1345	18	$26.95	$25.60	$24.25	$22.35
P-1346	30	38.45	36.55	34.60	31.90
P-1347	42	49.95	47.45	44.95	41.45
P-1348	51	58.95	56.00	53.05	48.95
Thin-base film:					
P-1500	18	26.95	25.60	24.25	22.35
P-1501	30	38.45	36.55	34.60	31.90
P-1502	42	49.95	47.45	44.95	41.45
P-1503	51	58.95	56.00	53.05	48.95
Regular paper:					
P-1341	18	7.30	6.95	6.60	6.10
P-1342	30	9.60	9.15	8.65	8.00
P-1343	42	11.90	11.30	10.75	9.90
P-1344	51	13.65	13.00	12.30	11.35
Grade S (stabilization) paper:					
P-1563	18	7.90	7.50	7.15	6.60
P-1564	30	10.50	10.00	9.45	8.75
P-1561	42	13.15	12.50	11.85	10.95
P-1562	51	15.10	14.35	13.60	12.55
CRT [1] paper:					
P-03004	18	29.15	27.70	26.25	24.20
P-03000	30	40.05	38.05	36.05	33.25
P-03001	42	51.00	48.45	45.90	42.35
P-03002	51	56.25	53.45	50.65	46.70
P-03003	69	70.50	67.00	63.45	58.55

[1] All rolls are 475 feet long.

IBM 360–30 configuration priced for study

	Lease cost
1. Central processor:	
2030 F	$3,870
3237 Decimal arithmetic	25
4427 Floating point	50
4760 Timer	50
6960 Selector channel	214
7520 Storage protect	150
7915 1051 attachment	75
Total	4,434
2. Control unit:	
1051 N-1	58
4410	5
4411	10
3130	10
Total	83
3. Printer keyboard: 1052-8	63
4. Printer control unit:	
2821-2	600
8637 UCS adapter	15
3615 1100 LPM adapter	75
Total	690
5. Line printer: 1403-N-1	875
6. Print train: 1416-001	97
7. Disk pack: 1316-1	15

8. Storage control:	
2841-1	525
6118 Record overflow	10
Total	535
9. Disc storage drive: 2311	570
10. Card reader: 2501-B-1	260
11. Tape control: 2804-1	930
12. Tape drives:	
2401-1 2 at $335	670
7160 2 at $10	20
Total	690
13. Paper tape control unit: 2022	210
14. Paper tape reader: 2671	140
Grand total	9, 592

An Analysis of the Mergenthaler Composition System as Applied to Eight Sample Pages

(Prepared by Dennis C. Slattery, Manager, Graphic Systems Development, Mergenthaler Linotype Company, Plainview, N.Y.)

Report of Linotron 1010 System Performance on Eight Health Education & Welfare Samples

I. INTRODUCTION

At the request of Mr. Lannon of the Health Education & Welfare Department, eight sample pages covering a wide range of formats were processed by the Linotron 1010 system at the Government Printing Office in Washington, D.C. The data for each sample was keyboarded, loaded on magnetic tape and formatted by the Government Printing Office's IBM 360/50 computer loaded with Mergenthaler's Master Typography Program. The formatted data was then typeset by the GPO Linotron 1010 system and outputted on photo typesetting paper.

For each of the eight samples, computer and Linotron processing time was recorded and is contained in this report.

II. SYSTEM DESCRIPTION

Enclosed with this report is a manual entitled "Format Design & Preparation of Input for the Linotron 1010 Master Typography System."

Section 1 of this manual contains a detailed description of the Hardware and Software required for the Linotron system. In order to facilitate preparation of input data for each one of these samples it was necessary to keypunch the data for each sample on cards. Each card then became an input record when it was transferred to magnetic tape. The input record therefore, was only 80 characters long as opposed to a maximum input record length of 3,000 characters. This will tend to cause the computer processing speeds shown in this report to be somewhat higher than what would normally be observed if input record size were close to 3,000 characters.

III. SUMMARY OF SPECIFICATIONS AND TEST RESULTS

Format No.	Format name	IBM 360/50 computer time in seconds	Linotron high resolution in seconds	Linotron low resolution in seconds
1	The Group	3.5	4.5	2.25
2	Prices and Production Plan	3.8	4.5	2.8
3	Policy	4.5	4.5	2.5
4	Pleistocene	5.5	6.0	3.0
5	The American Bar	8.5	9.0	4.8
6	Book catalog index	11.5	14.5	9.0
7	Directory page	19.5	14.0	9.0
8	Telephone book page	19.0	23.0	12.0

IV. SYSTEM COSTS

Linotron 1010 basic cost (per month):	
Lease of Linotron 1010	$10, 315. 00
Maintenance including onsite field engineer, tube and parts replacement	1, 833. 33
Operating supplies:	
Film and paper (per roll):	
Kodak phototypesetting paper spec. 54 (11 inches by 475 feet)	70. 00
Kodak phototypesetting film spec. 881 (11 inches by 500 feet)	360. 00
Kodak Ektamatic type No. 5 paper (12 inches by 475 feet)	76. 00
Chemicals:	
Ektamatic processing chemicals (per 100 pages)	[1] 5. 00
Developer (20 gallons)	30. 00
Hypo	18. 00
Estimated processing costs (per square foot):	
Paper	. 10
Film (nonreversal)	. 50
Ektamatic paper	. 11
Accessories:	
MLCO grid (not including special artwork)	2, 000. 00
MLCO cassette assembly (not including spools)	1, 795. 00
MLCO input spool assembly	1, 450. 00
MLCO output spool assembly	975. 00
Automatic paper cutter (Kodak)	2, 500. 00
Test equipment (minimum requirements):	
Oscilloscope, Tektronix model 545	1, 400. 00
Plug in unit model 1A1 for Tektronix oscilloscope	500. 00
Plug in unit model W for Tektronix oscilloscope	625. 00
Differential voltmeter, J. Fluke model 883AB	800. 00
Volt-ohm meter, Simpson model 270	70. 00

V. DETAILED SPECIFICATIONS AND TEST RESULTS

1. "The Group"

Specifications Provided by Health Education & Welfare:
- 1 Column 21 picas.
- 10/11 type 41 lines deep.
- 1 line running head
- Total text type: 1,025 pt. Ems.
- Typefaces:
  - 10 pt. Roman.
  - 10 pt. Roman Cap and Small Cap—once on page.
  - 10 pt. Italic—once on page.

Mergenthaler Specifications:
- 1 Column 22 picas.
- 10/11 type 40 lines deep.
- 1 line running head.
- Typefaces, Times Roman:
  - 10 pt. Roman.
  - 10 pt. Roman Cap and Small Cap—once on page.
  - 10 pt. Italic—once on page.
  - 10 pt. Bold—once on page.

Test Results:
- Computer Time: 3.5 seconds.
- High Resolution Linotron 1010 time: 4.5 seconds.
- Low Resolution Linotron 1010 time: 2.25 seconds.

[1] Approximate.

2. "Prices and the Production Plan"

Specifications provided by Health Education & Welfare:
- 1 Column 25½ picas.
- 32 lines 10/12 text.
- 8 lines 8/10 footnote.
- 1 line running head.
- Typefaces:
  - 8 and 10 pt. Roman.
  - 10 pt. Italic—4 times on page.
  - 8 and 10 pt. superiors—2 times on page.
  - 10 pt. small caps—once on page.
  - 10 pt. bold—once on page.
  - 10 pt. special symbol for prime mark.

Mergenthaler Specifications:
- 1 Column—25 picas
- 31 lines 10/12 text
- 8 lines 8/10 footnote
- 1 lines running head
- Typeface, Times Roman;
  - 8 and 10 pt. Roman.
  - 10 pt. Italic—4 times on page.
  - 8 and 10 pt. superior—2 times on page (substitute the number 1 for superior).
  - 10 pt. small caps—once on page—due to error in mark-up heading was set in caps instead of small caps.
  - 10 pt. bold—once on page.
  - 10 pt. special symbol for prime mark—used a closed quote.

Test Results:
- Computer time: 3.8 seconds.
- High Resolution Linotron 1010 time: 4.5 seconds.
- Low Resolution Linotron 1010 time: 2.8 seconds.

3. "Policy"

Specifications provided by Health Education & Welfare:
- 1 Column 27½ picas.
- 10/12 type 45 lines to text depth (actually 40 lines of type).
- 1 line running head.
- Typefaces:
  - 10 pt. Roman.
  - 10 pt. Italic—3 times on page.
  - 8 pt. San Serif Roman—once on page.
  - 10 pt. San Serif bold—3 times on page.

Mergenthaler Specifications:
- 1 Column 27½ picas.
- 10/12 type—41 lines.
- 1 line running head.
- Typeface, Times Roman:
  - 10 pt. Roman.
  - 10 pt. Italic—3 times on page.
  - 8 pt. Roman—once on page.
  - 10 pt. Bold—3 times on page.

Test Results:
- The indent in the first line was caused by an erroneous word space placed in the input.
- Computer time: 4.5 seconds.
- High Resolution Linotron 1010 time: 4.5 seconds.
- Low Resolution Linotron 1010 time: 2.5 seconds.

4. "Pleistocene"

Specifications provided by Health Education & Welfare:
- 1 Column 27 by 43 picas.
- 31 lines 10/12 type.
- 3 lines of 6 pt.
- 8 lines of 8 pt.
- Typefaces:
  - 6, 8 and 10 pt. Roman.
  - 6 and 10 pt. Roman Superiors.
  - 6, 8 and 10 pt. Italic (21 times).
  - Brackets in 10 pt. roman font (1 time).
  - 8 pt. cap and small cap (3 times on page).
  - 8 pt. roman accents (2 times on page).
  - 8 pt. bold (1 time on page).

49-852 O—70——7

Mergenthaler Specifications:
- 1 Column 28 by 43 picas.
- 32 lines 10/12 type.
- 2 lines of 6 pt.
- 6 lines of 8 pt.
- Typeface, Times Roman:
  - 6, 8 and 10 pt. Roman.
  - 6 and 10 pt. Roman superiors (substituted the numeral 4).
  - 6, 8 and 10 pt. Italic (19 times on page).
  - Brackets on 10 pt. roman font due to an oversight in Mark up, the brackets were overlooked and Parens were used.
  - 8 pt. Roman caps (3 times on page).
  - 8 pt. roman accents—none.
  - 8 pt. bold—once on page.

Test Results:
- Computer Time: 5.5 seconds.
- High Resolution Linotron 1010 time: 6.0 seconds.
- Low Resolution Linotron 1010 time: 3.0 seconds.

5. "The American Bar"

Specifications provided by Health, Education, and Welfare:
- 2 Columns 17½ by 52½ picas each.
- 1 Running head 36 picas.
- Actual text—average 67 lines/column.
- Typefaces:
  - 8 and 14 pt. Roman.
  - 8, 12 and 14 pt. Bold—10 times on page.
  - 8 pt. Bold Italic.

Mergenthaler Specifications:
- 2 Columns 17½ by 52 picas each.
- 1 Running head.
- Actual text—average 66 lines/column.
- Typefaces, Times Roman:
  - 8 and 14 pt. Roman.
  - Combination of 8, 12 and 14 pt.—10 times on page.
  - 8 pt. Roman Italic.

Test Results:
- Computer Time: 8.5 seconds.
- High Resolution Linotron 1010 time: 9.0 seconds.
- Low Resolution Linotron 1010 time: 4.8 seconds.

6. "Book Catalog Index"

Specifications provided for by Health, Education, and Welfare:
- 41 by 66⅔ picas.
- 100 lines of 8 pt. type.
- Typefaces:
  - 8 pt. Bold Italic.
  - 8 pt. Roman.
  - 8 pt. San Serif Medium.

Mergenthaler Specifications:
- 39½ by 63 picas—The Linotron cannot set a page deeper than 63 picas.
- 93 lines of 8 pt. type.
- Typeface, Times Roman Grid:
  - 8 pt. Italic.
  - 8 pt. Roman.
  - (NOTE 1.—Neither Bold Italic or San Serif Medium was available so the Roman typeface was used in their place.)
  - (NOTE 2.—In order to facilitate input preparation approximately one-half of the first column of data was keyboarded and then repeated several times to simulate a full page of data.)

Test Results:
- Computer time: 11.5 seconds.
- High Resolution Linotron 1010 time: 14.5 seconds.
- Low Resolution Linotron 1010 time: 9.0 seconds.

7. "Directory Page"

Specifications provided by Health Education & Welfare:
- 3 columns 13½ picas by 61½ picas.
- Average: 100 lines/column.
- Overall page size 41 picas.

7. "Directory Page"—Continued

Typefaces:
- 6 pt. medium.
- 6 pt. bold.
- 8 pt. bold.
- 6 pt. star.

Mergenthaler Specifications:
- 3 columns 13½ picas by 61½ picas.
- Average 106 lines/column.
- Overall page size 46 picas.
- Typeface, Times Roman Grid:
  - 6 pt. Roman.
  - 6 pt. Bold.
  - 6 pt. Dolt Leader—used in place of the 6 pt. Bold Star which was not available.
    (NOTE.—Times Roman was substituted for 6 pt. medium since this face was not available.)

Test Results:
- Computer time: 19.5 seconds.
- High Resolution Linotron 1010 time: 14.0 seconds.
- Low Resolution Linotron 1010 time: 9.0 seconds.

8. "Telephone Book Page"

Specifications provided by Health Education & Welfare:
- 4 columns 12 picas each, 120 lines deep.
- Overall width 50 picas.
- Typefaces:
  - Roman and Bold.
  - 12 pt. Bold Head.

Mergenthaler Specifications:
- 4 columns 12 picas each, 119 lines deep.
- Overall width—48 picas.

8. "Telephone Book Page"—Continued

Typeface, Times Roman Grid:
- Roman and Bold.
- 8 pt. Bold Head.
  (NOTE 1.—Due to an error in Mark Up, the Head was set at 8 pt. instead of 12 pt.)
  (NOTE 2.—In order to facilitate input preparation approximately 1 column of data was keyboarded and then repeated several times to simulate a full page of data.)

Test Results:
- Computer time: 19.0 seconds.
- High Resolution Linotron 1010 time: 23.0 seconds.
- Low Resolution Linotron 1010 time: 12.0 seconds.

360-50 CONFIGURATION

Item	Number	Monthly lease[1]
1. 2050 H central processor	1	$14,728
2. 2501 card reader	1	260
3. 1403 N1 line printer	1	885
4. 2821 control unit	1	690
5. 2401–2 tape drives	5	2,475
6. 2311 disc drives	2	1,140
7. 2841 control unit	1	535
8. 2804–1 control unit	1	930
9. 2822 control unit	1	210
10. 2671 paper tape reader	1	140
Total		21,993

[1] Provided by IBM Mar. 31, 1970.

SECTION I

THE LINOTRON 1010 SYSTEM

1-1 SCOPE OF MANUAL

This manual contains general information on the Linotron 1010 System and detailed instructions on preparing input data and Parameter Tapes for the Master Typography System to typeset the data in the desired typographic format. A manual is also provided that contains the Flow Charts for the Linotron 1010 Master Typography System. The actual Program for the Master Typography System is contained on a reel of magnetic tape.

1-2 THE LINOTRON 1010 SYSTEM

The Linotron 1010 System consists of the Master Typography System and the Linotron 1010 High-Speed Photocomposer. (See Figure 1-1)

1-2.1 Inputs to the Linotron 1010 System

The inputs to the Linotron 1010 System are a properly edited tape containing the data to be typeset and a parameter tape that has been especially prepared for processing that data tape. The Master Typography System operates upon the data and the tape that is produced is used as input to the Linotron 1010 Photocomposer to typeset the data.

1-2.1.1 Input Data Tape

Sources. The sources of data to be typeset by the Linotron 1010 System is usually an existing data tape that has been edited by a computer programmed to add reference codes or a data tape that has been prepared by editing a manuscript to include reference codes, keyboarding it into paper tape and then converting the output tape into magnetic tape by processing it through a Paper-Tape to Magnetic Tape Converter. (See Figure 1-2)

Coding. The edited input data tape to the Linotron 1010 System contains coded data characters and reference codes but does not contain codes for typesetting the data into page formats. Before the data tape is processed by the computer that has been programmed by the Master Typography System, the typographic specifications needed to format the data are read from the input parameter tape into the computer storage. During processing the reference codes are used to retrieve the specifications from storage when needed.

1-2.1.2 Parameter Library Tape and Maintenance Program

The Parameter Library Tape contains specifications for a number of typographic formats. All specifications needed to process the data on an input tape into the desired formats are stored before processing the data.

When reference codes are read from an input data tape, the corresponding specifications for a particular format locator are retrieved from storage and used by the Master Typography System to process the input data into the desired format.

The Parameter Library Tape is created and maintained by the Parameter Maintenance Program.

The Parameter Maintenance Program is used to (1) create a Parameter Library Tape; (2) Update a current Parameter tape by changing data for old formats; or (3) add data for new typographic formats. This information is used by the Master Typography System, as needed, for formatting input data. The Program combines inputs from the current Parameter Library tape (an old tape that needs updating), the Grid Library Tape and Parameter and Heading cards. (See Figure 1-3),

Grid Library Tape and Maintenance Program - The Grid Library Tape contains look-up tables with data for each character on every grid in inventory. These tables are arranged on the tape in ascending sequence according to grid number. They contain information that is needed by the Master Typography Program to perform the typographic computations required to format the input data. This information consists of grid-zone numbers, output shift/unshift status, character width values and output characters.

The Grid Library Tape is created and maintained by the Grid Maintenance Program.

The Grid Maintenance Program is used to (1) create a Grid Library Tape; (2) Update an old Grid Library Tape, by changing widths for characters on old grids; or (3) add widths for characters on new grids. The program combines inputs from the current Grid Library Tape (an old tape that needs updating), and new Grid cards. (See Figure 1-4).

