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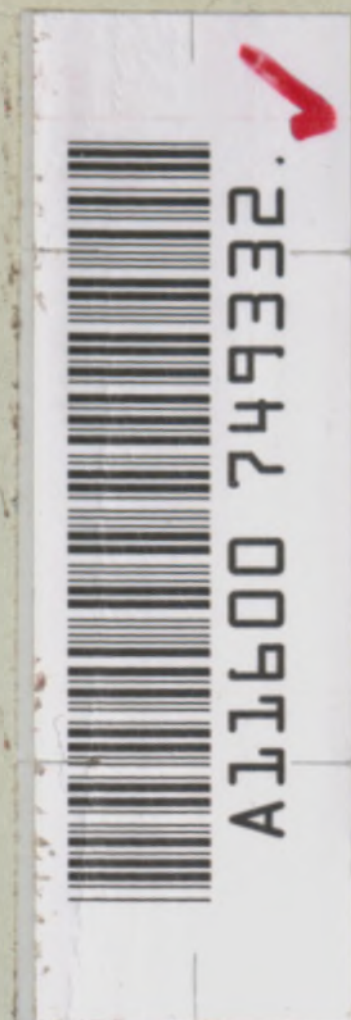
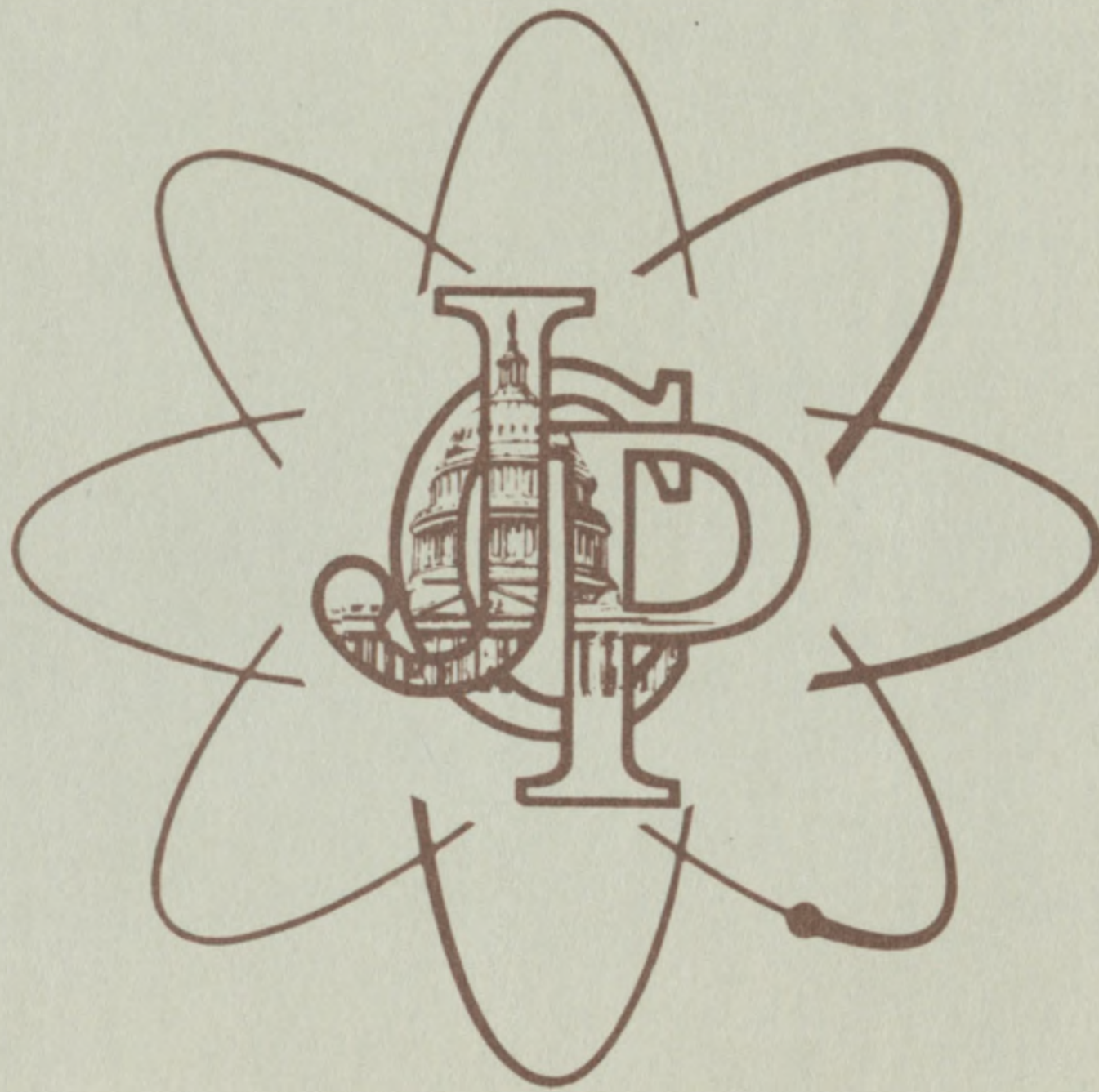
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# ELECTRONIC COMPOSITION Cost Comparison



Published by the  
Joint Committee on Printing  
United States Congress  
*October 1970*







# 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



*LC cd no. 76-609 538*

UNITED STATES GOVERNMENT PRINTING OFFICE

WASHINGTON, D.C. : 1970



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## FOREWORD

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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.

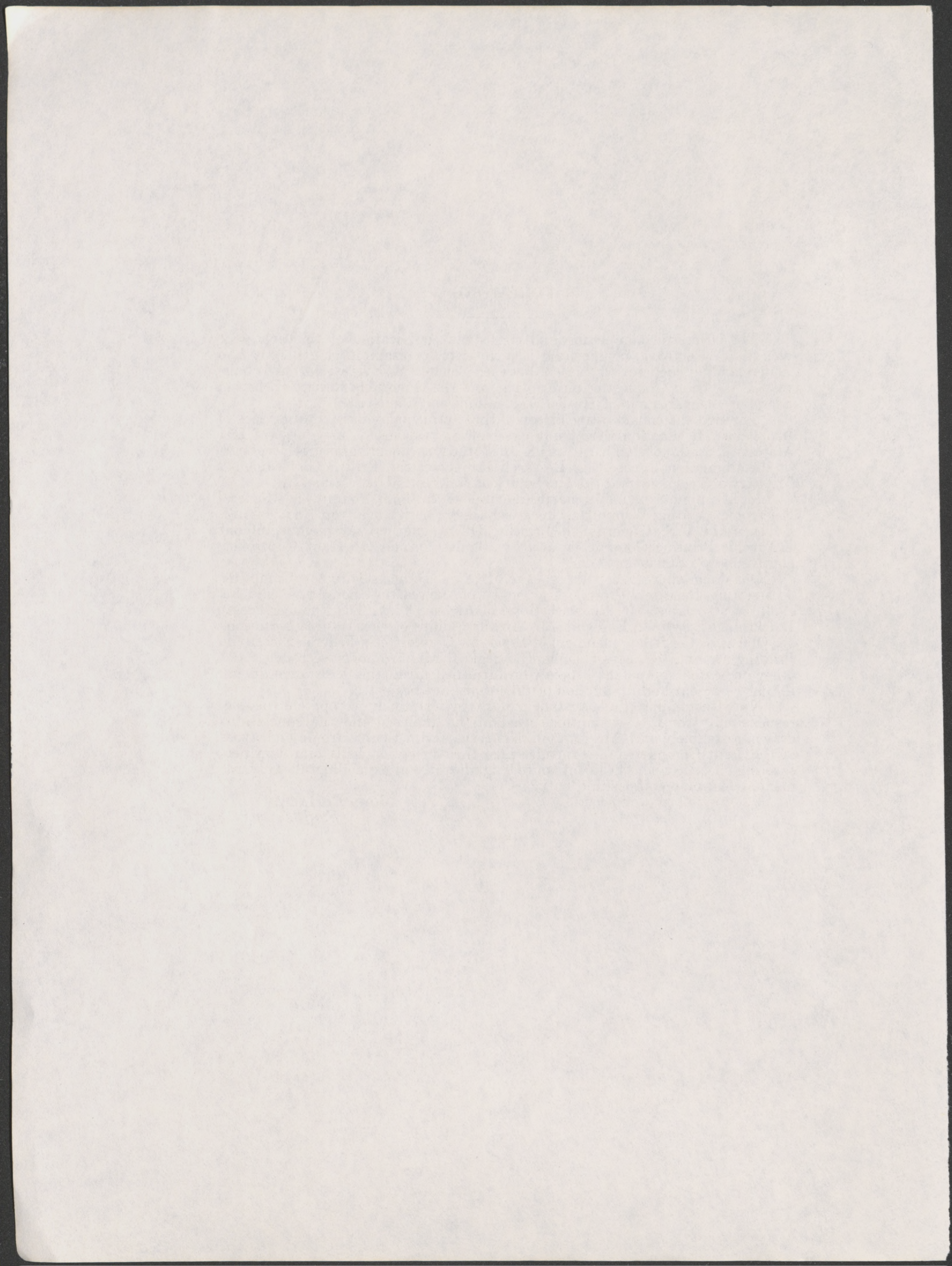
Mr. Lannon, a valuable charter member of the Joint Committee's Federal Electronic Printing Committee, received timely assistance from Mr. John J. Boyle of the U.S. Government Printing Office, another key member of our Electronic Printing Committee; and Mr. James Turner, Assistant Controller, Her Majesty's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