Initially, when a new Grid Library Tape is created, the grid width information is punched into cards and entered onto the Grid Library Tape by the Grid Maintenance Program. When additions and revisions are needed, they are punched on cards and fed into the Program along with the current Grid Library Tape. Therefore, the output of the program is always an updated Grid Library Tape that incorporates all known corrections and revisions.

Parameter Cards - The typographic specification for the different locators that appear in a format are entered into the Parameter Tape by parameter cards.

Heading Cards - Repetitive items, such as page and column heads that occur on a large number of pages are punched into heading cards from which they are entered into

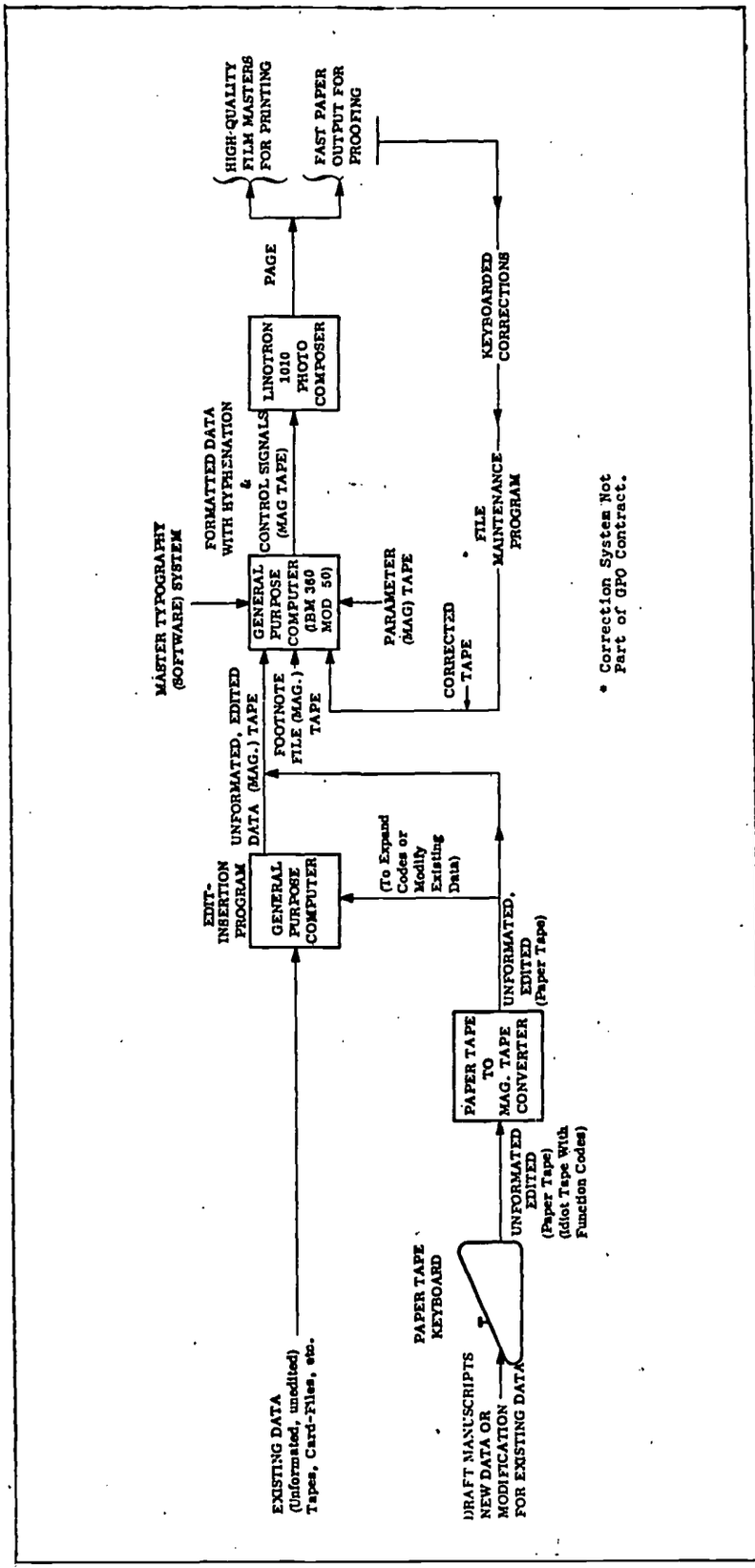


Figure 1-2. The Linotron 1010 System, Block Diagram

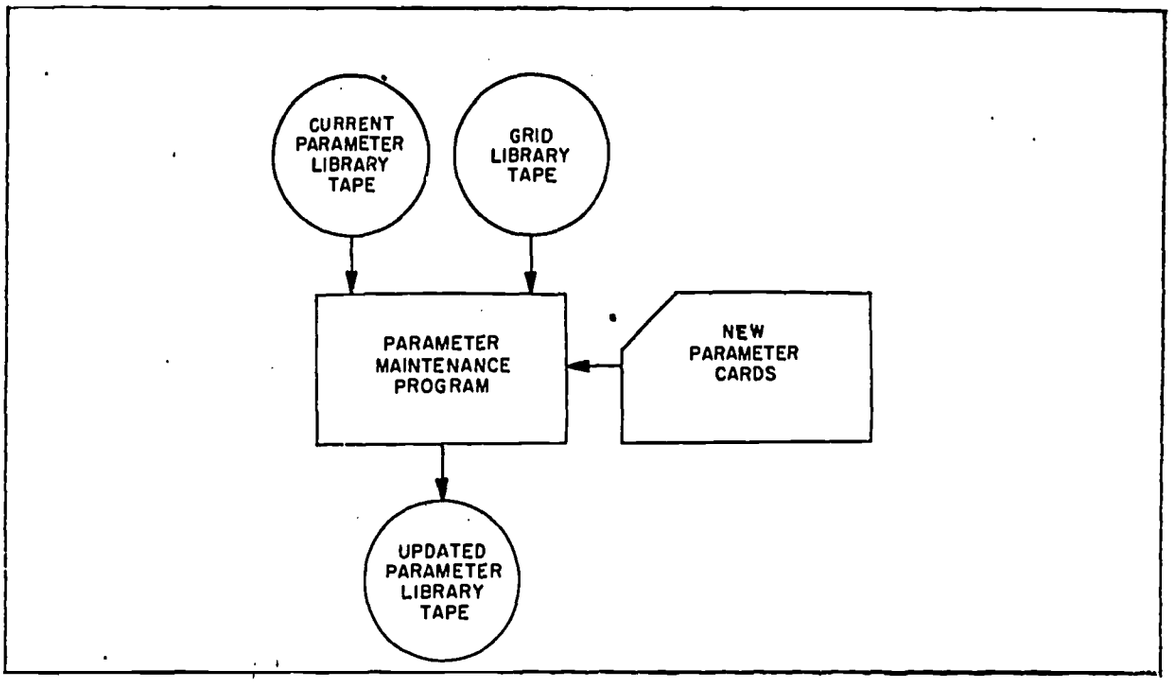


Figure 1-3 Parameter. Maintenance Program, Flow Chart.

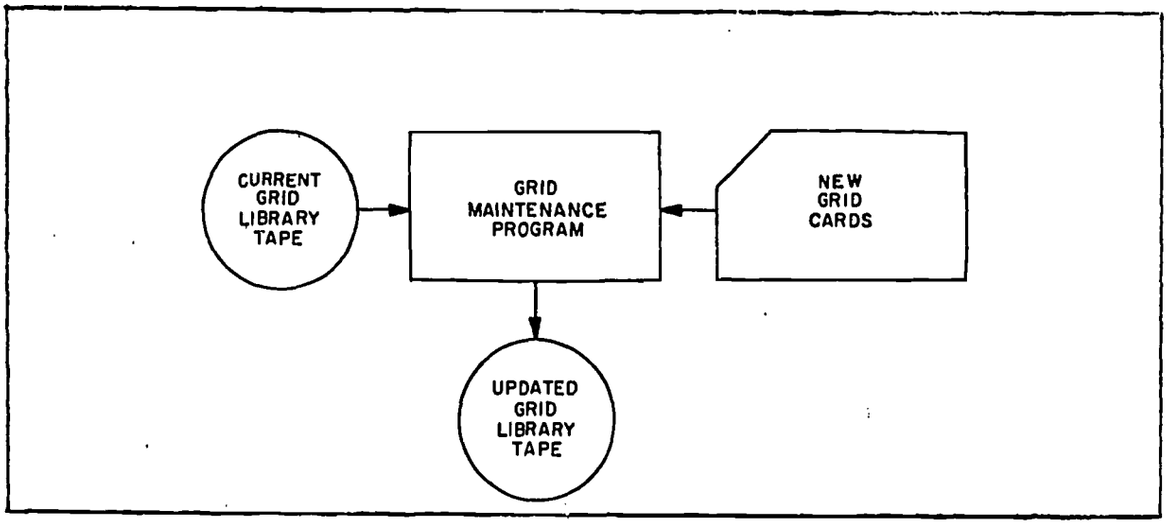


Figure 1-4 Grid Maintenance Program, Flow Chart

the Parameter Library Tape. These headings are extracted from storage by the Master Typography System in a preset form for each page of output. (Other types of headings are introduced into the Photocomposer output by an optical overlay projector which does not involve the Parameter Tape.)

1-2.2 The Master Typography System

The Master Typography System accepts raw data with a minimum of edit codes on input, makes all of the computations and decisions necessary to format a page and then produces a control tape for the Linotron 1010 Photocomposer on output to typeset the data.

The Master Typography System is a set of 34 separately assembled programs, which have been written for the IBM 360 Computer link edited under the Disk Operating System. The IBM 360 Computer configuration required for the MTS is shown in Figure 1-5.

The routines used in the System are listed and briefly described below. More detailed information on these routines can be obtained from the Linotron 1010 Master Typography System Flow Chart Manual.

1-2.2.1 Master Typography System Program Routines

Master Typography Program (MTP)

This is the first routine executed. It sends control to initialize checkpointing, handles End-of-File, End-of-Volume, and error conditions on all peripheral devices and it allows bypassing of any label (up to 9 records) on the input tape.

Initialization (INIT)

This routine reads the Job Card; calls in parameter data for the initial format; reads the initial record from the input data tape; sets up debugging features; checks for labels on the input tape; initialized the folio to the desired page and/or chapter number and sets up the checkpoint feature. Control is then transferred to either the Field Format Routine or to the Locator Format Routines.

Field Format (FLDFMT)

This routine controls the processing of data in the field format. Each field must be identified by a locator and the first field must be Locator #1.

Locator Format (LOCFMT)

In the Locator Mode of operation, this routine interrogates the input stream and directs the flow of the MTS Program.

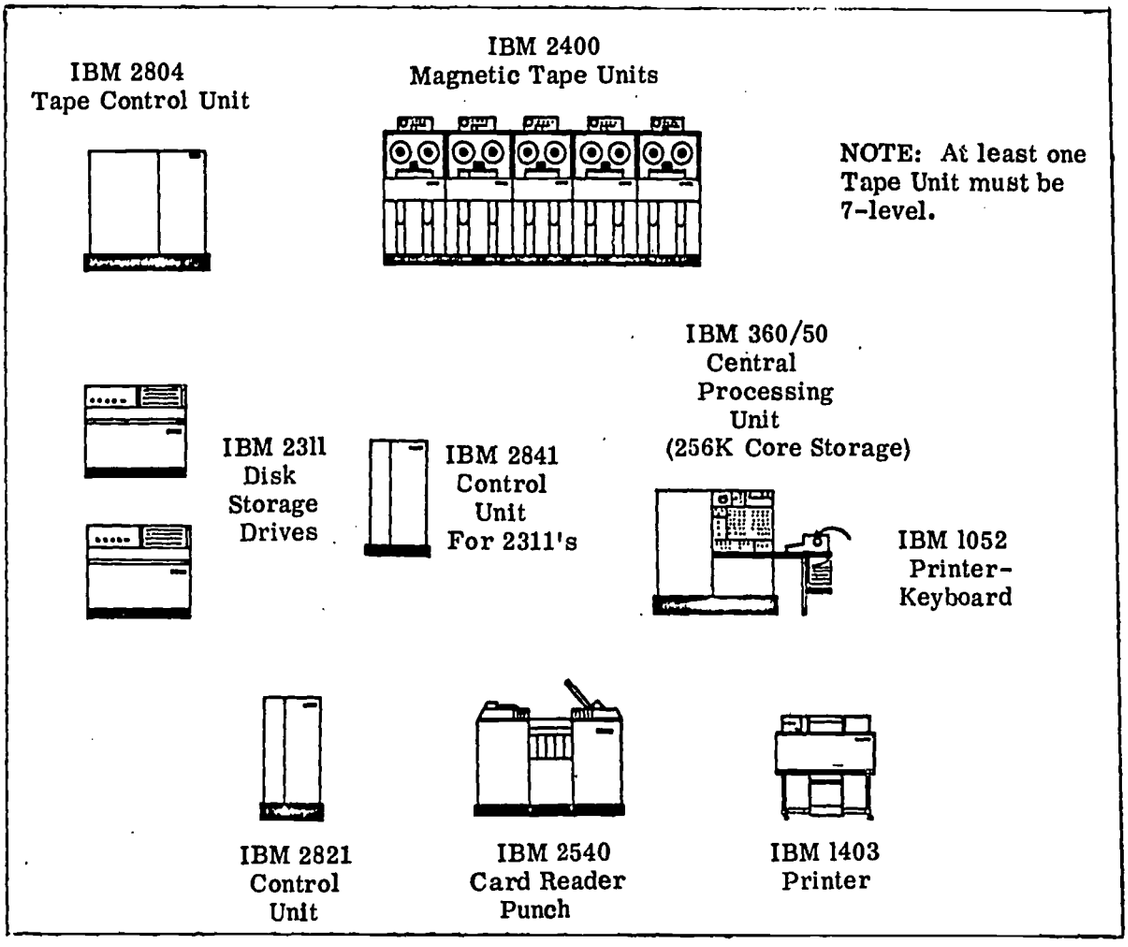


Figure 1-5 IBM 360 Computer Configuration Required for the Linotron 1010 Master Typography System.

Heading Location Test (HDLOCTST)

This routine determines the type of heading to be set and initializes the necessary conditions for setting it. The heading types are listed below along with their identifying codes.

1. Overlay Head (F5)
2. Page Running Head (F6)
3. Column Running Head (F7)
4. First/Last Line Entry Head (F9)

Hyphenate (HYPHNATE)

This routine prepares overrun words for the Hyphenation Logic Routine. When a word cannot be hyphenated, in a justified line, the remainder of the word or the entire word is saved.

New Line (NWLINE)

This routine moves the newly formed line into the matrix area and determines the justification and column ending properties. When runover lines occur, it sets-up the line features, such as line length, indent, etc., and increments the Y-value for the next anticipated line. It also controls the direct access feature.

Line Justification (SPACER)

This routine handles line justification. It first determines whether the line is to be quadded (right, left, centered) or justified. When the line is to be justified it initiates hyphenation.

Translate (TRNSLT)

This routine translates the raw input code to obtain the output character and its shift status, relative width and the typeface.

Quad (QUAD)

This routine quads a line left, right, or center and initiates leadering as required.

Underscore (UNDRSCORE)

This routine initiates the underscore function along with the required X, Y-values and underscore length. The actual words to be underscored are determined by the NWLINE Routine.

Subscript (SETSUPSC)

This routine sets the footnote superscripts and stores them on tape.

Graphic Insertion (GRAPHIK)

This routine determines whether the graphic is mandatory or non-mandatory. It sends control to the Update Routine to allow space for the required graphic and then supervises the typesetting of the serial number and caption. When a Graphic Code is encountered, the routine assumes the input to be in the following order:

1. Four codes relating to the serial number.
2. Three codes relating to the depth of the desired graphic.
3. Caption data, if any.
4. End-of-Paragraph and/or Locator Code.

Format Change (FMTCHNGE)

This routine handles a request for a change to another format. It ends the page and initializes the new format.

Typefolio (TYPFOLIO)

This routine interrogates the Folio Locators and typesets the folio accordingly. The folio is stored until the end-of-page occurs.

Page Start (PAGESTART)

This routine updates the folio, determines the headings to be moved into the page area and initializes the parameters necessary for starting a new page.

End Page (ENDPAGE)

This routine converts all Y-values to BCD, packs the typeset lines into one continuous block of 2048 characters and writes the block on the output tape.

Program Flow Control (MAIN)

This routine controls the traffic between other routines. It is entered whenever,a MCRO (kall) or a return statement is being executed.

Leader (LEADER)

This routine handles all leader conditions. It insures that the proper shift and typeface are moved into the page area before the desired leaders and then restores the shift and typeface after setting the leaders.

Precedence Search (PRECRT)

This routine determines the course of action to be taken when function codes following Precedence codes are encountered. It handles Vertical and Horizontal Quadding Codes within the routine while all others are executed through their appropriate routines.

Line Initialization (LINEINIT)

This routine is entered whenever a locator or a Locator Code is encountered on input. It initializes the constants used to typeset a line and processes separation characters, double-column lines and footnotes.

Set Timer (SETTIMER)

This routine uses the checkpoint frequency, which it obtains from the Checkpoint Job Card, to supervise the frequency of checkpoint. It also handles the restart function and processes all replacement patch cards.

End-of-Volume (EOVCND)

This routine handles the End-of-Volume condition for the checkpoint file.

Check Checkpoint (TEXTX)

This routine checks to determine whether a checkpoint record is forthcoming and when a checkpoint is detected it sets-up the preliminary steps necessary to branch to the Settimer Routine.

Test Text Reference (TSTXRF)

This routine tests the End-of-Volume switch and backspaces and writes a tape-mark on the output tape when necessary.