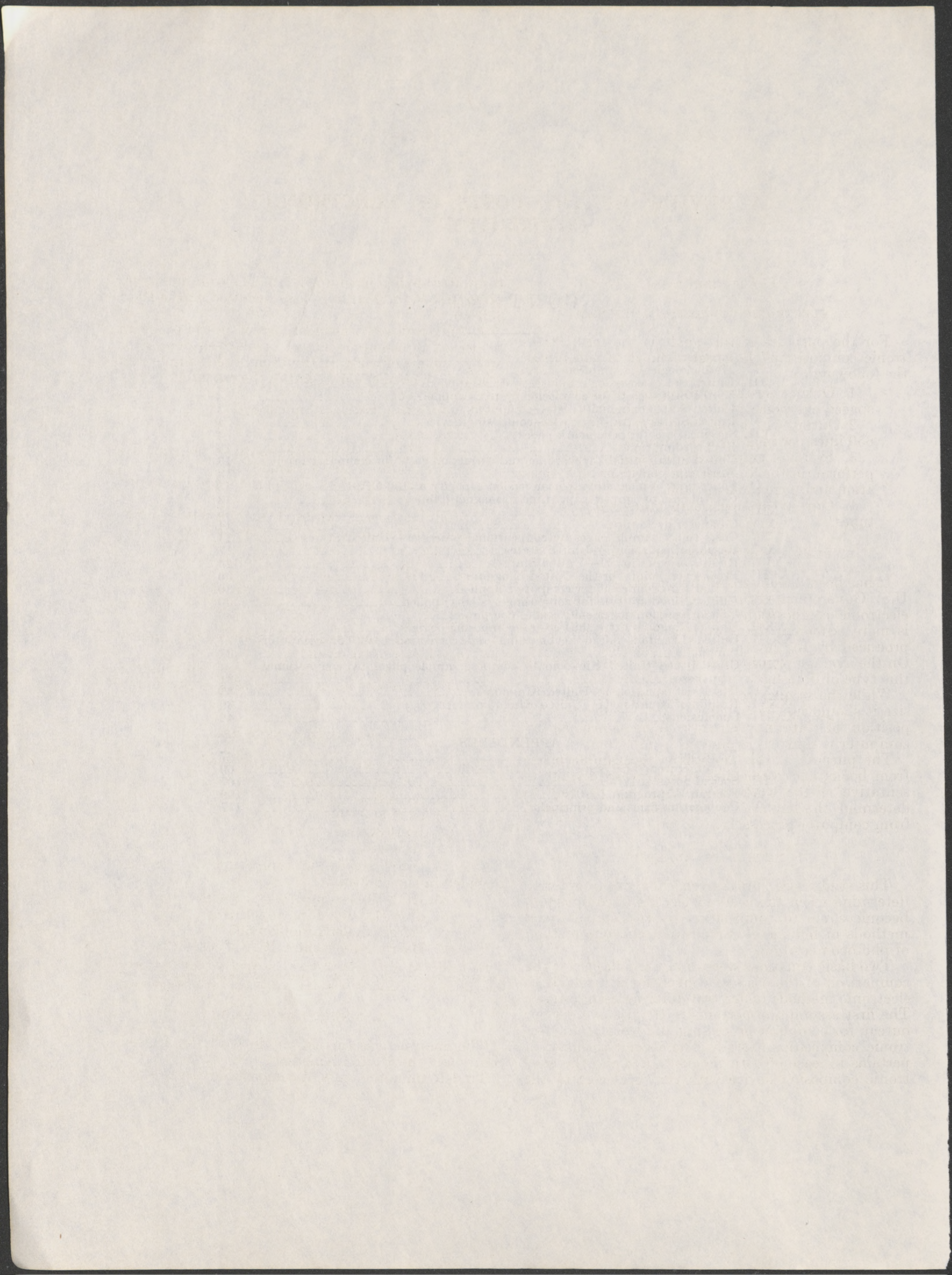
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# A REVIEW OF THE COSTS OF ELECTRONIC COMPOSITION

## 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<sup>1</sup> 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. <sup>2</sup> |

<sup>1</sup> Based on U.S. Government Printing Office configuration; cost provided by IBM Corporation.

<sup>2</sup> 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<sup>1</sup>

|                                           |            |
|-------------------------------------------|------------|
| 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   |

<sup>1</sup> 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         | <sup>1</sup> \$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             | <sup>2</sup> 550.00     |
| Total                          | 14,714.00               |

<sup>1</sup> Includes 1-shift maintenance costs.

<sup>2</sup> Price subject to change, quoted by Harris on Mar. 26, 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 arbitrary 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                            | 176 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.  
6 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 intermediate group that show some deficits and some surpluses. Cancelling out the intermediate 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.<sup>1</sup>

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

<sup>1</sup> 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 drug-stores, raises this issue anew.<sup>4</sup> *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*."

<sup>4</sup> 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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Atlas-Aire—See Atlas Tool & Mfg Co  
Atlas Tool & Mfg Co 5147 Natural Bridge Av St Louis 15 Mo  
Borrow Basket—See Pope Mfg Co  
Borntside H B 63 Willard Av Providence 5 RI  
Boyco—See Boyle Mfg  
Boyle Mfg Div US Steel Products Co 5100 Sante Fe Av Los Angeles  
Burner-Caddy—See Aero Mfg Co  
Burnzit—See Wolverine Feeder Co  
Cart-Basket—See Pope Mfg Co  
Catch-All—See United States Steel Corp  
Cincinnati Galvanizing Co 4879 Spring Grove Av Cincinnati 32 O

Daisy—See Massillon Wire Basket Co  
Eastern Can Co 306 Bremen St East Boston Mass  
Easy Open—See Hume Mfg Co

\* Empire-Reeves Steel Div Cyclops Corp 125 Iron Av Dover O  
Fire Guard—See Mid-West Metal Products Co  
Fiske J W Architectural Metals Inc 111 Pennsylvania Av Paterson NJ

Gilbert & Bennett Mfg Co Georgetown Conn  
Hold-All—See Gilbert & Bennett Mfg Co  
Hume Mfg Co 1301 Burlington N Kansas City Mo  
Hydrox-O-Lator—See Outdoor Oven Fireplace Co  
Johnson W P Co 311 SW 9 St Des Moines Iowa  
Keystone Wire Matting Co Rochester Pa  
Massillon Wire Basket Co 118 N Summit Massillon O  
Mid-West Metal Products Co Muncie Ind  
Manticello Mfg Co Elwood Ind  
Neehan Brass Works Neehan Wis  
Norwich Wire Works Inc Norwich NY  
Outdoor Oven Fireplace Co 872 Windsor St Hartford 1 Conn  
Pope Mfg Co Prairie View Ill  
Ranz—See Neehan Brass Works  
Red Tag—See United States Steel Corp  
Saf-T-Brn—See Alsto Company  
Skyscraper—See Borntside H B  
Superior Sheet Metal Works Co 3201 Roosevelt Av Indianapolis Ind  
Tidy—See Superior Sheet Metal Works Co  
United States Steel Corp 525 William Penn Pl Pittsburgh  
Wheeling Corrugating Co 1134-40 Market St Wheeling W Va  
Wolverine Feeder Co 1010 S Kendall At K River Battle Creek Mich  
Yard Boy—See Fiske J W Architectural Metals Inc

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

**BURNERS, Weed**

Aerol—See Aerol Products Co  
Aerol 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  
Chapin R E Mfg Works Inc Batavia NY  
Dobbins Div Chamberlain Corp Monroe Ga  
Firegun—See Root-Lowell Corp  
Flame-Gun—See Smith D B & Co  
Flame 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 Saranac 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 Leedsdale Pa  
Master 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  
Joilet Wrought Washer Co Joilet 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 Brush & 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 5 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  
Standard 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 Coleman St Rice Lake Wis