Footnotes (FOOT)

This routine computes the space necessary to set the encountered footnote and takes the necessary action when a footnote will not fit. It also obtains the required footnotes and insures proper positioning of the footnotes on the Footnote Tape.

Hyphenation Logic Routine (NORM)

This routine determines the possible hyphenation points between characters of words with six characters or more.

Update Folio (PAGEUP)

This routine updates both the chapter count and page count of the folio.

Proofmode (PROOF)

This routine sets each column of a multicolumn page on a separate page to obtain a proof output copy. Basically, this is done by changing all Absolute -X Codes to values relative to the first column's origin.

Update (UPDATE)

This is a major supervisory routine. It controls the switching of text from column to column and from page to page. It sets both footnotes and graphics and then tests for an End-of-Column and/or End-of-Page condition after they are set.

It tests whether an entry of multiple lines has been set ending a column and if so, saves them on end of column or page, shortens the page deleting the entry and then restores the entry in the next column or on the next page of the matrix.

This routine can be used to process pages containing a number of columns at the end. It branches to the appropriate routine for outputting the page in either the proof or normal mode.

Graphics (GRAPHICS)

This routine is entered when a graphic to be set is encountered. It handles single and double-column mandatory and non-mandatory graphics.

Column Justification (JUSTIFY)

This routine adjusts the columns on a multicolumn page until they are all equal in length.

Presearch (PRECSRCH)

PRECSRCH updates a specified number of X or Y Function Codes absolute or delta values within a given line to justify that line.

Write Disk Record After Initial Write (DISAFT)

This routine writes all lines, after the first, which must be put on the direct access device. It also checks for disk I/O errors and upon detecting one, terminates the job.

Initial Write (INIT)

This routine executes the initial write to the Direct Access Device.

Read Disk (RDDK)

This routine is used to read all of the records (line) written on the Direct Access Device during composition of the page.

1-2.2.2 Footnote File Input

The MTS requires that all footnotes be written in numerical order at the beginning of the data tape. The footnotes are read into the System where they are formatted and then stored on a scratch tape. During process of the data, the footnote subscripts in the data call in the footnotes from the scratch tape and typesets them at the bottom of the page on which the subscript appears.

1-2.2.3 File Maintenance System (See Figure 1-2 and 1-6).

Proof Output (Figure 1-2 and 1-6. If the input tapes are not known to be error free the Master Typography System is operated in the Proofmode. The output tape when used as input to the Photocomposer, will produce a proof output copy. A proof page (see Figure 1-7) differs from the final page in that (1) multicolumn text is produced with the proper final output column width but only one column is typeset to a page to facilitate the notation of corrections; (2) space is reserved for illustrations and (3) all lines carry an eight-digit label. The first four digits of the label specify the record number and the second four digits specify the location in the record of the first character in the line.

Correcting Data Tapes. The proof output copy is proof read and the lines that are found to be incorrect are rekeyboarded and identified by the same line labels as appears on the proof copy.

The corrected lines are then processed along with the original input data tape in the File Maintenance System to obtain a new data tape on which the corrected lines have been substituted for the incorrect ones. This tape is then processed by the Master Typography System in the final mode to produce a completely made-up error-free page.

Updating Data Tapes. The File Maintenance System is also used to update tapes to produce revisions and new editions of existing publications.

1-2.2.4 Final Output

If the input tape is known to be error free, the Master Typography System is operated in the Final Mode. The output tape will, when used as input to the Linotron 1010 Photo-

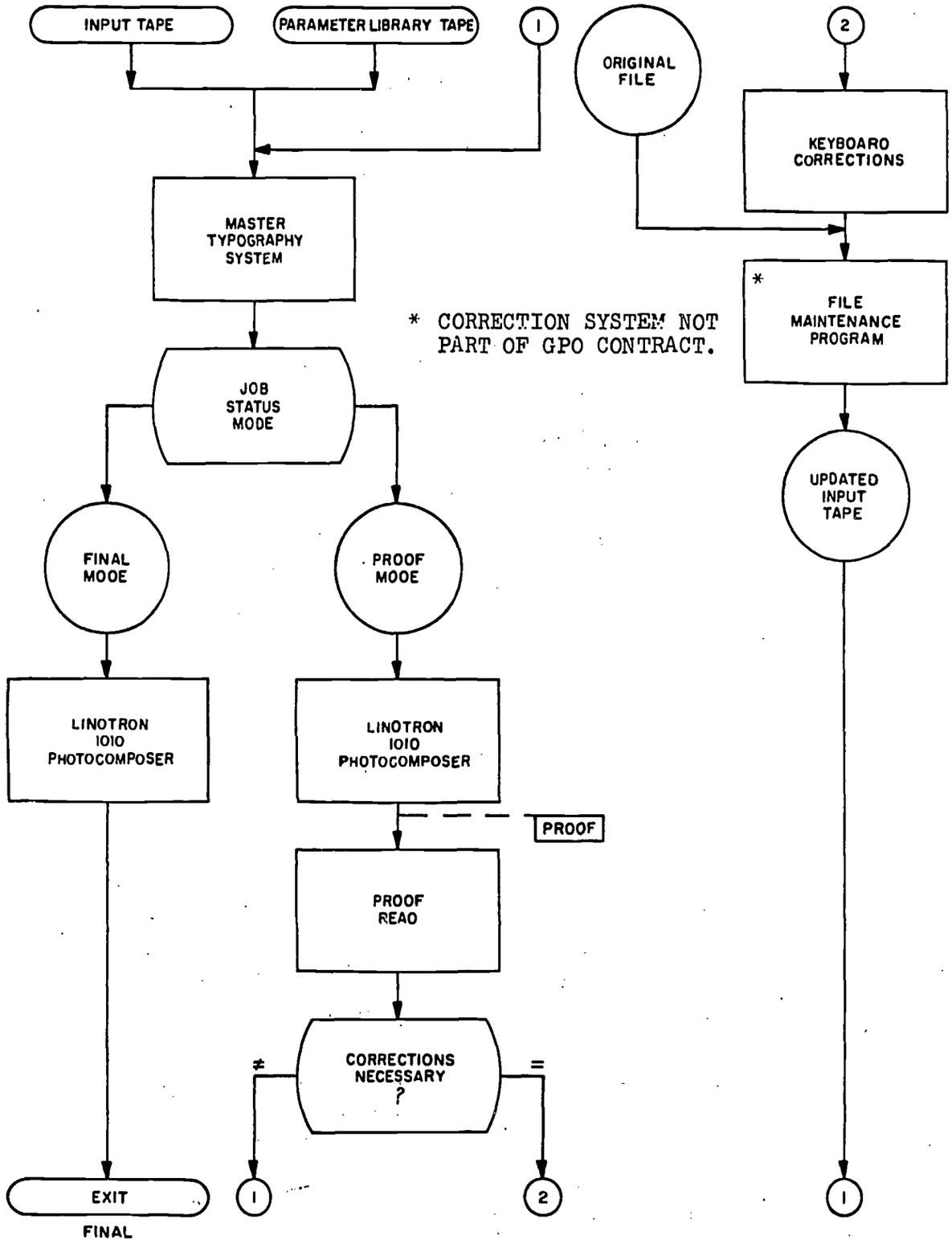


Figure 1-6 The Linotron 1010 System, Flow Diagram

00010006 **Chapter 3**

00010022 **SUPPORT**

00010032 **Section I. GENERAL**

00010063 **44. Introduction**

00010088 Combat, combat support, and combat ser-
00010150 vice support units are provided to the forward
00010240 infantry, mechanized, or armored brigades
00010307 and battalions as required to assist in the
00010393 accomplishment of the mission. These units
00010467 may be organic, attached, in support of, or
00010553 under operation control of the brigade or
00010631 battalion. For the purpose of this chapter
00010711 only, those units normally assisting the

Figure 1-7 Proof Output of the First Column of a Two Column Format Page (showing line labels.)

composer, produce completely typeset pages, properly made-up with space reserved for illustrations.

1-2.3 The Linotron 1010 Photocomposer

The Linotron 1010 Photocomposer is the typesetting component of the Linotron System. It is a high-speed phototypesetter that produces typeset matter under control of a properly programmed magnetic tape. It consists of three major components: The Tape Reader and Logic Control Unit, the Character Generator Unit and the Display Unit. (See Figure 1-1).

1-2.3.1 Input Tape Information (See Figure 1-8)

To start Phototypesetting data on an input tape generated by the Master Typography System, the Tape Reader reads a record (2,048 characters), which contains typesetting instructions, function codes and codes for the data being typeset.

If no errors are detected in the coding, the record is stored in the input buffer. Upon completing the storage cycle, codes are read-out of the buffer, one character at a time, as they are needed and routed to decoding circuits. A signal from the tape control and buffer storage, turns-on the Tape Reader upon completion of the buffer storage readout cycle, and a new record is read and stored in the buffer. Instruction and function codes are fed to the Logic Control Circuits where they are converted into control signals for directing and synchronizing the operation of the various circuits of the Photocomposer.

When a Data Character Code is decoded, a signal is sent to the Character Generator to select the proper character from a specified grid.

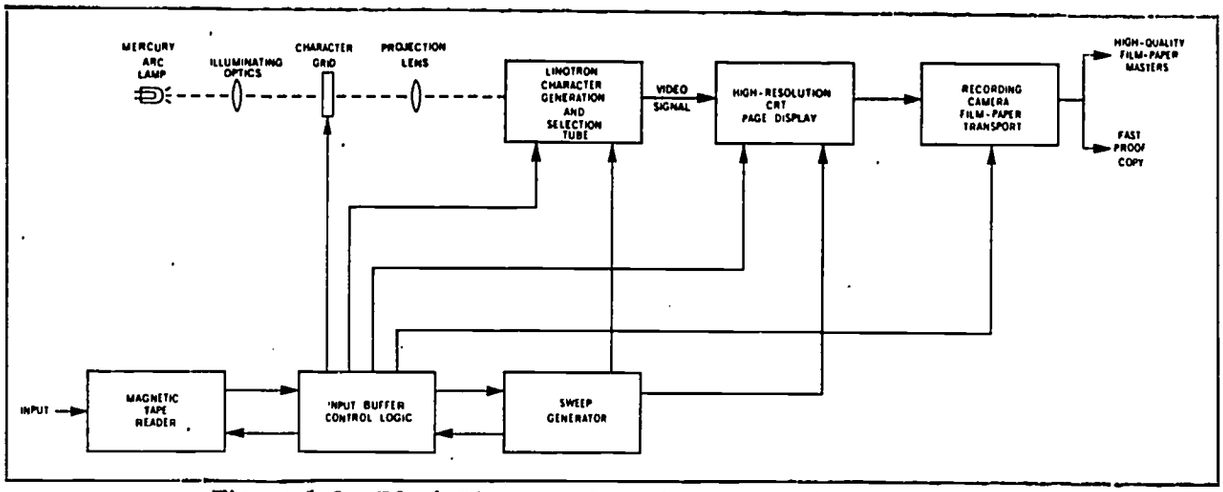


Figure 1-8. Block Diagram of Linotron 1010 Photocomposer

1-2.3.2 Electronic Character Generation

The function of the Character Generator is to receive the Character Code and Character Point-Size Code and, in return, generate a high-quality video signal for the character. If the Photocomposer is equipped with a 4-Grid Magazine Changer, the character is selected from an assembly of 1,024 characters whose typographical configuration is stored on four character grids. (A character grid consists of a backlighted negative glass transparency which presents a visual array of upper and lower case letters, numerals, punctuation marks, and special symbols in different type faces.)

1-2.3.3 Linotron Tube

The heart of the Character Generator is the Linotron tube; a single-envelope, high-quality vacuum tube which transforms the light image of characters focused on its photocathode into a character video signal of a given size.

The generation of the character video signal is accomplished by use of a mercury arc lamp which constantly projects the entire complement of a character grid (256 characters) together with their respective character widths, onto the light-sensitive cathodes of the Linotron tube. (No mechanical shutters are used.) The Linotron tube produces scanned video electron beams from all 256 symbols, but only one of these beams is allowed to pass through an electrostatic wire grid selection matrix. (Selection of any of the 256 characters is by electronic switching within the tube under external logic signal control.) This selected beam then passes through an electron multiplier, where it is amplified to become a video brightening signal for a high-resolution cathode-ray tube.

1-2.3.4 Cathode-Ray Display Tube

The video signal for the selected character is positioned precisely on the face of the CRT Display tube by the control circuits. (The point size of the character is changed by adjusting the amplitude of the CRT sweep. This is controlled automatically by the control logic when a point-size change is called for by the input tape.) The character on the display-tube screen is exposed through the main optics of the display projection assembly,

onto either the photographic film or paper on the film transport. The film transport carries film from a supply cassette to the image recording plane where it is exposed and then fed into a take-up cassette. When full the take-up cassette is removed for film processing. Graphic control data information in the input tape are also decoded and used to allocate space in the output display page area for inserting required illustrations.

1-2.3.5 Photographic Output

During the composition of a page, the film or paper is kept stationary while the characters to be set appear one-at-a-time at appropriate positions on the display-tube screen. Film or paper motion in the transport takes place only on the receipt of a film or paper advance command in the tape input signals, normally when a page has been fully composed. At this time, the film or paper is automatically moved to a new page position and the photocomposing process is ready to be resumed.

APPENDIX III. SPECIAL NOTES

A. Note on Edit and Insert Programs.
B. Note on RCA Videocomp Timings.
C. Note on Use of Owned or Leased Computer and Purchase of Service Bureau Composer Time.
D. Note on Data Bank Applications.
E. Note on Proof Modes.
F. Note on Electronic Composition of Telephone Directories.
G. Note on Computer and Composer Timings.

A. Note on Edit and Insert Programs

All of the high speed systems required that programs be written for each format represented by the eight samples.

The actual time and costs for writing these programs is not included in the analysis. To compensate for these costs the analysis charges two programmers to each system other than the Linotron 505. The Linotron 505 is charged with the cost of one programmer.

It was not easy to have the edit and insert programs written. RCA apparently had less trouble than either Mergenthaler or Harris.

The relative ease in writing edit and insert program is a factor of potential cost significance that is not reviewed in this analysis.

B. Note on RCA Videocomp Timings

The timing data for RCA used in the analysis uses one cycle of Mode D (low resolution) time and one cycle of final mode (high resolution) time.

The samples produced in the proof pass included a line count which was generated by the logic of the 70/800 Videocomp (64K).

While the line count is considered to be a most useful means of making corrections to proof copy it does take additional time. Since the other systems studied did not generate line counts the RCA proof samples have not been charged with the time required to generate the line count.

The capability of the Videocomp to produce line counts without using computer time is a plus for this system.

The incremental time to produce the line counts was as follows:

Sample	Increment to time (in minutes)
1. The Group	.0133
2. Policy	.0100
3. Prices and Production	.0099
4. Pleistocene	.0117
5. American Bar	.0133
6. Book Catalog	.0200
7. Hardware Directory	.0100
8. Telephone Directory	.0200

These increments to total processing time would have minor impact on the break-even points shown for Equation I and no impact on the break-even points shown for Equation II.

C. Note on Use of Owned or Leased Computer and Purchase of Service Bureau Composer Time

It has been suggested that a third equation depicting the cost implications of electronic composition for a firm already possessing a computer would be useful in appraising this field.

Actually, Equation I used in the basic analysis can be used for this situation by substituting the cost per minute for the computer owned or leased by the firm for the prime shift service bureau costs assumed in the analysis.

The extra shift costs for the computers involved generally could be substituted for the prime shift rates and a new break-even point computed. To the extent that access to one of the CRT systems could be obtained at a cost less than the break-even price computed, the break-even points would decline.

To illustrate this for the Sample "The Group" for Linotype vs. Linotron 1010:

$$A(X) = B - C(C_1) - D\ (D_1 + D_2) - E\ (D_1 + D_2) - F$$

$$.1125\ (X) = \$2.0609 - .1062\ (\$0.3457) - 12.11\ (\$0.0812 + \$0.0054) - .42\ (\$0.0812 + \$0.0054) - \$0.2120$$

$$.1125X = \$2.0609 - \$0.0367 - \$1.0851 - \$0.2120$$

$$.1125X = \$0.7271$$

$$= \$6.4631$$

$$\text{Break-even minutes} = \frac{\$17{,}012.00}{\$6.4631} = 2{,}632$$

$$\text{Break-even pages} = \frac{2{,}632}{.1125} = 23{,}396$$

If the Linotron 1010 were fully utilized for 176 hours in a month, its cost per minute would be $1.6110. If, in fact, Linotron 1010 time could be purchased at $1.6110 per minute the cost per page for electronic composition of the sample "The Group" would be:

.1125 ($1.6110) + $0.0367 + $1.0851 + $0.2120 or $1.5150

In this type of situation electronic composition would reduce costs $0.5459 per page below Linotype.

D. Note on Data Bank Applications

It is essential it not be inferred that the results shown for the execution of Equation I and II depict the only possible results. Not only will results vary significantly with changes in labor and capital costs but also with respect to subsequent publications. Certain of the samples used, in fact, represent publications already maintained on magnetic tape. While it is quite possible that the data on the magnetic tape for the sample "American Bar" could be used for additional purposes, e.g., mailing lists or abridged versions of the basic publication, by reformatting the data, we will here compare subsequent issue page costs by Linotype from saved metal to Linotron 1010 from saved magnetic tape in order to illustrate the potential of electronic composition with respect to reiterative publications.

The publication "The American Bar" is issued annually with a page content in the range of 2145 pages per issue. The annual changes in entries amount to 25% of the text composed.