**BUTTONS, Handles and Knobs, China**

Scovill Mfg Co Plumbers' Brass Goods 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 Daboll 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 2368 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 51 St West New York NJ  
\* Lenape Products Inc 120 Stokes Av Trenton 7 NJ (Ceramic)  
Liberty Bell Mfg Co Div Philip Carey Mfg Co Swainsboro Ga  
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  
Russwin—See Russwin Div  
Russwin 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 Risno Sun Av ..... OR 3-1261  
 Kelly Jos 7749 E Roosevelt Blvd ..... MAYfr 4-3141  
 Kelly Jos 437 Shurs La ..... IVyrdg 2-0284  
 Kelly Jos 2231 S 3 ..... DEwy 6-6975  
 Kelly Jos 1421 S 55 ..... SARatga 6-5744  
 Kelly Jos antiq 1024 Pine ..... WA 5-5679  
 Kelly Jos Jr 3400 W Clearfld ..... BA 3-4888  
 Kelly Jos Jr 5451 Malcolm ..... GR 2-8022  
 Kelly Jos 5420 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 ..... SARatga 9-5226  
 Kelly Jos A 3106 Unruh ..... MAYfr 4-2454  
 Kelly Jos A 1906 S 22 ..... FUItn 9-0782  
 Kelly Jos A dimnd set 106 S 7 ..... WAItn 5-3092  
 Kelly Jos A Mrs 3553 Brookvld 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 Nellson ..... Ploner 3-8892  
 Kelly Jos D Rev 154 E Mt Airy Av ..... CH esthl 7-0661  
 Kelly Jos E 610 Arthur ..... FI 2-3345  
 Kelly Jos E 5222 N Fairhl ..... DAVmpt 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 ant 2-6359  
 Kelly Jos F 6226 Argyle ..... PI 5-0897  
 Kelly Jos F 5742 N Howard ..... CA 4-6889  
 Kelly Jos F 3449 Indian Queen La ..... VI 4-9028  
 Kelly Jos J 1048 E Cheltnhm Av CUMbrld 9-2277  
 Kelly Jos J 4240 Cottman Av ..... DEVnshr 8-5920  
 Kelly Jos J 4609 Higbee ..... 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 ..... SARatga 9-4086  
 Kelly Jos J 137 Ridgelfd Rd ..... NEptn 7-8915  
 Kelly Jos J 446 Shurs La ..... IVyrdg 3-2692  
 Kelly Jos J 2525 S 64 ..... SARatga 7-5779  
 Kelly Jos J photograph 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 2604 Pine ..... KI 5-7747  
 Kelly Jos M 3125 N Wendle ..... BALdwn 5-3354  
 Kelly Jos M Jr 3656 N 11 ..... 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 Delhi ..... BA 5-4516  
 Kelly Jos P 1916 Durtor ..... DEwy 6-0453  
 Kelly Jos P 2000 Griffith ..... PIgrm 5-3384  
 Kelly Jos P 110 Hoffman ..... DE wry 4-2425  
 Kelly Jos P 5259 N Mascher ..... DA 4-1628  
 Kelly Jos P 221 Nedro Av ..... WAvrly 4-8873  
 Kelly Jos P 7959 Temple Rd ..... WAvrly 4-4477  
 Kelly Jos P 5351 Thomas ..... GRnit 6-3393  
 Kelly Jos P 263 E Walnut Prk Dr ..... WAvrly 7-3352  
 Kelly Jos P 5629 Whitby Av ..... GRnit 4-6940  
 Kelly Jos R 945 Scatterd ..... JE 5-4187  
 Kelly Jos R 5923 N 3 ..... WAvrly 7-4846  
 Kelly Jos S 4120 Princntn Av ..... DE 8-8413  
 Kelly Jos T 6060 Crescntrl Rd ..... WA 7-1769  
 Kelly Jos T 3504 Grant Av ..... ORchrd 3-0931  
 Kelly Jos T 6513 Grays Av ..... SARatga 4-3178  
 Kelly Jos T 4435 H ..... CUMbrld 9-8617  
 Kelly Jos T 8620 Marigold Pl ..... MA 4-6215  
 Kelly Jos T 2821 N Orkney ..... GARfld 6-0431  
 Kelly Jos T 141 Ridgelfd Rd ..... NE 7-1564  
 Kelly Jos T 4620 Spruce ..... SH 8-4993  
 Kelly Jos Vincent 5046 N Sydenhm DAVmpt 4-0713  
 Kelly Jos W 2062 E Elkhrt ..... RE 9-2340  
 Kelly Jos W 4274 Fkd Av ..... CUMbrld 8-7543  
 Kelly Jos W 4230 Lansing ..... DE 4-4809  
 Kelly Jos W 936 E Price ..... VI 3-5929  
 Kelly Jos W 5529 Regent ..... SARatga 9-8411  
 Kelly Jos W Jr 507 E Brnghurst ..... VI 4-4069  
 Kelly Josephine 3558 Chippendale ..... MAYfr 4-6554  
 Kelly Josephine 816 S 47 ..... SA 9-6264  
 Kelly Josephine Mrs 2515 N Franklin BALdwn 5-7138  
 Kelly Julia 2619 Cathrine ..... PE 5-3613  
 Kelly KM 129 W Carptr Ln ..... VI 4-1174  
 Kelly KT 3433 W Queen Ln ..... VI 3-6338  
 Kelly Katherine 2502 Jackson ..... DEwy 6-0230  
 Kelly Katherine E Mrs 5937 N 3 ..... LIVmstn 9-2673  
 Kelly Katherine M 7185 N 18 ..... WA 7-7093  
 Kelly Kathryn A 4730 Meridian ..... DEVnshr 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 Kathym 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 ElksPrk ..... CA 4-2888  
 Kelly LP 568 E Marwd ..... GL 5-6244

# KELLY LABORATORIES

5601 Cedar Av ..... GR 2-5953  
 Kelly Larry 823 S Broad ..... HO 3-8088  
 Kelly Lawrence 182 W Godfrey Av ..... LIVmstn 8-6789  
 Kelly Lawrence J 3961 Lanknu Av ..... GR 3-7382  
 Kelly Lawrence P 4439 Princntn Av ..... DE 2-5939  
 Kelly Lelia 3229 W Montgmy Av ..... CE 6-4574  
 Kelly Leo 7221 Cottage ..... GRnwd 8-1824  
 Kelly Leo M 6722 Lethan Av ..... GR 3-7153  
 Kelly Leona 5420 W Girard Av ..... GR 3-7153  
 Kelly Leroy 1402 S Napa ..... HO wrd 5-8219  
 Kelly Leslie 517 N Wanmaker ..... GRnit 6-8365  
 Kelly Lev 4130 Parkside Av ..... TR 8-4086  
 Kelly Lila Mrs 5435 Delancey ..... GR 2-6033  
 Kelly Lillian 437 W Raymond ..... GLadstn 7-1867  
 Kelly Lillian 2115 Shalldross ..... PI 4-2975  
 Kelly Lillian S Mrs 4530 N Carlisle DAVmpt 4-7926  
 Kelly Lillie M Mrs 818 N 20 ..... CEnt 2-0474  
 Kelly Loretta J Mrs 12050 Glenfld ..... NE 7-0829  
 Kelly Lorraine 1310 Geary Terr ..... DE 4-4864  
 Kelly Lorraine M 5506 N 3 ..... LIVmstn 8-2272  
 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 ant 4-1070