Costs of recomposing a page by Linotype are given in "A" below and the break-even point for recomposition by a Linotron 1010 driven by an IBM 360-50 is given in "B" below:

A. LINOTYPE PER-PAGE COSTS FROM SAVED METAL

Function	Time	Rate	Cost
I. Change data keyboarding:			
(a) Labor	14.25	0.0812	$1.1570
(b) Capital	14.25	.0113	.1610
II. Page makeup: (a) Labor	10.03	.0812	.8959
III. Initial proof: (a) Labor	.50	.0812	.0406
IV. Correction keyboarding:			
(a) Labor	.75	.0812	.0609
(b) Capital	.75	.0113	.0085
V. Insertion of corrections: (a) Labor	.36	.0812	.0292
VI. House proof: (a) Labor	.50	.0812	.0406
VII. Supply cost:			
(a) New metal			.0230
(b) Old metal (5-year amortization)			.8000
(c) Storage cost			1.0000
Total cost			4.2167

49-852 O—70——8

B. COST FACTORS FOR ELECTRONIC COMPOSITION OF CHANGES TO AMERICAN BAR BY LINOTRON 1010

Function	Time	Rate	Cost
I. Input keyboarding:			
A. Labor	8.8125	0.0812	$0.71560
B. Capital	8.8125	.0054	.04590
II. Correction keyboarding:			
A. Labor	.275	.0812	.02230
B. Capital	.275	.0054	.00150
III. Supply costs:			
A. Stabilization paper			.20000
B. Paper tape to magnetic tape			.00790
C. Magnetic tape (2 reels) (cost per page over 5 years)			.00101
IV. Computer cycle: A. 0.2722 minutes at $2.0495			.55790
V. Subtotal			1.55211
VI. Composer cost per month (exclusive of systems programers			$14,374
VII. Number of pages per month required to break even with Linotype—Equation I			5,394
VIII. Number of 1-shift keyboards required to produce input			4.64

The initially computed break-even point was 6,608 pages per month, thus a 18.37% reduction in break-even volume is possible. The revised page would break-even in 1,158 minutes or 10.97% of a shift of composer time compared to 1,520 minutes or 14.39% of a shift of composer time for the initial page.

It must, however, be stressed that the above cited reduction in break-even volume is influenced heavily by the fact that the costs of edit and insert programming were charged only to the initial issue. If format changes are made and the same rate is charged for edit and insert programming as was charged to an initial page monthly break-even volume for a revised page would rise to 6,384.

An object lesson here is that edit and format programming is expensive and once an acceptable format is achieved it should not be changed.

E. Note on Proof Modes

(*a*) *Linotron 1010.*—The Linotron 1010 has a high speed—low resolution mode that is approximately two times as fast as the high resolution mode. The quality of the copy is perfectly adequate for proof purposes and to an untrained eye, would be adequate for actual plate imposition. The high speed mode does, however, have implications with respect to the life of the character generation tube. In practice the U.S. Government Printing Office does not use this mode.

(*b*) *Harris Fototronic CRT.*—The Fototronic CRT achieves a high speed low resolution output by running the proof copy against a higher point master. This method has no implications with respect to system life and is a perfectly acceptable method of producing proof quality output.

(*c*) *RCA Videocomp.*—To run proof copy in low resolution requires a low resolution font which must be put into digital form. RCA has had limited demand for such fonts and originally provided timings only in their high resolution mode. The timings used in the analysis reflect the use of the proof mode.

F. Note on Electronic Composition of Telephone Directories

Some of the early and successful commercial applications of electronic composition have been in telephone directory work.

Standing type is now being routinely converted to machine language by optical character recognition devices and change data for publication purposes introduced as a by-product of accounting or other data in machine processable form.

In integrated data processing systems such as those operative in telephone companies electronic composition, even at current capital costs, is a viable economic undertaking.

In every case encountered specialized computer software has been developed for telephone directory composition.

Her Majesty's Stationery Office is applying specialized software on an ICL 1905F computer and is processing a page in 9.9 seconds. Baird-Ward Printing Company in Nashville, Tennessee is using an IBM 360–30 system to drive a Harris Fototronic CRT. The Baird-Ward system would generate the current telephone directory for the Washington Metropolitan Area (2,110 pages) in 2,602.3 minutes.

G. Note on Computer and Composer Timings

Notwithstanding an attempt to ensure a common approach to the measurement of computer and composer timings there were differences in practice.

RCA did the most complete job (see Appendix II) in measuring times by providing digital clock readings for their computers and composer timings that reflected overhead factors which would impinge on a series of pages rather than a single page, e.g., font loading times.

For RCA the analysis uses page timings derived as follows:

(*a*) A single page was run and timed by stopwatch. This time would include any overhead associated with a job.

(*b*) The input tape for the sample page was "looped" so that the sample page was run ten times. This cycle was timed by stopwatch.

(*c*) The value derived in step (*a*) above was subtracted from the value derived in step (*b*) above. The balance was then divided by nine to derive a run time free of over-head factors that would be job dependent.

Harris describes the method they used to eliminate overhead factors in Appendix II.

For the IBM 360–50 the digital clock readings recorded for each page were used. The blocking factors used in input preparation by Mergäntheler systematically caused higher cycle times than need have been.

While the timing methods leave something to be desired it should be borne in mind that this analysis is not attempting to determine which system is superior but is, rather, concerned with a generalized method of evaluation.

APPENDIX IV. FORTRAN IV PROGRAM—COMPUTER PROGRAMS EQI AND EQII[1]

I. INTRODUCTION

Break-even data were determined by two computer programs. EQI solved Equation I and EQII solved Equations IIA and IIB. Modifications can be made in the programs to increase the items of output and eliminate the need for duplicate data for runs which contain both the single and mix comparisons.

The programs, written in Fortran IV, were compiled using the IBM Fortran H compiler operating under OS/MFT-II, level 18. The programs were run from object decks using an IBM 2050 Processing Unit. Times for the runs each consisting of 296 comparisons, based on Xerox Corporation's 360/OS accounting routine are as follows:

Program	CPU time (sec.)	Wait time [1] (sec.)
EQI	140.95	212.71
EQII	79.00	272.76

[1] Briefly, wait time is that time when the system is "tied up" waiting, in most cases, for the completion of I/O. However, because of the job mix and the interrelationship of wait time with CPU and idle times, wait time variation between identical runs is more than one might consider satisfactory. CPU time and wait time represent billable time for the execution of these programs under a multiprocessing environment.

Program Size is as follows:

EQI	1910_{16}	(6416_{10})
EQII	$1C78_{16}$	(7288_{10})

Load Module Size is as follows:

EQI	$6C18_{16}$	$(27,672)_{10}$
EQII	$6F80_{16}$	$(28,544)_{10}$

It should be noted that both programs call a date routine, SPDATE. If necessary four source cards can be removed from each program to eliminate the date as follows:

EQI	*EQII*
ISN 0002 [2]	ISN 0002 [2]
ISN 0121	ISN 0105
ISN 0122	ISN 0106
ISN 0283	ISN 0371

II. SETUP OF DATA INCLUDING PARAMETER CONTROL CARDS:

1st card—NO. OF COMPUTERS: card
set 1 { 2nd card—Computer Model card
3rd card—DATA SETS: card
subset 1 { 4th card—"Mix" card
5th card(s)—DATA: card(s)
subset 2 as above
etc.
set 2 { nth card—Computer Model card
nth+1 card—DATA SETS: card
subset 1 { nth+2 card—"Mix" card
nth+3 card(s)—DATA: card(s)
etc.

III. KEYPUNCH INSTRUCTIONS:

1. No. of Computers card

Card column	*Punch*
1–17	NO. OF COMPUTERS:
18	Leave blank
19–20	Two-digit number indicating the total individual computer/composer combinations in the run
21–80	[not used]

2. Computer Model card

Card column	*Punch*
1–50	Any description which will identify the computer/composer combination for the computed data
51–80	[not used]

3. Data Sets card

Card column	*Punch*
1–10	DATA SETS:
11–12	Leave blank
13–14	Two-digit number indicating the total number of comparisons analyzed
15–80	[not used]

4. "Mix" card

A. For a one sample comparison:

Card column	*Punch*
1–4	ONE:
5	Code for the sample type
6–11	(1.)
12–68	[not used]
69	Code for the conventional process type
70	1
71–80	[not used]

B. For a sample type mix comparison:

Card column	*Punch*
1–4	MIX:
5	Code for 1st sample type
6	"("—open parenthesis
7–10	A number expressed to one decimal place indicating the desired contribution of the 1st sample type
11	")"—close parenthesis
12	","—comma
13	Code for 2nd sample type
14	"("—open parenthesis
15–18	A number expressed to one decimal place indicating the desired contribution of the 2nd sample type
19	")"—close parenthesis
20	","—comma
21–28	3rd sample information as above, if present
29–36	4th sample information as above, if present
37–44	5th sample information as above, if present
45–52	6th sample information as above, if present
53–60	7th sample information as above, if present
61–67	8th sample information as above, if present
68	Leave blank
69	Code for the conventional process type
70	One-digit number indicating the number of sample types in the mix
71–80	[not used]

(NOTE.—Comma not used after the last sample type (e.g. Leave cc 44 blank for a 5-sample mix).)

5. Data card

See attached self-explanatory Keypunch Coding Sheet.

[1] Equation Roman numeral one, Equation Roman numeral two respectively.
[2] Refer to attached listings.

KEYPUNCH CODING | ACCT NO. | PUNCH PER LINE ☐ ONE CARD ☐ TWO cards | DATE SUBMITTED | Page of pages | TITLE EQI & EQII

COLUMN NUMBER

LINE NO.	Card Identifier	1	2	Cost to set page conventionally (A) [B]	Computer one shift operating costs/month (B) *Used only by EQII*	Photocomposer (one shift) operating costs/month (C) [Cmonly]	Initial keyboarding cycle in minutes (D) [D]	Correction keyboarding cycle in minutes (E) [E]	Photocomposer cycles in minutes (POSCYC) [A]	Computer cycles in minutes (PUTCYC) [C]	Extra shift cost/min of photocomposer (SFTPOS)	Extra shift cost/min of computer (SFTPUT)	Supply Cost per page [F] (F)	Cost computer configuration/min [C_1] *Used only by EQ I*	3	4/	5
1.	DATA:																
2.	DATA:																
3.	DATA:																
4.	DATA:																
5.	DATA:																
6.	DATA:																
7.	DATA:																
8.	DATA:																

() = EQII Terminology
[] = EQI Terminology

Enter for types not coded:

COMPUTER: _____

COMPOSER: _____

1/ CONVENTIONAL PROCESS TYPE

L = Linotype
M = Monotype
P = Photon
B = Photon Balance

2/ SAMPLE TYPE

A = American Bar (5.)
B = Book Catalogue (6.)
G = Group (1.)
H = Hardware Director (7.)
L = Prices And The Production Plan (3.)
P = Pleistocene (4.)
T = Telephone Director (8.)
Y = Policy (2.)

3/ COUNTRY OF DATA

b (Blank) = U.S.A.
B = United Kingdom

4/ COMPUTER MODEL

IBM 360/50 =50
IBM 360/30 =30
M-16 =16
RCA Spectra 70/45=45
RCA Spectra 70/35=35

5/ COMPOSER TYPE (OPTIONAL)

Harris Fototronic= H
Linotron 505 = T
Linotron 1010 = L
Videocomp = V
Videocomp-Mode D = D

3/10/70 M.C.L.

N.B. 1. USE A SEPARATE PAGE FOR EACH COMPUTER COMPOSER COMBINATION.
2. ENTER ONLY ONE CHARACTER (NUMBER OR DECIMAL POINT) IN A SQUARE.
3. ALWAYS ENTER DECIMAL POINT.
4. NEVER EXCEED THE FIELD LENCTH (NO. OF SQUARES BETWEEN HEAVY LINES).