Kelly Luceille A 1116 Duncannon ..... DAVmpt 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 ..... CUMbrld 8-3042  
 Kelly M A 4938 N Marvne ..... 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 ..... DAVmpt 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 Magdalene Mrs 101 E Horiter ..... VI 4-1149  
 Kelly Malcolm Mrs 3305 Powltn Av ..... EV 7-0278  
 Kelly Marcella 406 N 40 ..... EVgrm 6-9186  
 Kelly Margaret 2336 Almond ..... REgnt 9-5581  
 Kelly Margaret 4629 Baltmre Av ..... SA 9-2581  
 Kelly Margaret 7901 Bayard ..... LIVmstn 9-2271  
 Kelly Margaret 4222 Elsinore ..... CUMbrld 9-4426  
 Kelly Margaret 5464 New Pl ..... SH 8-3591  
 Kelly Margaret 2101 North College Av CEnt 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 ..... PENypr 5-6045  
 Kelly Margaret A Mrs 1319 S 29 ..... HO wrd 2-2428  
 Kelly Margaret C Mrs 7134 Torrsdile 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 Beaumont Av ..... SA 7-7338  
 Kelly Margaret M 6429 Beechwd ..... LIVmstn 9-3022  
 Kelly Margaret M 1823 S Broad ..... HO 3-8088  
 Kelly Margaret M 2025 S Bucknell ..... FU Itn 9-4209  
 Kelly Margaret M 301 E Gravers Ln ..... CH 2-0167  
 Kelly Margaret M 512 Kerper ..... RA 2-0238  
 Kelly Margaret M 502 S 57 ..... GRnit 2-6093  
 Kelly Margaret W 1356 Magee Av CUMbrld 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 vnsr 3-3555  
 Kelly Marie M 122 W Champlst ..... 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 A 3433 N Bodine ..... GARfld 6-1628  
 Kelly Martha A 4643 Emery ..... JEFrsn 5-8909  
 Kelly Martin 7700 Torrsdile Av ..... DE 3-5060  
 Kelly Martin J 2670 Belgrade ..... NEbrska 4-4965  
 Kelly Martin M 3506 York Rd ..... BA 8-1064  
 Kelly Mary 2337 E Norris ..... GA 3-4791  
 Kelly Mary 1040 N Orianna ..... 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 Montros ..... PE 5-2035  
 Kelly Mary Mrs 1632 S Yewdall ..... SA 9-2875  
 Kelly Mary A 2646 S 2 ..... HO wrd 2-8759  
 Kelly Mary Ann 1811 Rhawn ..... RA 2-1603  
 Kelly Mary Anne 880 Bridge ..... CUMbrld 9-6604  
 Kelly Mary E 5728 Cedar Av ..... GRnit 2-1313  
 Kelly Mary E 6602 Dorel ..... SARatga 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 ..... VICTR 3-0974  
 Kelly Mary G Mrs 5857 Brush Rd ..... LIVmstn 8-2307  
 Kelly Mary I 6345 Cardiff ..... CU 8-6118  
 Kelly Mary J Hopkinson 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 ..... CHEstHI 7-0493  
 Kelly Mary Louise 1530 Locust ..... KI 6-5095  
 Kelly Mary M Mrs 5426 Hermit Terr ..... IV 2-7028  
 Kelly Mary T 5840 Oxfrd Av ..... JE frn 3-5934  
 Kelly Mary T Mrs 1644 S Conestoga SARatga 7-0471  
 Kelly Mary Teresa 4136 Levick ..... DEvnsr 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 LIVmstn 9-0873  
 Kelly Matthew A 2617 S 17 ..... DEwy 4-2692  
 Kelly Matthew A Jr 11821 Basile Rd NEptn 7-5254  
 Kelly Matthew R 1717 Lanett Rd ..... NEptn 7-1383  
 Kelly Maurice 4812 N Carlisle ..... DAVmpt 9-4991  
 Kelly Maybelle 836 E Haines ..... VI 3-2725  
 Kelly McGINLEY beer 544 E VanKirk ..... PIgrm 5-9067  
 Kelly Michael 6889 Forrest Av ..... WAvrly 7-2595  
 Kelly Michael 2345 S Lee ..... FUItn 9-5312  
 Kelly Michael A 4252 Frost ..... MA 4-6934  
 Kelly Michael A 302 W Sparks ..... LIVmstn 9-1931  
 Kelly Michael D 1300 N 51 ..... TR 8-9298  
 Kelly Michael J 3566 Calumet ..... VICTR 8-8450  
 Kelly Michael J 5331 Hedge ..... Ploner 3-6586  
 Kelly Michael J 4145 Maywood ..... JEFrsn 5-4499  
 Kelly Michael J 4141 Orianna ..... GLadstn 5-4466  
 Kelly Michael J 2320 Shalldross ..... PI 3-2133  
 Kelly Michael P 4842 E Roosevelt Blvd ..... CU 8-1766  
 Kelly Michael V 322 Helmerm ..... PI 5-8372  
 Kelly Mildred I 221 Higbee ..... FIDITY 2-3995  
 Kelly Milton 6449 N 16 ..... WA 7-7492