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      COMPILER OPTIONS - NAME= EQONE,OPT=02,LINECNT=56,SOURCE,EBCDIC,NOLIST,NODECK,LOAD,NOMAP,NOEDIT,ID,XREF
           C   THIS VERSION CONTAINS EVERYTHING BUT MINIMIZING CONTROLS CARDS!
           C
           C       * * * * * * * * * * * * * * * * * * *
ISN 0002            DIMENSION ASPDTG(10)
ISN 0003            REAL*8 A(8),B(8),C(8),C1,D(8),D1,D2,D12,E(8),F(8),CHONLY          20MAY
ISN 0004            REAL*8 CDTITL,TITLE(8),PRCNT(8),PERCEN(8),PERTOT
ISN 0005            REAL*8 CPTYPD,CPTYPM,MODELS(3),DS(2),SMPL(8),DATLIT,ORIGIN        7MAY
ISN 0006            REAL*8 FORMAT(8),PROCES(4),MIX,MODLS(3),SETS(2),CPT(4,2),SMPLT(9,5 7MAY
                   1),ONE,DELTA(18),DATA,CNTY(2),PATRIA(2)                           7MAY
ISN 0007            REAL*8 SIGMAA,SIGMAB,SIGMAC,SIGMAD,SIGMAE,W(18),SIGMAF
ISN 0008            REAL*8 TOPHLF,X,BEGIN,PAGES,KEYBD
ISN 0009            DATA CNTY(1)/6HU.S.A./                                            7MAY
ISN 0010            DATA CNTY(2)/6H U.K. /                                            7MAY
ISN 0011            DATA CPT(1,1)/4HLINO/
ISN 0012            DATA CPT(1,2)/4HTYPE/
ISN 0013            DATA CPT(2,1)/4HMONO/
ISN 0014            DATA CPT(2,2)/4HTYPE/
ISN 0015            DATA CPT(3,1)/4HPHOT/
ISN 0016            DATA CPT(3,2)/4HON   /
ISN 0017            DATA CPT(4,1)/4HPH B/                                             7MAY
ISN 0018            DATA CPT(4,2)/4HLNCE/                                             7MAY
ISN 0019            DATA DATA/6HDATA: /
ISN 0020            DATA DELTA(1)/5H+100%/
ISN 0021            DATA DELTA(2)/5H +90%/
ISN 0022            DATA DELTA(3)/5H +80%/
ISN 0023            DATA DELTA(4)/5H +70%/
ISN 0024            DATA DELTA(5)/5H +60%/
ISN 0025            DATA DELTA(6)/5H +50%/
ISN 0026            DATA DELTA(7)/5H +40%/
ISN 0027            DATA DELTA(8)/5H +30%/
ISN 0028            DATA DELTA(9)/5H +20%/
ISN 0029            DATA DELTA(10)/5H +10%/
ISN 0030            DATA DELTA(11)/5H ZERO/
ISN 0031            DATA DELTA(12)/5H -10%/
ISN 0032            DATA DELTA(13)/5H -20%/
ISN 0033            DATA DELTA(14)/5H -30%/
ISN 0034            DATA DELTA(15)/5H -40%/
ISN 0035            DATA DELTA(16)/5H -50%/
ISN 0036            DATA DELTA(17)/5H -60%/
ISN 0037            DATA DELTA(18)/5H -70%/
ISN 0038            DATA FORMAT(1)/1HA/
ISN 0039            DATA FORMAT(2)/1HB/
ISN 0040            DATA FORMAT(3)/1HG/
ISN 0041            DATA FORMAT(4)/1HH/
ISN 0042            DATA FORMAT(5)/1HI/
ISN 0043            DATA FORMAT(6)/1HP/
ISN 0044            DATA FORMAT(7)/1HT/
ISN 0045            DATA FORMAT(8)/1HY/
ISN 0046            DATA MIX/4HMIX:/
ISN 0047            DATA MODLS(1)/6HNO. OF/
ISN 0048            DATA MODLS(2)/6H COMPU/
ISN 0049            DATA MODLS(3)/6HTERS: /
ISN 0050            DATA ONE/4HONE:/
ISN 0051            DATA PATRIA(1)/1H /                                               7MAY
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ISN 0052          DATA PATRIA(2)/1HB/                                          7MAY
ISN 0053          DATA PROCES(1)/1HL/
ISN 0054          DATA PROCES(2)/1HM/
ISN 0055          DATA PROCES(3)/1HP/
ISN 0056          DATA PROCES(4)/1HB/                                          7MAY
ISN 0057          DATA SETS(1)/6HDATA S/
ISN 0058          DATA SETS(2)/6HETS:  /
ISN 0059          DATA SMPLT(1,1)/6HGROUP /
ISN 0060          DATA SMPLT(1,2)/6H      /
ISN 0061          DATA SMPLT(1,3)/6H      /
ISN 0062          DATA SMPLT(1,4)/6H      /
ISN 0063          DATA SMPLT(1,5)/6H      /
ISN 0064          DATA SMPLT(2,1)/6HPOLICY/
ISN 0065          DATA SMPLT(2,2)/6H      /
ISN 0066          DATA SMPLT(2,3)/6H      /
ISN 0067          DATA SMPLT(2,4)/6H      /
ISN 0068          DATA SMPLT(2,5)/6H      /
ISN 0069          DATA SMPLT(3,1)/6HPRICES/
ISN 0070          DATA SMPLT(3,2)/6H AND T/
ISN 0071          DATA SMPLT(3,3)/6HHE PRC/
ISN 0072          DATA SMPLT(3,4)/6HDUCTIC/
ISN 0073          DATA SMPLT(3,5)/6HN PLAN/
ISN 0074          DATA SMPLT(4,1)/6HPLEIST/
ISN 0075          DATA SMPLT(4,2)/6HOCENE /
ISN 0076          DATA SMPLT(4,3)/6H      /
ISN 0077          DATA SMPLT(4,4)/6H      /
ISN 0078          DATA SMPLT(4,5)/6H      /
ISN 0079          DATA SMPLT(5,1)/6HAMERIC/
ISN 0080          DATA SMPLT(5,2)/6HAN BAR/
ISN 0081          DATA SMPLT(5,3)/6H      /
ISN 0082          DATA SMPLT(5,4)/6H      /
ISN 0083          DATA SMPLT(5,5)/6H      /
ISN 0084          DATA SMPLT(6,1)/6HHARDWA/
ISN 0085          DATA SMPLT(6,2)/6HRE DIR/
ISN 0086          DATA SMPLT(6,3)/6HECTORY/
ISN 0087          DATA SMPLT(6,4)/6H      /
ISN 0088          DATA SMPLT(6,5)/6H      /
ISN 0089          DATA SMPLT(7,1)/6HBOOK C/
ISN 0090          DATA SMPLT(7,2)/6HATALOG/
ISN 0091          DATA SMPLT(7,3)/6HUE    /
ISN 0092          DATA SMPLT(7,4)/6H      /
ISN 0093          DATA SMPLT(7,5)/6H      /
ISN 0094          DATA SMPLT(8,1)/6HTELEPH/
ISN 0095          DATA SMPLT(8,2)/6HONE DI/
ISN 0096          DATA SMPLT(8,3)/6HRECTOR/
ISN 0097          DATA SMPLT(8,4)/6HY     /
ISN 0098          DATA SMPLT(8,5)/6H      /
ISN 0099          DATA SMPLT(9,1)/6HMIX   /
ISN 0100          DATA SMPLT(9,2)/6H      /
ISN 0101          DATA SMPLT(9,3)/6H      /
ISN 0102          DATA SMPLT(9,4)/6H      /
ISN 0103          DATA SMPLT(9,5)/6H      /
ISN 0104          DATA W(1),W(2),W(3),W(4),W(5),W(6),W(7),W(8),W(9),W(10),W(11),
                 1     W(12),W(13),W(14),W(15),W(16),W(17),W(18)/1.90,1.81,1.72,
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                2     1.63,1.54,1.45,1.36,1.27,1.18,1.09,1.00,.91,.82,.73,.64,.55,
                3     .46,.37/
ISN 0105         READ (5,100) MODELS(1),MODELS(2),MODELS(3),N
ISN 0106         IF (MODELS(1) .NE. MODLS(1)) GO TO 51
ISN 0108         IF (MODELS(2) .NE. MODLS(2)) GO TO 51
ISN 0110         IF (MODELS(3) .NE. MODLS(3)) GO TO 51
ISN 0112         DO  60 I=1,N
ISN 0113         READ (5,102)
ISN 0114         READ (5,104) DS(1),DS(2),NN
ISN 0115         IF (DS(1) .NE. SETS(1)) GO TO 52
ISN 0117         IF (DS(2) .NE. SETS(2)) GO TO 52
ISN 0119         DO 61 KMAC=1,NN
ISN 0120         WRITE (6,101)
ISN 0121         CALL SPDATE(ASPDTG)
ISN 0122         WRITE (6,505) (ASPDTG(JDTG),JDTG=4,10)
ISN 0123         WRITE (6,102)
ISN 0124         WRITE (6,105)
               C      PAGE OVERFLOW NEEDED
ISN 0125         INGLE = 0
ISN 0126         READ(5,106) CDTITL,(TITLE(IJ),PRCNT(IJ),IJ=1,8),CPTYPM,NNN
ISN 0127         IF (CDTITL .EQ. ONE) GO TO 62
ISN 0129         IF (CDTITL .EQ. MIX) GO TO 63
ISN 0131         GO TO 53
ISN 0132      62 INGLE = 1
ISN 0133      63 PERTOT = DABS(PRCNT(1)+PRCNT(2)+PRCNT(3)+PRCNT(4)+PRCNT(5)+
                1 PRCNT(6)+PRCNT(7)+PRCNT(8)-100.)
ISN 0134         IF (PERTOT .GT. 0.1) GO TO 54
ISN 0136       1 NDATA = 0
ISN 0137         DO 7 MN=1,8
ISN 0138       7 PERCEN(MN) = PRCNT(MN)/100.
ISN 0139         DO 9 J=1,NNN
ISN 0140         READ (5,108) DATLIT,CPTYPD,SMPL(J),B(J),   CMONLY,D(J),E(J),A(J),
                1 C(J),F(J),C1,ORIGIN                                          7MAY
ISN 0141         IF(DATLIT .NE. DATA) GO TO 49
ISN 0143         NDATA = NDATA+1
ISN 0144         IF (CPTYPM .NE. CPTYPD) GO TO 56
ISN 0146         IF (NDATA-NNN) 9,9,57
ISN 0147       9 CONTINUE
ISN 0148         IF (ORIGIN .EQ. PATRIA(1)) GO TO 73                           7MAY
ISN 0150         IF (ORIGIN .EQ. PATRIA(2)) GO TO 74                           7MAY
ISN 0152         GO TO 49                                                      7MAY
ISN 0153      73 LAND = 1                                                      7MAY
ISN 0154         D1 = 0.0812
ISN 0155         GO TO 75                                                      7MAY
ISN 0156      74 LAND = 2                                                      7MAY
ISN 0157         D1 = 0.0263                                                   7MAYU.K
ISN 0158      75 D2 = 0.0054                                                   7MAY
ISN 0159         DO 11 LBLOOP=1,18
               C      LABOR FACTOR = 90% OF B & D1 DELTAS.
ISN 0160         D12 = D1*W(LBLOOP) + D2
ISN 0161         SIGMAA = A(1)*PERCEN(1)+A(2)*PERCEN(2)+A(3)*PERCEN(3)+
                1         A(4)*PERCEN(4)+A(5)*PERCEN(5)+A(6)*PERCEN(6)+
                2         A(7)*PERCEN(7)+A(8)*PERCEN(8)
ISN 0162         SIGMAB = B(1)*PERCEN(1)+B(2)*PERCEN(2)+B(3)*PERCEN(3)+
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                1          B(4)*PERCEN(4)+B(5)*PERCEN(5)+B(6)*PERCEN(6)+
                2          B(7)*PERCEN(7)+B(8)*PERCEN(8)
ISN 0163         SIGMAC = C(1)*PERCEN(1)+C(2)*PERCEN(2)+C(3)*PERCEN(3)+
                1          C(4)*PERCEN(4)+C(5)*PERCEN(5)+C(6)*PERCEN(6)+
                2          C(7)*PERCEN(7)+C(8)*PERCEN(8)
ISN 0164         SIGMAD = D(1)*PERCEN(1)+D(2)*PERCEN(2)+D(3)*PERCEN(3)+
                1          D(4)*PERCEN(4)+D(5)*PERCEN(5)+D(6)*PERCEN(6)+
                2          D(7)*PERCEN(7)+D(8)*PERCEN(8)
ISN 0165         SIGMAE = E(1)*PERCEN(1)+E(2)*PERCEN(2)+E(3)*PERCEN(3)+
                1          E(4)*PERCEN(4)+E(5)*PERCEN(5)+E(6)*PERCEN(6)+
                2          E(7)*PERCEN(7)+E(8)*PERCEN(8)
ISN 0166         SIGMAF = F(1)*PERCEN(1)+F(2)*PERCEN(2)+F(3)*PERCEN(3)+
                1          F(4)*PERCEN(4)+F(5)*PERCEN(5)+F(6)*PERCEN(6)+
                2          F(7)*PERCEN(7)+F(8)*PERCEN(8)
ISN 0167         SIGMAB = SIGMAB*W(LBLOOP)
ISN 0168         TOPHLF = SIGMAB-SIGMAC*C1-SIGMAD*D12-SIGMAE*D12-SIGMAF
ISN 0169         X = TOPHLF/SIGMAA
ISN 0170         IF (X-0.) 3,50,3
               C     FUTURE: MAKE LABEL 50 A SUBROUTINE ENTRY POINT
ISN 0171       3 BEMIN = CMONLY/X                                        13MAY18
ISN 0172         IF (BEMIN .GT. 10560.) GO TO 4                          18MAY
ISN 0174         PAGES = BEMIN/SIGMAA
ISN 0175         KEYBD = (PAGES*(SIGMAD+SIGMAE)/60.0)/176.0
ISN 0176         GO TO 5                                                 13MAY
               C     RESID1=60.0*C1(J)
               C     RESID2=C(J)*PAGES
               C     RESID3=RESID2/60.0
               C     RESID = (228.8-RESID3)*RESID1
ISN 0177       4 IEXTRA=1                                                13MAY
ISN 0178       5 IF (LBLOOP .GT. 1) GO TO 8                              13MAY
ISN 0180         IF (CPTYPM .EQ. PROCES(1)) GO TO 21
ISN 0182         IF (CPTYPM .EQ. PROCES(2)) GO TO 22
ISN 0184         IF (CPTYPM .EQ. PROCES(3)) GO TO 23
ISN 0186         IF (CPTYPM .EQ. PROCES(4)) GO TO 25                     7MAY
ISN 0188         GO TO 59
ISN 0189      21 II = 1
ISN 0190         GO TO 24
ISN 0191      22 II = 2
ISN 0192         GO TO 24
ISN 0193      23 II = 3
ISN 0194         GO TO 24                                                7MAY
ISN 0195      25 II = 4                                                  7MAY
ISN 0196      24 IF (SMPL(1) .NE. SMPL(NNN)) GO TO 39
ISN 0198         IF (SMPL(1) .EQ. FORMAT(1)) GO TO 31
ISN 0200         IF (SMPL(1) .EQ. FORMAT(2)) GO TO 32
ISN 0202         IF (SMPL(1) .EQ. FORMAT(3)) GO TO 33
ISN 0204         IF (SMPL(1) .EQ. FORMAT(4)) GO TO 34
ISN 0206         IF (SMPL(1) .EQ. FORMAT(5)) GO TO 35
ISN 0208         IF (SMPL(1) .EQ. FORMAT(6)) GO TO 36
ISN 0210         IF (SMPL(1) .EQ. FORMAT(7)) GO TO 37
ISN 0212         IF (SMPL(1) .EQ. FORMAT(8)) GO TO 38
ISN 0214         GO TO 70
ISN 0215      31 JJ = 5
ISN 0216         GO TO 40
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ISN 0217        32 JJ = 7
ISN 0218           GO TO 40
ISN 0219        33 JJ = 1
ISN 0220           GO TO 40
ISN 0221        34 JJ = 6
ISN 0222           GO TO 40
ISN 0223        35 JJ = 3
ISN 0224           GO TO 40
ISN 0225        36 JJ = 4
ISN 0226           GO TO 40
ISN 0227        37 JJ = 8
ISN 0228           GO TO 40
ISN 0229        38 JJ = 2
ISN 0230           GO TO 40
ISN 0231        39 JJ = 9
ISN 0232        40 WRITE (6,107) (CPT(II,KK),KK=1,2),(SMPLT(JJ,KK),KK=1,5)
ISN 0233         8 IF (IEXTRA .NE. 1) GO TO 6                                  13MAY
ISN 0235           WRITE (6,753) DELTA(LBLCOP)                                 13MAY
ISN 0236           GO TO 10                                                    18MAY
ISN 0237         6 IF (INGLE-1) 41,42,71                                       13MAY
ISN 0238        41 WRITE (6,109)  X, BEMIN, PAGES, KEYBD,DELTA(LBLOOP)
ISN 0239           GO TO 11
ISN 0240        42 WRITE (6,109)  X, BEMIN, PAGES, KEYBD, DELTA(LBLCOP)
ISN 0241        11 IEXTRA = 0                                                  13MAY
ISN 0242        10 IEXTRA = 0                                                  18MAY
ISN 0243           IF (JJ-9) 64,55,64                                          7MAY
ISN 0244        55 WRITE(6,111) (TITLE(IL),PRCNT(IL),IL=1,8)
ISN 0245        64 WRITE (6,199) CNTY(LAND)                                    7MAY
ISN 0246        61 WRITE (6,201) (CPT(II,KK),KK=1,2), (SMPLT(JJ,KK),KK=1,5),(A(J),
                  1 B(J),C(J),C1,D(J),D1,D2,E(J),F(J),CMONLY,J=1,NNN)           20MAY
ISN 0247        60 CONTINUE
ISN 0248           GO TO 88
ISN 0249        49 WRITE (6,949)
ISN 0250           GO TO 88
ISN 0251        50 WRITE (6,950)
ISN 0252           GO TO 88
ISN 0253        51 WRITE (6,951)
ISN 0254           GO TO 88
ISN 0255        52 WRITE (6,952)
ISN 0256           GO TO 88
ISN 0257        53 WRITE (6,953)
ISN 0258           GO TO 88
ISN 0259        54 WRITE (6,954)
ISN 0260           GO TO 88
ISN 0261        56 WRITE (6,956)
ISN 0262           GO TO 88
ISN 0263        57 WRITE (6,957)
ISN 0264           GO TO 88
ISN 0265        59 WRITE (6,959)
ISN 0266           GO TO 88
ISN 0267        70 WRITE (6,970)
ISN 0268           GO TO 88
ISN 0269        71 WRITE (6,971)
ISN 0270        88 STOP
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ISN 0271        100 FORMAT (3A6,I2)
ISN 0272        102 FORMAT (50H                                                    )
ISN 0273        104 FORMAT (2A6,I2)
ISN 0274        106 FORMAT (A4,8(A1,1X,F4.1,2X),A1,I1)                                    22MAY
ISN 0275        108 FORMAT (A6,2A1,F7.0,8X,F8.0,4F6.0,10X,F5.0,F6.0,A1)                   7MAY
ISN 0276        101 FORMAT (1H1,29X,'COMPARISON OF COMPOSING PROCESSES: CRT PHOTOCOMPO
                   1SITION VS. CONVENTIONAL'/43X,'BASED ON PURCHASED COMPUTER TIME (EQ
                   2UATION I)')
ISN 0277        105 FORMAT (1H0/1X,'CONVENTIONAL PROCESS',14X,'SAMPLE',21X,'BREAKEVEN:
                   1'//62X,'COST PER MINUTE',5X,'MINUTES',5X,' PAGES',5X,'KEYBOARDS',
                   2 5X,'DELTA LABOR')
ISN 0278        107 FORMAT (5X,2A4,12X,5A6)
ISN 0279        109 FORMAT (62X,F11.2,8X,F8.2,5X,F6.0,4X,F8.2,8X,A5)
ISN 0280        111 FORMAT (1H  ////1X,'MIX=',8(A1,'(',F4.1,'%)',))
ISN 0281        199 FORMAT (1H0///37X,'(',A6,')')                                         7MAY
ISN 0282        201 FORMAT (1H+,     'DATA FOR THE ABOVE ARE AS FOLLOWS:'//6X,2A4,6X,5A   7MAY
                   16///4X,'A',9X,'B',6X,'C',7X,'C1',6X,'D',7X,'D1',6X,'D2',6X,'E',7X,   18MAY
                   2'F',4X,'MNTHLY COST',2X,'       '//(1X,F7.4,2X,F7.4,2X,2(F6.4,2X),   18MAY22
                   3 F6.2,2X,2(F6.4,2X),F5.2,2X,F6.4,3X,F8.2))                           18M2022
ISN 0283        505 FORMAT (1H+,103X,7A4///)
ISN 0284        753 FORMAT (85X,'SEE EQUATION II',20X,A5)                                 13MAY
ISN 0285        949 FORMAT (1H0//1X,'DATA CARD INVALID')                                  MAY22
ISN 0286        950 FORMAT (1H0//1X,'X EQUALS ZERO!')                                     MAY22
ISN 0287        951 FORMAT (1H0//1X,'NO. CARD INVALID')                                   MAY22
ISN 0288        952 FORMAT (1H0//1X,'SET CARD INVALID')                                   MAY22
ISN 0289        953 FORMAT (1H0//1X,'TITLE CARD INVALID')                                 MAY22
ISN 0290        954 FORMAT (1H0//1X,'PERCENTAGES INVALID')                                MAY22
ISN 0291        956 FORMAT (1H0//1X,'PROCESSES MIXED')                                    MAY22
ISN 0292        957 FORMAT (1H0//1X,'TOO MUCH DATA')                                      MAY22
ISN 0293        959 FORMAT (1H0//1X,'TYPE CODE INVALID')                                  MAY22
ISN 0294        970 FORMAT (1H0//1X,'SAMPLE CODE INVALID')                                MAY22
ISN 0295        971 FORMAT (1H0//1X,'SWITCH-2 ERROR')                                     MAY22
ISN 0296            END
```

SYMBOL	INTERNAL STATEMENT NUMBERS																		
A	0003	0140	0161	0161	0161	0161	0161	0161	0161	0161	0246								
B	0003	0140	0162	0162	0162	0162	0162	0162	0162	0162	0246								
C	0003	0140	0163	0163	0163	0163	0163	0163	0163	0163	0246								
D	0003	0140	0164	0164	0164	0164	0164	0164	0164	0164	0246								
E	0003	0140	0165	0165	0165	0165	0165	0165	0165	0165	0246								
F	0003	0140	0166	0166	0166	0166	0166	0166	0166	0166	0246								
I	0112																		
J	0139	0140	0140	0140	0140	0140	0140	0140	0246	0246	0246	0246	0246	0246	0246	0246			
N	0105	0112																	
W	0007	0104	0104	0104	0104	0104	0104	0104	0104	0104	0104	0104	0104	0104	0104	0104	0104	0104	0104
	0160	0167																	
X	0008	0169	0170	0171	0238	0240													
C1	0003	0140	0168	0246															
DS	0005	0114	0114	0115	0117														
D1	0003	0154	0157	0160	0246														
D2	0003	0158	0160	0246															
II	0189	0191	0193	0195	0232	0246													
IJ	0126	0126	0126	0126															
IL	0244	0244	0244	0244															
JJ	0215	0217	0219	0221	0223	0225	0227	0229	0231	0232	0243	0246							
KK	0232	0232	0232	0232	0232	0232	0246	0246	0246	0246	0246	0246							
MN	0137	0138	0138																
NN	0114	0119																	
CPT	0006	0011	0012	0013	0014	0015	0016	0017	0018	0232	0246								
D12	0003	0160	0168	0168															
MIX	0006	0046	0129																
NNN	0126	0139	0146	0196	0246														
ONE	0006	0050	0127																
CNTY	0006	0009	0010	0245															
DABS	0133																		
DATA	0006	0019	0141																
JDTG	0122	0122	0122																
KMAC	0119																		
LAND	0153	0156	0245																
SETS	0006	0057	0058	0115	0117														
SMPL	0005	0140	0196	0196	0198	0200	0202	0204	0206	0208	0210	0212							
BEMIN	0008	0171	0172	0174	0238	0240													
DELTA	0006	0020	0021	0022	0023	0024	0025	0026	0027	0028	0029	0030	0031	0032	0033	0034	0035	0036	0037
	0235	0238	0240																
INGLE	0125	0132	0237																
KEYBD	0008	0175	0238	0240															
MODLS	0006	0047	0048	0049	0106	0108	0110												
NDATA	0136	0143	0143	0146															
PAGES	0008	0174	0175	0238	0240														
PRCNT	0004	0126	0133	0133	0133	0133	0133	0133	0133	0133	0138	0244							
SMPLT	0006	0059	0060	0061	0062	0063	0064	0065	0066	0067	0068	0069	0070	0071	0072	0073	0074	0075	0076
	0077	0078	0079	0080	0081	0082	0083	0084	0085	0086	0087	0088	0089	0090	0091	0092	0093	0094	0095
	0096	0097	0098	0099	0100	0101	0102	0103	0232	0246									
TITLE	0004	0126	0244																
ASPDTG	0002	0121	0122																
CDTITL	0004	0126	0127	0129															
CMONLY	0003	0140	0171	0246															

SYMBOL	INTERNAL STATEMENT NUMBERS																	
CPTYPD	0005	0140	0144															
CPTYPM	0005	0126	0144	0180	0182	0184	0186											
DATLIT	0005	0140	0141															
FORMAT	0006	0038	0039	0040	0041	0042	0043	0044	0045	0198	0200	0202	0204	0206	0208	0210	0212	
IEXTRA	0177	0233	0241	0242														
LBLOOP	0159	0160	0167	0178	0235	0238	0240											
MODELS	0005	0105	0105	0105	0106	0108	0110											
ORIGIN	0005	0140	0148	0150														
PATRIA	0006	0051	0052	0148	0150													
PERCEN	0004	0138	0161	0161	0161	0161	0161	0161	0161	0161	0162	0162	0162	0162	0162	0162	0162	0162	0163
	0163	0163	0163	0163	0163	0163	0163	0164	0164	0164	0164	0164	0164	0164	0164	0165	0165	0165	0165
	0165	0165	0165	0165	0166	0166	0166	0166	0166	0166	0166	0166							
PERTOT	0004	0133	0134															
PROCES	0006	0053	0054	0055	0056	0180	0182	0184	0186									
SIGMAA	0007	0161	0169	0174														
SIGMAB	0007	0162	0167	0167	0168													
SIGMAC	0007	0163	0168															
SIGMAD	0007	0164	0168	0175														
SIGMAE	0007	0165	0168	0175														
SIGMAF	0007	0166	0168															
SPDATE	0121																	
TOPHLF	0008	0168	0169															

LABEL	DEFINED	REFERENCES									
1	0136										
3	0171	0170	0170								
4	0177	0172									
5	0178	0176									
6	0237	0233									
7	0138	0137									
8	0233	0178									
9	0147	0139	0146	0146							
10	0242	0236									
11	0241	0159	0239								
21	0189	0180									
22	0191	0182									
23	0193	0184									
24	0196	0190	0192	0194							
25	0195	0186									
31	0215	0198									
32	0217	0200									
33	0219	0202									
34	0221	0204									
35	0223	0206									
36	0225	0208									
37	0227	0210									
38	0229	0212									
39	0231	0196									
40	0232	0216	0218	0220	0222	0224	0226	0228	0230		
41	0238	0237									
42	0240	0237									
49	0249	0141	0152								
50	0251	0170									
51	0253	0106	0108	0110							
52	0255	0115	0117								
53	0257	0131									
54	0259	0134									
55	0244	0243									
56	0261	0144									
57	0263	0146									
59	0265	0188									
60	0247	0112									
61	0246	0119									
62	0132	0127									
63	0133	0129									
64	0245	0243	0243								
70	0267	0214									
71	0269	0237									
73	0153	0148									
74	0156	0150									
75	0158	0155									
88	0270	0248	0250	0252	0254	0256	0258	0260	0262	0264	0266	0268
100	0271	0105									
101	0276	0120									
102	0272	0113	0123								
104	0273	0114									

LABEL	DEFINED	REFERENCES
105	0277	0124
106	0274	0126
107	0278	0232
108	0275	0140
109	0279	0238 0240
111	0280	0244
199	0281	0245
201	0282	0246
505	0283	0122
753	0284	0235
949	0285	0249
950	0286	0251
951	0287	0253
952	0288	0255
953	0289	0257
954	0290	0259
956	0291	0261
957	0292	0263
959	0293	0265
970	0294	0267
971	0295	0269

OPTIONS IN EFFECT NAME= EQONE,OPT=02,LINECNT=56

OPTIONS IN EFFECT SOURCE,EBCDIC,NOLIST,NODECK,LOAD,NOMAP,NOEDIT,ID,XREF

STATISTICS SOURCE STATEMENTS = 295 ,PROGRAM SIZE = 6416

STATISTICS NO DIAGNOSTICS GENERATED

****** END OF COMPILATION ******

F88-LEVEL LINKAGE EDITOR OPTIONS SPECIFIED MAP,LET,LIST
VARIABLE OPTIONS USED - SIZE=(102400,16384)

DEFAULT OPTION(S) USED

MODULE MAP

CONTROL SECTION

NAME	ORIGIN	LENGTH
EQONE	00	1910
IHCECOMH*	1910	F31
IHCCOMH2*	2848	581
SPDATE *	2DD0	346
IHCFCVTH*	3118	1195
IHCEFNTH*	42B0	512
IHCEFIOS*	47C8	129C
IHCUOPT *	5A68	328
IHCERRM *	5D90	5BC
IHCUATBL*	6350	638
IHCETRCH*	6988	28E

ENTRY

NAME	LOCATION	NAME	LOCATION	NAME	LOCATION	NAME	LOCATION
IBCOM#	1910	FDIOCS#	19CC	INTSWTCH	282E		
SEQDASD	2AE4						
ADCON#	3118	FCVAOUTP	31C2	FCVLOUTP	3252	FCVZOUTP	33A2
FCVIOUTP	3748	FCVEOUTP	3C4A	FCVCOUTP	3E64	INT6SWCH	414B
ARITH#	42B0	ADJSWTCH	461C				
FIOCS#	47C8	FIOCSBEP	47CE				
ERRMON	5D90	IHCERRE	5DA8				
IHCTRCH	6988	ERRTRA	6990				

ENTRY ADDRESS 00
TOTAL LENGTH 6C18

****MAIN DOES NOT EXIST BUT HAS BEEN ADDED TO DATA SET

```
IEF285I   SYS1.FORTLIB                                          KEPT
IEF285I   VOL SER NOS= CPERES.
IEF285I   SYS1.LINKLIB                                          KEPT
IEF285I   VOL SER NOS= CPELNK.
IEF285I   SYS70195.T150215.SF000.WNMEQI.R0000211                SYSOUT
IEF285I   VOL SER NOS= CPE235.
IEF285I   SYS70195.T150215.RF000.WNMEQI.S0000212                SYSIN
IEF285I   VOL SER NOS= CPE232.
IEF285I   SYS70195.T150215.RF000.WNMEQI.S0000212                DELETED
IEF285I   VOL SER NOS= CPE232.
IEF285I   SYS70195.T150215.RF000.WNMEQI.GOSET                   PASSED
IEF285I   VOL SER NOS= CPE231.
IEF285I   SYS70195.T150215.RF000.WNMEQI.SYSUT1                  DELETED
IEF285I   VOL SER NOS= CPE331.
********************************************************************************************************************************
OS/360 RELEASE NO. 18    CURRENT DAY=195 TIME=15:30  JOB WNMEQI    STEP LKED      RUN TIME=000046.41 SEC. CUML.JOB=000046.41 SEC. **
CPU TIME=000003.24 SEC.     WAIT TIME=000032.38 SEC.     IDLE TIME=000010.79 SEC.     I/O ACTIVITY=      764** [redacted] COMPUTER CENTER **
********************************************************************************************************************************
XXGO   EXEC  PGM=*.LKED.SYSLMOD,COND=(4,LT,LKED)                    64000014
XXFT05F001 DD  DDNAME=SYSIN                                         72000014
//GO.FT06F001 DD SYSOUT=Z
X/FT06F001 DD  SYSOUT=A
XXFT07F001 DD  SYSOUT=B                                             80000014
//GO.SYSIN  DD *                                                    88000014
//SYSUDUMP DD SYSOUT=A
//
IEF236I ALLOC. FOR WNMEQI   GD       STEP1
IEF237I 231   ALLOCATED TO PGM=*.DD
IEF237I 232   ALLOCATED TO FT05F001
IEF237I 335   ALLOCATED TO FT06F001
IEF237I 334   ALLOCATED TO FT07F001
IEF237I 234   ALLOCATED TO SYSUDUMP
IEF285I   SYS70195.T150215.RF000.WNMEQI.GOSET                   PASSED
IEF285I   VOL SER NOS= CPE231.
IEF285I   SYS70195.T150215.RF000.WNMEQI.S0000215                SYSIN
IEF285I   VOL SER NOS= CPE232.
IEF285I   SYS70195.T150215.RF000.WNMEQI.S0000215                DELETED
IEF285I   VOL SER NOS= CPE232.
IEF285I   SYS70195.T150215.SF000.WNMEQI.R0000213                SYSOUT
IEF285I   VOL SER NOS= CPE335.
IEF285I   SYS70195.T150215.SF000.WNMEQI.R0000214                DELETED
IEF285I   VOL SER NOS= CPE334.
IEF285I   SYS70195.T150215.SF000.WNMEQI.R0000216                DELETED
IEF285I   VOL SER NOS= CPE234.
********************************************************************************************************************************
OS/360 RELEASE NO. 18    CURRENT DAY=195 TIME=15:38  JOB WNMEQI    STEP GO        RUN TIME=000472.48 SEC. CUML.JOB=000523.94 SEC. **
CPU TIME=000140.95 SEC.     WAIT TIME=000212.71 SEC.     IDLE TIME=000118.82 SEC.     I/O ACTIVITY=   13,682** [redacted] COMPUTER CENTER **
********************************************************************************************************************************
IEF285I   SYS70195.T150215.RF000.WNMEQI.GOSET                   DELETED
IEF285I   VOL SER NOS= CPE231.
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          COMPILER OPTIONS - NAME= EQTWO,OPT=02,LINECNT=56,SOURCE,EBCDIC,NOLIST,NODECK,LOAD,NOMAP,NOEDIT,ID,XREF
               C
               C   THIS VERSION CONTAINS VAR/C F, COUNTRY OPTION AND COMPUTER OPTION.
               C        PROGRAM DOES NOT INCLUDE DELTA LABOR.
               C        NOT CHANGED TO MINIMIZE CONTROLS YET!
               C        * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
  ISN 0002           DIMENSION ASPDTG(10)
  ISN 0003           REAL*8 FORMAT(8),PROCES(4),MIX,MODLS(3),SETS(2),CPT(4,2),SMPLT(9,5 7MAY
                    1),ONE,          DATA,CNTY(2),PATRIA(2)                              7MAY
  ISN 0004           REAL*8 CPTYPD,CPTYPM,MODELS(3),DS(2),SMPL(8),DATLIT,ORIGIN          7MAY
  ISN 0005           REAL*8 CDTITL,TITLE(8),PRCNT(8),PERCEN(8),PERTOT
  ISN 0006           REAL*8 A(8),B,   C,   D(8),E(8),POSCYC(8),PUTCYC(8),SFTPOS,SFTPUT
  ISN 0007           REAL*8 BC,D1,D2,D12,F(8)
  ISN 0008           REAL*8 G,H,H1,H2,I,I1,I2,J
  ISN 0009           REAL*8 SIGMAA,SIGMAB,SIGMAC,SIGMAD,SIGMAE,SIGMAO,SIGMAU,SIGMAF     1MAY
  ISN 0010           REAL*8 EOTHLP,X1,X23,X123,KEYBDS
  ISN 0011           DATA CNTY(1)/6HU.S.A./                                             7MAY
  ISN 0012           DATA CNTY(2)/6H U.K. /                                             7MAY
  ISN 0013           DATA CPT(1,1)/4HLINO/
  ISN 0014           DATA CPT(1,2)/4HTYPE/
  ISN 0015           DATA CPT(2,1)/4HMONO/
  ISN 0016           DATA CPT(2,2)/4HTYPE/
  ISN 0017           DATA CPT(3,1)/4HPHOT/
  ISN 0018           DATA CPT(3,2)/4HON  /
  ISN 0019           DATA CPT(4,1)/4HPH B/                                              7MAY
  ISN 0020           DATA CPT(4,2)/4HLNCE/                                              7MAY
  ISN 0021           DATA DATA/6HDATA: /
  ISN 0022           DATA FORMAT(1)/1HA/
  ISN 0023           DATA FORMAT(2)/1HB/
  ISN 0024           DATA FORMAT(3)/1HG/
  ISN 0025           DATA FORMAT(4)/1HH/
  ISN 0026           DATA FORMAT(5)/1HL/
  ISN 0027           DATA FORMAT(6)/1HP/
  ISN 0028           DATA FORMAT(7)/1HT/
  ISN 0029           DATA FORMAT(8)/1HY/
  ISN 0030           DATA MIX/4HMIX:/
  ISN 0031           DATA MODLS(1)/6HNO. OF/
  ISN 0032           DATA MODLS(2)/6H COMPU/
  ISN 0033           DATA MODLS(3)/6HTERS: /
  ISN 0034           DATA ONE/4HONE:/
  ISN 0035           DATA PATRIA(1)/1H /                                                7MAY
  ISN 0036           DATA PATRIA(2)/1HB/                                                7MAY
  ISN 0037           DATA PROCES(1)/1HL/
  ISN 0038           DATA PROCES(2)/1HM/
  ISN 0039           DATA PROCES(3)/1HP/
  ISN 0040           DATA PROCES(4)/1HB/                                                7MAY
  ISN 0041           DATA SETS(1)/6HDATA S/
  ISN 0042           DATA SETS(2)/6HETS:  /
  ISN 0043           DATA SMPLT(1,1)/6HGROUP /
  ISN 0044           DATA SMPLT(1,2)/6H      /
  ISN 0045           DATA SMPLT(1,3)/6H      /
  ISN 0046           DATA SMPLT(1,4)/6H      /
  ISN 0047           DATA SMPLT(1,5)/6H      /
  ISN 0048           DATA SMPLT(2,1)/6HPOLICY/
  ISN 0049           DATA SMPLT(2,2)/6H      /
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ISN 0050          DATA SMELT(2,3)/6H      /
ISN 0051          DATA SMPLT(2,4)/6H      /
ISN 0052          DATA SMPLT(2,5)/6H      /
ISN 0053          DATA SMPLT(3,1)/6HPRICES/
ISN 0054          DATA SMPLT(3,2)/6H AND T/
ISN 0055          DATA SMPLT(3,3)/6HHE PRO/
ISN 0056          DATA SMPLT(3,4)/6HDUCTIO/
ISN 0057          DATA SMPLT(3,5)/6HN PLAN/
ISN 0058          DATA SMPLT(4,1)/6HPLEIST/
ISN 0059          DATA SMPLT(4,2)/6HOCENE /
ISN 0060          DATA SMPLT(4,3)/6H      /
ISN 0061          DATA SMPLT(4,4)/6H      /
ISN 0062          DATA SMPLT(4,5)/6H      /
ISN 0063          DATA SMPLT(5,1)/6HAMERIC/
ISN 0064          DATA SMPLT(5,2)/6HAN BAR/
ISN 0065          DATA SMPLT(5,3)/6H      /
ISN 0066          DATA SMPLT(5,4)/6H      /
ISN 0067          DATA SMPLT(5,5)/6H      /
ISN 0068          DATA SMPLT(6,1)/6HHARDWA/
ISN 0069          DATA SMPLT(6,2)/6HRE DIR/
ISN 0070          DATA SMPLT(6,3)/6HECTORY/
ISN 0071          DATA SMPLT(6,4)/6H      /
ISN 0072          DATA SMPLT(6,5)/6H      /
ISN 0073          DATA SMPLT(7,1)/6HBOOK C/
ISN 0074          DATA SMPLT(7,2)/6HATALOG/
ISN 0075          DATA SMPLT(7,3)/6HUE    /
ISN 0076          DATA SMPLT(7,4)/6H      /
ISN 0077          DATA SMPLT(7,5)/6H      /
ISN 0078          DATA SMPLT(8,1)/6HTELEPH/
ISN 0079          DATA SMPLT(8,2)/6HONE DI/
ISN 0080          DATA SMPLT(8,3)/6HRECTOR/
ISN 0081          DATA SMPLT(8,4)/6HY     /
ISN 0082          DATA SMPLT(8,5)/6H      /
ISN 0083          DATA SMPLT(9,1)/6HMIX   /
ISN 0084          DATA SMPLT(9,2)/6H      /
ISN 0085          DATA SMPLT(9,3)/6H      /
ISN 0086          DATA SMPLT(9,4)/6H      /
ISN 0087          DATA SMPLT(9,5)/6H      /
ISN 0088          NEG = 1
ISN 0089          READ (5,100) MODELS(1),MODELS(2),MODELS(3),N
ISN 0090          IF (MODELS(1) .NE. MODLS(1)) GO TO 51
ISN 0092          IF (MODELS(2) .NE. MODLS(2)) GO TO 51
ISN 0094          IF (MODELS(3) .NE. MODLS(3)) GO TO 51
ISN 0096          DO 60 ILOOP=1,N
ISN 0097          READ (5,102)
ISN 0098          READ (5,104) DS(1),DS(2),NN
ISN 0099          IF (DS(1) .NE. SETS(1)) GO TO 52
ISN 0101          IF (DS(2) .NE. SETS(2)) GO TO 52
ISN 0103          DO 61 KMAC=1,NN
ISN 0104          WRITE (6,101)
ISN 0105          CALL SPDATE(ASPDTG)
ISN 0106          WRITE (6,505) (ASPDTG(JDTG),JDTG=4,10)
ISN 0107          WRITE (6,102)
ISN 0108          WRITE (6,105)
```

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            C        PAGE OVERFLOW NEEDED
ISN 0109          INGLE = 0
ISN 0110          READ(5,106) CDTITL,(TITLE(IJ),PRCNT(IJ),IJ=1,8),CPTYPM,NNN
ISN 0111          IF (CDTITL .EQ. ONE) GO TO 62
ISN 0113          IF (CDTITL .EQ. MIX) GO TO 63
ISN 0115          GO TO 53
ISN 0116       62 INGLE = 1
ISN 0117       63 PERTOT = DABS(PRCNT(1)+PRCNT(2)+PRCNT(3)+PRCNT(4)+PRCNT(5)+
                 1 PRCNT(6)+PRCNT(7)+PRCNT(8)-100.)
ISN 0118          IF (PERTOT .GT. 0.1) GO TO 54
ISN 0120        4 NDATA = 0
ISN 0121          DO 7 MN=1,8
ISN 0122        7 PERCEN(MN) = PRCNT(MN)/100.
ISN 0123          DO 9 JAY=1,NNN
ISN 0124          READ(5,108) DATLIT,CPTYPD,SMPL(JAY),A(JAY),B,     C,     D(JAY),
                 1 E(JAY),POSCYC(JAY),PUTCYC(JAY),SFTPOS,SFTPUT,F(JAY),ORIGIN,IBMRCA1MAY 12M
ISN 0125          IF (DATLIT .NE. DATA) GO TO 49
ISN 0127          NDATA = NDATA+1
ISN 0128          IF (CPTYPM .NE. CPTYPD) GO TO 56
ISN 0130          IF (NDATA-NNN) 9,9,57
ISN 0131        9 CONTINUE
ISN 0132          IF (ORIGIN .EQ. PATRIA(1)) GO TO 73                              7MAY
ISN 0134          IF (ORIGIN .EQ. PATRIA(2)) GO TO 74                              7MAY
ISN 0136          GO TO 49                                                         7MAY
ISN 0137       73 LAND = 1                                                         7MAY
ISN 0138          D1 = 0.0812
ISN 0139          GO TO 75                                                         7MAY
ISN 0140       74 LAND = 2                                                         7MAY
ISN 0141          D1 = 0.0263                                                      7MAYU.K
ISN 0142       75 D2 = 0.0054                                                      7MAY
ISN 0143          D12 = D1+D2
ISN 0144          IF (IBMRCA .EQ. 1) GO TO 600                                     12MAY
ISN 0146          DO 601 JAY=1,NNN                                                 12MAY
ISN 0147      601 F(JAY)=0.20                                                      12MAY
ISN 0148      600 SIGMAF = F(1)*PERCEN(1)+F(2)*PERCEN(2)+F(3)*PERCEN(3)+          1MAY 12M
                 1         F(4)*PERCEN(4)+F(5)*PERCEN(5)+F(6)*PERCEN(6)+          1MAY
                 2         F(7)*PERCEN(7)+F(8)*PERCEN(8)                          1MAY
ISN 0149           SIGMAA = A(1)*PERCEN(1)+A(2)*PERCEN(2)+A(3)*PERCEN(3)+
                 1         A(4)*PERCEN(4)+A(5)*PERCEN(5)+A(6)*PERCEN(6)+
                 2         A(7)*PERCEN(7)+A(8)*PERCEN(8)
ISN 0150           SIGMAB = B
ISN 0151           SIGMAC = C
ISN 0152           SIGMAD = D(1)*PERCEN(1)+D(2)*PERCEN(2)+D(3)*PERCEN(3)+
                 1         D(4)*PERCEN(4)+D(5)*PERCEN(5)+D(6)*PERCEN(6)+
                 2         D(7)*PERCEN(7)+D(8)*PERCEN(8)
ISN 0153           SIGMAE = E(1)*PERCEN(1)+E(2)*PERCEN(2)+E(3)*PERCEN(3)+
                 1         E(4)*PERCEN(4)+E(5)*PERCEN(5)+E(6)*PERCEN(6)+
                 2         E(7)*PERCEN(7)+E(8)*PERCEN(8)
ISN 0154           SIGMAO = POSCYC(1)*PERCEN(1)+POSCYC(2)*PERCEN(2)+
                 1         POSCYC(3)*PERCEN(3)+POSCYC(4)*PERCEN(4)+
                 2         POSCYC(5)*PERCEN(5)+POSCYC(6)*PERCEN(6)+
                 3         POSCYC(7)*PERCEN(7)+POSCYC(8)*PERCEN(8)
ISN 0155           SIGMAU = PUTCYC(1)*PERCEN(1)+PUTCYC(2)*PERCEN(2)+
                 1         PUTCYC(3)*PERCEN(3)+PUTCYC(4)*PERCEN(4)+
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                     2         PUTCYC(5)*PERCEN(5)+PUTCYC(6)*PERCEN(6)+
                     3         PUTCYC(7)*PERCEN(7)+PUTCYC(8)*PERCEN(8)
ISN 0156              BC = SIGMAB+SIGMAC
ISN 0157              BOTHLF = SIGMAA-SIGMAD*D12-SIGMAE*D12-SIGMAF                    1MAY
ISN 0158              IF (BOTHLF-0.) 3,50,3
                   C     FUTURE: MAKE LABEL 50 A SUBROUTINE ENTRY POINT
ISN 0159            3 X1 = BC/BOTHLF
ISN 0160              IF (SIGMAO .GT. SIGMAU) GO TO 700                             12MAY
ISN 0162              IF ((X1*SIGMAU) .GT. 72300.) GO TO 710                        12MAY
ISN 0164              GO TO 701                                                     12MAY
ISN 0165          700 IF ((X1*SIGMAO) .GT. 72300.) GO TO 710                        12MAY
ISN 0167          701 IF (X1-(10560./SIGMAO)) 1,1,2                                 12MAY
ISN 0168            1 IF (SIGMAU .EQ. 0.) GO TO 10
ISN 0170              IF (X1-(10560./SIGMAU)) 10,10,14
ISN 0171            2 IF (SIGMAU .EQ. 0.) GO TO 15
ISN 0173              IF (X1-(10560./SIGMAU)) 15,15,25
                   C     * * * * * * * * * * * * * * * * * * * * * *
                   C   ALL LIMITS ARE WITH RESPECT TO PAGES ONLY
                   C     * * * * * * * * * * * * * * * * * * * * * *
                   C     COMPUTER LIMITING:
ISN 0174           14 LIMIT = 1
ISN 0175              G=10560./SIGMAU
ISN 0176              H=SIGMAB
ISN 0177              I=SIGMAC
ISN 0178              H1=SIGMAU
                   C                    FOR RCA SPECTRA, EXTRA SHIFT MACHINE COST = ZERO
ISN 0179              H2=SFTPUT
ISN 0180              J=G
ISN 0181              XF = 10560./SIGMAO
ISN 0182              I1 = 0.
ISN 0183              I2 = 0.
ISN 0184              ISWT = 1
                   C     END OF ROUTINE.
ISN 0185              GO TO 46
                   C     COMPOSER LIMITING:
ISN 0186           15 LIMIT = 2
ISN 0187              G=10560./SIGMAO
ISN 0188              H=SIGMAC
ISN 0189              I=SIGMAB
ISN 0190              H1=SIGMAO
ISN 0191              H2=SFTPOS
ISN 0192              J=G
ISN 0193              IF (SIGMAU .NE. 0.) GO TO 350
                   C     ONE MILLION IS USED SO THAT XF WILL ALWAYS BE .GT. X123
ISN 0195              XF = 1000000.
ISN 0196              GO TO 351
ISN 0197          350 XF = 10560./SIGMAU
ISN 0198          351 I1 = 0.
ISN 0199              I2 = 0.
ISN 0200              ISWT = 2
                   C     END OF ROUTINE.
ISN 0201              GO TO 46
                   C     BOTH COMPUTER & COMPOSER LIMITING:
ISN 0202           25 LIMIT = 3
```

```
ISN 0203          IF (SIGMAU-SIGMAO) 30,30,16
                C              COMPOSER MORE LIMITING:
ISN 0204       30 G=10560./SIGMAU
ISN 0205          H=SIGMAC
ISN 0206          I=SIGMAB
ISN 0207          H1=SIGMAO
ISN 0208          H2=SPTPOS
ISN 0209          J=10560./SIGMAO
ISN 0210          I1=SIGMAU
ISN 0211          I2=SPTPUT
ISN 0212          ISWT = 3                                                    8MAY
                C              END OF SUBROUTINE.
ISN 0213          GO TO 46
                C              COMPUTER MORE LIMITING:
ISN 0214       16 G=10560./SIGMAO
ISN 0215          H=SIGMAB
ISN 0216          I=SIGMAC
ISN 0217          H1=SIGMAU
ISN 0218          H2=SPTPUT
ISN 0219          J=10560./SIGMAU
ISN 0220          I1=SIGMAO
ISN 0221          I2=SPTPOS
ISN 0222          ISWT = 3
                C              END OF SUBROUTINE.
                C          END OF ROUTINE.
ISN 0223       46 X23 = (H+I+H1*H2*(G-J)+SIGMAF*G+SIGMAD*D12*G+SIGMAE*D12*G-SIGMAA* 1MAY
                  1 G ) / (SIGMAA-H1*H2-I1*I2-SIGMAP-SIGMAD*D12-SIGMAE*D12)       1MAY
ISN 0224          X123 = G+X23
ISN 0225          IF (SIGMAO .GT. SIGMAU) GO TO 702                           18MAY
ISN 0227          IF ((X123*SIGMAU) .GT. 72300.) GO TO 710                    18MAY
ISN 0229          GO TO 703                                                   18MAY
ISN 0230      702 IF ((X123*SIGMAO) .GT. 72300.) GO TO 710                    20MAY
ISN 0232      703 IF (ISWT .EQ. 3) GO TO 305                                  8MAY18M
ISN 0234          IF (X123 .LE. XF) GO TO 305
ISN 0236          GO TO (300,301),     ISWT
ISN 0237          GO TO 71                                                    8MAY
ISN 0238      300 I1 = SIGMAO
ISN 0239          I2=SPTPOS
ISN 0240          GO TO 304
ISN 0241      301 I1 = SIGMAU
ISN 0242          I2=SPTPUT
ISN 0243      304 X23 = (H+I+H1*H2*(G-J)+SIGMAF*G+SIGMAD*D12*G+SIGMAE*D12*G-SIGMAA* 1MAY
                  1 G ) / (SIGMAA-H1*H2-I1*I2-SIGMAP-SIGMAD*D12-SIGMAE*D12)       1MAY
ISN 0244          X123 = G+X23
ISN 0245          IF (SIGMAO .GT. SIGMAU) GO TO 704                           18MAY
ISN 0247          IF ((X123*SIGMAU) .GT. 72300.) GO TO 710                    18MAY
ISN 0249          GO TO 305                                                   18MAY
ISN 0250      704 IF ((X123*SIGMAO) .GT. 72300.) GO TO 710                    20MAY
ISN 0252      305 KEYBDS = X123*(SIGMAD+SIGMAE)/10560.
ISN 0253          GO TO 400
ISN 0254       10 LIMIT = 4
ISN 0255          KEYBDS = X1*(SIGMAI+SIGMAE)/10560.
ISN 0256          X123 = X1
ISN 0257          GO TO 400                                                   12MAY
```

```
ISN 0258       710 NEG = 0                                                    12MAY
ISN 0259       400 IF (CPTYPM .EQ. PROCES(1)) GO TO 21
ISN 0261           IF (CPTYPM .EQ. PROCES(2)) GO TO 22
ISN 0263           IF (CPTYPM .EQ. PROCES(3)) GO TO 23
ISN 0265           IF (CPTYPM .EQ. PROCES(4)) GO TO 26                        7MAY
ISN 0267           GO TO 59
ISN 0268        21 II = 1
ISN 0269           GO TO 24
ISN 0270        22 II = 2
ISN 0271           GO TO 24
ISN 0272        23 II = 3
ISN 0273           GO TO 24                                                   7MAY
ISN 0274        26 II = 4                                                     7MAY
ISN 0275        24 IF (SMPL(1) .NE. SMPL(NNN)) GO TO 39
ISN 0277           IF (SMPL(1) .EQ. FORMAT(1)) GO TO 31
ISN 0279           IF (SMPL(1) .EQ. FORMAT(2)) GO TO 32
ISN 0281           IF (SMPL(1) .EQ. FORMAT(3)) GO TO 33
ISN 0283           IF (SMPL(1) .EQ. FORMAT(4)) GO TO 34
ISN 0285           IF (SMPL(1) .EQ. FORMAT(5)) GO TO 35
ISN 0287           IF (SMPL(1) .EQ. FORMAT(6)) GO TO 36
ISN 0289           IF (SMPL(1) .EQ. FORMAT(7)) GO TO 37
ISN 0291           IF (SMPL(1) .EQ. FORMAT(8)) GO TO 38
ISN 0293           GO TO 70
ISN 0294        31 JJ = 5
ISN 0295           GO TO 40
ISN 0296        32 JJ = 7
ISN 0297           GO TO 40
ISN 0298        33 JJ = 1
ISN 0299           GO TO 40
ISN 0300        34 JJ = 6
ISN 0301           GO TO 40
ISN 0302        35 JJ = 3
ISN 0303           GO TO 40
ISN 0304        36 JJ = 4
ISN 0305           GO TO 40
ISN 0306        37 JJ = 8
ISN 0307           GO TO 40
ISN 0308        38 JJ = 2
ISN 0309           GO TO 40
ISN 0310        39 JJ = 9
ISN 0311        40 WRITE (6,107) (CPT(II,KK),KK=1,2),(SMPLT(JJ,KK),KK=1,5)
ISN 0312           GO TO (90,91,92,193), LIMIT                                18MAY
ISN 0313        90 WRITE (6,113)
ISN 0314           GO TO 193                                                  18MAY
ISN 0315        91 WRITE (6,115)
ISN 0316           GO TO 193                                                  18MAY
ISN 0317        92 WRITE (6,117)
ISN 0318       193 IF (NEG .EQ. 1) GO TO 93                                   12MAY18
ISN 0320           WRITE (6,751)                                              12MAY
ISN 0321           NEG = 1                                                    12MAY
ISN 0322           GO TO 43                                                   12MAY
ISN 0323        93 IF (INGIE-1) 41,42,71
ISN 0324        41 WRITE (6,109) X123,KEYEDS,X1
ISN 0325           GO TO 43
```

```
ISN 0326        42 WRITE (6,109) X123,KEYBDS,X1
ISN 0327           GO TO 64                                                    18MAY
ISN 0328        43 IF (JJ-9) 64,55,64                                          7MAY
ISN 0329        55 WRITE(6,111) (TITLE(IL),PRCNT(IL),IL=1,8)
ISN 0330        64 WRITE (6,199) CNTY(LAND)                                    7MAY
ISN 0331        61 WRITE (6,201) (CPT(II,KK),KK=1,2), (SMPLT(JJ,KK),KK=1,5),(A(JAY),  7MAY
                  1 B,C,D(JAY),D1,D2,E(JAY),F(JAY),     POSCYC(JAY),PUTCYC(JAY),     1MAY
                  2 SFTPOS,SFTPUT,JAY=1,NNN)
ISN 0332        60 CONTINUE
ISN 0333           GO TO 88
ISN 0334        49 WRITE (6,949)
ISN 0335           GO TO 88
ISN 0336        50 WRITE (6,950)
ISN 0337           GO TO 88
ISN 0338        51 WRITE (6,951)
ISN 0339           GO TO 88
ISN 0340        52 WRITE (6,952)
ISN 0341           GO TO 88
ISN 0342        53 WRITE (6,953)
ISN 0343           GO TO 88
ISN 0344        54 WRITE (6,954)
ISN 0345           GO TO 88
ISN 0346        56 WRITE (6,956)
ISN 0347           GO TO 88
ISN 0348        57 WRITE (6,957)
ISN 0349           GO TO 88
ISN 0350        59 WRITE (6,959)
ISN 0351           GO TO 88
ISN 0352        70 WRITE (6,970)
ISN 0353           GO TO 88
ISN 0354        71 WRITE (6,971)
ISN 0355        88 STOP
ISN 0356       100 FORMAT (3A6,I2)
ISN 0357       102 FORMAT (50H                                                )
ISN 0358       104 FORMAT (2A6,I2)
ISN 0359       106 FORMAT (A4,8(A1,X,F4.1,2X),A1,I1)
ISN 0360       108 FORMAT (A6,2A1,F7.0,2F8.0,4F6.0,3F5.0,6X,A1,I1)                1MAY 12M
ISN 0361       101 FORMAT (1H1,29X,'COMPARISON OF COMPOSING PROCESSES: CRT PHOTOCOMPO
                  1SITION VS. CONVENTIONAL'/39X,'BASED ON A PURCHASED COMPUTER  (EQUA
                  2TIONS IIA & IIB)')
ISN 0362       105 FORMAT (1H0/1X,'CONVENTICNAL PROCESS',10X,'SAMPLE',28X,'BREAKEVEN:
                  1'//65X,'PAGES',10X,'KEYBOARDS',10X,'FIRST SHIFT PAGES')
ISN 0363       107 FORMAT (5X,2A4,17X,5A6)
ISN 0364       109 FORMAT (1H ,61X,F10.2,4X,F10.2,14X,F10.2/1H0)
ISN 0365       111 FORMAT (1H  ////1X,'MIX=',8(A1,'(',F4.1,'%),'))
ISN 0366       113 FORMAT (40X,'COMPUTER LIMITING!')
ISN 0367       115 FORMAT (40X,'COMPOSER LIMITING!')
ISN 0368       117 FORMAT (44X,'BOTH LIMITING!')
ISN 0369       199 FORMAT (1H0///37X,'(',A6,')')                               7MAY
ISN 0370       201 FORMAT (1H+,    'DATA FOR THE ABOVE ARE AS FOLLOWS:'//6X,2A4,6X,5A 7MAY
                  16///4X,'A',8X,'B',9X,'C',9X,'D',6X,'D1',6X,'D2',6X,'E',7X,'F',4X,'
                  2POSCYC',2X,'PUTCYC',2X,'SFTPOS',2X,'SFTPUT'//(X,F7.4,2X,2(F8.2,2X)
                  3 ,F6.2,2X,2(F6.4,2X),F6.2,2X,3(F6.4,2X),2(F5.4,2X)))
ISN 0371       505 FORMAT (1H+,103X,7A4///)
```

```
ISN 0372        751 FORMAT (1H ,65X,'NEGATIVE')
ISN 0373        949 FORMAT (1HO///X,'DATA CARD INVALID')
ISN 0374        950 FORMAT (1HO///X,'X EQUALS ZERO!')
ISN 0375        951 FORMAT (1HO///X,'NO. CARD INVALID')
ISN 0376        952 FORMAT (1HO///X,'SET CARD INVALID')
ISN 0377        953 FORMAT (1HO///X,'TITLE CARD INVALID')
ISN 0378        954 FORMAT (1HO///X,'PERCENTAGES INVALID')
ISN 0379        956 FORMAT (1HO///X,'PROCESSES MIXED')
ISN 0380        957 FORMAT (1HO///X,'TOO MUCH DATA')
ISN 0381        959 FORMAT (1HO///X,'TYPE CODE INVALID')
ISN 0382        970 FORMAT (1HO///X,'SAMPLE CODE INVALID')
ISN 0383        971 FORMAT (1HO///X,'SWITCH-2 ERROR')
ISN 0384            END
```

SYMBOL	INTERNAL STATEMENT NUMBERS																	
A	0006	0124	0149	0149	0149	0149	0149	0149	0149	0331								
B	0006	0124	0150	0331														
C	0006	0124	0151	0331														
D	0006	0124	0152	0152	0152	0152	0152	0152	0152	0152	0331							
E	0006	0124	0153	0153	0153	0153	0153	0153	0153	0153	0331							
F	0007	0124	0147	0148	0148	0148	0148	0148	0148	0148	0148	0331						
G	0008	0175	0180	0187	0192	0204	0214	0223	0223	0223	0223	0223	0224	0243	0243	0243	0243	0243	0244
H	0008	0176	0188	0205	0215	0223	0243											
I	0008	0177	0189	0206	0216	0223	0243											
J	0008	0180	0192	0209	0219	0223	0243											
N	0089	0096																
BC	0007	0156	0159															
DS	0004	0098	0098	0099	0101													
D1	0007	0138	0141	0143	0331													
D2	0007	0142	0143	0331														
H1	0008	0178	0190	0207	0217	0223	0223	0243	0243									
H2	0008	0179	0191	0208	0218	0223	0223	0243	0243									
II	0268	027C	0272	0274	0311	0331												
IJ	0110	0110	0110	0110														
IL	0329	0329	0329	0329														
I1	0008	0182	0198	0210	0220	0223	0238	0241	0243									
I2	0008	0183	0199	0211	0221	0223	0239	0242	0243									
JJ	0294	0296	0298	0300	0302	0304	0306	0308	0310	0311	0328	0331						
KK	0311	0311	0311	0311	0311	0311	0331	0331	0331	0331	0331	0331						
MN	0121	0122	0122															
NN	0098	0103																
XP	0181	0195	0197	0234														
X1	0010	0159	0162	0165	0167	0170	0173	0255	0256	0324	0326							
CPT	0003	0013	0014	0015	0016	0017	0018	0019	0020	0311	0331							
D12	0007	0143	0157	0157	0223	0223	0223	0223	0243	0243	0243	0243						
JAY	0123	0124	0124	0124	0124	0124	0124	0124	0146	0147	0331	0331	0331	0331	0331	0331	0331	0331
MIX	0003	0030	0113															
NEG	0088	0258	0318	0321														
NNN	0110	0123	0130	0146	0275	0331												
ONE	0003	0034	0111															
X23	0010	0223	0224	0243	0244													
CNTY	0003	0011	0012	0330														
DABS	0117																	
DATA	0003	0021	0125															
ISWT	0184	0200	0212	0222	0232	0236												
JDTG	0106	0106	0106															
KMAC	0103																	
LAND	0137	0140	0330															
SETS	0003	0041	0042	0099	0101													
SMPL	0004	0124	0275	0275	0277	0279	0281	0283	0285	0287	0289	0291						
X123	0010	0224	0227	0230	0234	0244	0247	0250	0252	0256	0324	0326						
ILOOP	0096																	
INGLE	0109	0116	0323															
LIMIT	0174	0186	0202	0254	0312													
MODLS	0003	0031	0032	0033	0090	0092	0094											
NDATA	0120	0127	0127	0130														
PRCNT	0005	0110	0117	0117	0117	0117	0117	0117	0117	0117	0122	0329						

SYMBOL	INTERNAL STATEMENT NUMBERS																	
SMPLT	0003	0043	0044	0045	0046	0047	0048	0049	0050	0051	0052	0053	0054	0055	0056	0057	0058	0059	0060
	0061	0062	0063	0064	0065	0066	0067	0068	0069	0070	0071	0072	0073	0074	0075	0076	0077	0078	0079
	0080	0081	0082	0083	0084	0085	0086	0087	0311	0331									
TITLE	0005	0110	0329																
ASPDTG	0002	0105	0106																
BOTHLF	0010	0157	0158	0159															
CDTITL	0005	0110	0111	0113															
CPTYPD	0004	0124	0128																
CPTYPM	0004	0110	0128	0259	0261	0263	0265												
DATLIT	0004	0124	0125																
FORMAT	0003	0022	0023	0024	0025	0026	0027	0028	0029	0277	0279	0281	0283	0285	0287	0289	0291		
IBMRCA	0124	0144																	
KEYBDS	0010	0252	0255	0324	0326														
MODELS	0004	0089	0089	0089	0090	0092	0094												
ORIGIN	0004	0124	0132	0134															
PATRIA	0003	0035	0036	0132	0134														
PERCEN	0005	0122	0148	0148	0148	0148	0148	0148	0148	0148	0149	0149	0149	0149	0149	0149	0149	0149	0152
	0152	0152	0152	0152	0152	0152	0152	0153	0153	0153	0153	0153	0153	0153	0153	0154	0154	0154	0154
	0154	0154	0154	0154	0155	0155	0155	0155	0155	0155	0155	0155							
PERTOT	0005	0117	0118																
POSCYC	0006	0124	0154	0154	0154	0154	0154	0154	0154	0154	0331								
PROCES	0003	0037	0038	0039	0040	0259	0261	0263	0265										
PUTCYC	0006	0124	0155	0155	0155	0155	0155	0155	0155	0155	0331								
SFTPOS	0006	0124	0191	0208	0221	0239	0331												
SFTPUT	0006	0124	0179	0211	0218	0242	0331												
SIGMAA	0009	0149	0157	0223	0223	0243	0243												
SIGMAB	0009	0150	0156	0176	0189	0206	0215												
SIGMAC	0009	0151	0156	0177	0188	0205	0216												
SIGMAD	0009	0152	0157	0223	0223	0243	0243	0252	0255										
SIGMAE	0009	0153	0157	0223	0223	0243	0243	0252	0255										
SIGMAF	0009	0148	0157	0223	0223	0243	0243												
SIGMAO	0009	0154	0160	0165	0167	0181	0187	0190	0203	0207	0209	0214	0220	0225	0230	0238	0245	0250	
SIGMAU	0009	0155	0160	0162	0168	0170	0171	0173	0175	0178	0193	0197	0203	0204	0210	0217	0219	0225	0227
	0241	0245	0247																
SPDATE	0105																		

LABEL	DEFINED	REFERENCES										
1	0168	0167	0167									
2	0171	0167										
3	0159	0158	0158									
4	0120											
7	0122	0121										
9	0131	0123	0130	0130								
10	0254	0168	0170	0170								
14	0174	0170										
15	0186	0171	0173	0173								
16	0214	0203										
21	0268	0259										
22	0270	0261										
23	0272	0263										
24	0275	0269	0271	0273								
25	0202	0173										
26	0274	0265										
30	0204	0203	0203									
31	0294	0277										
32	0296	0279										
33	0298	0281										
34	0300	0283										
35	0302	0285										
36	0304	0287										
37	0306	0289										
38	0308	0291										
39	0310	0275										
40	0311	0295	0297	0299	0301	0303	0305	0307	0309			
41	0324	0323										
42	0326	0323										
43	0328	0322	0325									
46	0223	0185	0201	0213								
49	0334	0125	0136									
50	0336	0158										
51	0338	0090	0092	0094								
52	0340	0099	0101									
53	0342	0115										
54	0344	0118										
55	0329	0328										
56	0346	0128										
57	0348	0130										
59	0350	0267										
60	0332	0096										
61	0331	0103										
62	0116	0111										
63	0117	0113										
64	0330	0327	0328	0328								
70	0352	0293										
71	0354	0237	0323									
73	0137	0132										
74	0140	0134										
75	0142	0139										
88	0355	0333	0335	0337	0339	0341	0343	0345	0347	0349	0351	0353

LABEL	DEFINED	REFERENCES
90	0313	0312
91	0315	0312
92	0317	0312
93	0323	0318
100	0356	0089
101	0361	0104
102	0357	0097 0107
104	0358	0098
105	0362	0108
106	0359	0110
107	0363	0311
108	0360	0124
109	0364	0324 0326
111	0365	0329
113	0366	0313
115	0367	0315
117	0368	0317
193	0318	0312 0314 0316
199	0369	0320
201	0370	0331
300	0238	0236
301	0241	0236
304	0243	0240
305	0252	0232 0234 0249
350	0197	0193
351	0198	0196
400	0259	0253 0257
505	0371	0106
600	0148	0144
601	0147	0146
700	0165	0160
701	0167	0164
702	0230	0225
703	0232	0229
704	0250	0245
710	0258	0162 0165 0227 0230 0247 0250
751	0372	0320
949	0373	0334
950	0374	0336
951	0375	0338
952	0376	0340
953	0377	0342
954	0378	0344
956	0379	0346
957	0380	0348
959	0381	0350
970	0382	0352
971	0383	0354

OPTIONS IN EFFECT NAME= EQTWO,OPT=02,LINECNT=56

OPTIONS IN EFFECT SOURCE,EBCDIC,NOLIST,NODECK,LOAD,NOMAP,NOEDIT,ID,XREF

STATISTICS SOURCE STATEMENTS = 383 ,PROGRAM SIZE = 7288

STATISTICS NO DIAGNOSTICS GENERATED

****** END OF COMPILATION ******

F88-LEVEL LINKAGE EDITOR OPTIONS SPECIFIED MAP,LET,LIST

VARIABLE OPTIONS USED - SIZE=(102400,16384) DEFAULT OPTION(S) USED

MODULE MAP

CONTROL SECTION

NAME	ORIGIN	LENGTH
EQTWO	00	1C78
IHCECOMH*	1C78	F31
IHCCOMH2*	2BB0	581
SPDATE *	3138	346
IHCFCVTH*	3480	1195
IHCEFNTH*	4618	512
IHCEFIOS*	4B30	129C
IHCUOPT *	5DD0	328
IHCERRM *	60F8	5BC
IHCUATBL*	66B8	638
IHCETRCH*	6CF0	28E

ENTRY

NAME	LOCATION	NAME	LOCATION	NAME	LOCATION	NAME	LOCATION
IBCOM#	1C78	FDIOCS#	1D34	INTSWTCH	2B96		
SEQDASD	2E4C						
ADCON#	3480	FCVAOUTP	352A	FCVLOUTP	35BA	FCVZOUTP	370A
FCVIOUTP	3AB0	FCVEOUTP	3FB2	FCVCOUTP	41CC	INT6SWCH	44B3
ARITH#	4618	ADJSWTCH	4984				
FIOCS#	4B30	FIOCSBEP	4B36				
ERRMON	60F8	IHCERRE	6110				
IHCTRCH	6CF0	ERRTRA	6CF8				

ENTRY ADDRESS 00
TOTAL LENGTH 6F80

****MAIN DOES NOT EXIST BUT HAS BEEN ADDED TO DATA SET

```
IEF285I   SYS1.FORTLIB                                    KEPT
IEF285I   VOL SER NOS= CPERES.
IEF285I   SYS1.LINKLIB                                    KEPT
IEF285I   VOL SER NOS= CPELNK.
IEF285I   SYS70195.T162525.SF000.WNMEQII.R0000082         SYSOUT
IEF285I   VOL SER NOS= CPE335.
IEF285I   SYS70195.T162525.RF000.WNMEQII.S0000083         SYSIN
IEF285I   VOL SER NOS= CPE232.
IEF285I   SYS70195.T162525.RF000.WNMEQII.S0000083         DELETED
IEF285I   VOL SER NOS= CPE232.
IEF285I   SYS70195.T162525.RF000.WNMEQII.GOSET            PASSED
IEF285I   VOL SER NOS= CPE330.
IEF285I   SYS70195.T162525.RF000.WNMEQII.SYSUT1           DELETED
IEF285I   VOL SER NOS= CPE232.
********************************************************************************************************************************
OS/360 RELEASE NO. 18    CURRENT DAY=195 TIME=17:22  JOB WNMEQII   STEP LKED      RUN TIME=000038.70 SEC. CUML.JOB=00003B.70 SEC. **
CPU TIME=000003.62 SEC.     WAIT TIME=000026.59 SEC.     IDLE TIME=000008.49 SEC.     I/O ACTIVITY=      772**EES COMPUTER CENTER **
********************************************************************************************************************************
XXGO  EXEC  PGM=*.LKED.SYSLMOD,COND=(4,LT,LKED)                          64000014
XXFT05F001 DD  DDNAME=SYSIN                                              72000014
//GO.FT06F001 DD SYSOUT=Z
X/FT06F001 DD  SYSOUT=A                                                  80000014
XXFT07F001 DD  SYSOUT=B                                                  88000014
//GO.SYSIN  DD *
//
IEF236I ALLOC. FOR WNMEQII  GO      STEP1
IEF237I 330   ALLOCATED TO PGM=*.DD
IEF237I 232   ALLOCATED TO FT05F001
IEF237I 235   ALLOCATED TO FT06F001
IEF237I 335   ALLOCATED TO FT07F001
IEF285I   SYS70195.T162525.RF000.WNMEQII.GOSET            PASSED
IEF285I   VOL SER NOS= CPE330.
IEF285I   SYS70195.T162525.RF000.WNMEQII.S0000086         SYSIN
IEF285I   VOL SER NOS= CPE232.
IEF285I   SYS70195.T162525.RF000.WNMEQII.S0000086         DELETED
IEF285I   VOL SER NOS= CPE232.
IEF285I   SYS70195.T162525.SF000.WNMEQII.R0000084         SYSOUT
IEF285I   VOL SER NOS= CPE235.
IEF285I   SYS70195.T162525.SF000.WNMEQII.R0000085         DELETED
IEF285I   VOL SER NOS= CPE335.
********************************************************************************************************************************
OS/360 RELEASE NO. 18    CURRENT DAY=195 TIME=17:28  JOB WNMEQII   STEP GO        RUN TIME=000385.23 SEC. CUML.JOB=000428.03 SEC. **
CPU TIME=000079.00 SEC.     WAIT TIME=000272.76 SEC.     IDLE TIME=000033.47 SEC.     I/O ACTIVITY=     9,422**EES COMPUTER CENTER **
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IEF285I   SYS70195.T162525.RF000.WNMEQII.GOSET            DELETED
IEF285I   VOL SER NOS= CPE330.
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APPENDIX V. COOPERATING FIRMS AND PRINCIPALS

RCA Graphic Systems Division	Mr. N. Richard Miller.
Mergenthaler Linotype Company	Mr. Victor Corrado.
Harris Intertype Corporation	Dr. Edwin R. Kolb.
Crosfield Electronics Ltd	Mr. Brian Mulholland.
Linotype-Paul Ltd	Mr. Edward S. Emery.
Richard Clay (The Chaucer Press) Ltd	Mr. Roderick Boyd.
U.S. Government Printing Office	Mr. John J. Boyle.
Her Majesty's Stationery Office	Mr. James P. Turner.
	Mr. James McCausland.
	Mr. Arthur Phillips.
	Mr. Kenneth Allen.
	Mr. Norman Frost.
Northumberland Press Ltd	Mr. G. Aitken.
Kynoch Press Ltd	Mr. S. A. Pace.
British Federation of Master Printers	Mr. Henry Kendall.
Typesetters Inc	Mr. Harold Zalesch.
William Clowes & Sons Ltd	Mr. M. K. Feavyour.
Computer Typesetting Research Project—University of Newcastle-upon-Tyne.	Mr. C. J. Duncan.
	Dr. Lindsey Molyneux.
Sun Printers Ltd	Mr. F. E. J. Rothwell.
Petty and Sons Ltd	Mr. H. Tolson.

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