# KELLY MOTOR FREIGHT INC

2030 S 62 ..... SA 9-2250  
 Kelly Myrtle 5927 Mascher ..... LIVmstn 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 ..... SARatga 9-8081  
 Kelly Nan G 4835 Walton Av ..... SHerwd 7-3488  
 Kelly Nancy M 4746 N 10 ..... GL 5-5662  
 Kelly Nathaniel C 1428 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 Hansbery ..... VI 3-2814  
 Kelly Patk 518 E Hiltan ..... GA 6-3744  
 Kelly Patrick F 1104 Rhawn ..... PIgrm 2-8638  
 Kelly Patrick J 9777 Clark ..... OR 7-3264  
 Kelly Patrick J 4057 Creston ..... CUMbrld 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 8-8281  
 Kelly Paul 963 E Ontario ..... GA 3-3693  
 Kelly Paul Capt 5512 Houghtn ..... IV 2-3668  
 Kelly Paul E 6346 Woodbine Av ..... TR IV 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 ..... DE 1-0724  
 Kelly Peter F Verree & Welsh Rds ..... ORchrd 3-0715  
 Kelly Peter J 228 W Sparks ..... WAvrly 7-5037  
 Kelly Philip 1508 N 61 ..... TR IV 7-2262  
 Kelly Prince 1723 N 18 ..... CEnt 2-9059  
 Kelly Queenie 1847 N Tancy ..... CE 2-9065  
 Kelly R A 1001 66 Av ..... LI 9-6968  
 Kelly R W 3111 Guilford ..... DE vnsr 3-0948  
 Kelly Rae Hopkins Hse ..... GA 7-2715  
 Kelly Ralph 2839 E Victoria ..... MA 3-9517  
 Kelly Ralph Mrs 398 Chestnut ..... BA 2-3979  
 Kelly Raymond 11711 Gifford ..... ORchrd 3-8500  
 Kelly Raymond 3843 Oak Dr ..... DE 1-1954  
 Kelly Raymond 442 W Somerset ..... GARfld 5-0591  
 Kelly Raymond A 6631 Walker ..... DE 8-9755  
 Kelly Raymond E 8110 Martindale ..... DEVnshr 3-6469  
 Kelly Raymond F 1138 Bloomdie Rd ..... HObrt 4-7720  
 Kelly Raymond J 2148 E Stella ..... NEbrska 4-2037  
 Kelly Raymond W 1928 S 2 ..... HO wrd 2-0955  
 Kelly Rena Mrs 1029 W Somerset ..... BA 8-7255  
 Kelly Richa 1305 Kimberly Dr ..... GR 7-9789  
 Kelly Richd Mrs 6028 Kingessing Av ..... SA 6-6208  
 Kelly Richd A 2813 Ryerson Pl ..... HO 4-7163  
 Kelly Richd D 12050 Glenfld ..... NE 7-0829  
 Kelly Richd D 1503 Womrath ..... CU 8-0187  
 Kelly Richd E 3706 Azela Dr ..... DE 8-8592  
 Kelly Richd F 7502 Tulphckn St ..... HANck 4-4993  
 Kelly Richd G bldr Toby Farms Brookhvn ..... SA 7-1395  
 Kelly Richd J 1349 S Newkirk ..... HO wrd 8-6484  
 Kelly Richd J 1866 E Wensley ..... NEbrska 4-4681  
 Kelly Richd J ins Girard Tr BI ..... LO 4-1235  
 Kelly Richd L 870 Carver ..... JEFrsn 3-7945  
 Kelly Richd M 533 Christian ..... HO wrd 5-9389  
 Kelly Rita Beauty Shop 3345 Kensington Av GA 5-0935  
 Kelly Robt 6524 N Amer ..... WAvrly 7-4645  
 Kelly Robt 5213 Florence Av ..... SA 4-4176  
 Kelly Robt 1416 N Frazz ..... TR 8-9588  
 Kelly Robt 1514 S Patton ..... FUItn 9-2360  
 Kelly Robt 1831 Wakeling ..... CUMbrld 9-2074  
 Kelly Robt A 1617 S Etting ..... HO wrd 8-5944  
 Kelly Robt A 8104 Mitchner ..... CHEstHI 7-4079  
 Kelly Robt B 6522 Windsor Av ..... SARatga 6-4872  
 Kelly Robt C 7905 Dungan Rd ..... RA 5-3572  
 Kelly Robt C 9326 Trout Rd ..... HObrt 4-5140  
 Kelly Robt G 866 Wynnd 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 141 W Rosemar ..... LIVmstn 8-6890  
 Kelly Robt V Erringer PI Apt ..... GE 8-3412  
 Kelly Robt W 3805 Oakhill Rd ..... NEptn 7-5740  
 Kelly Robt W 1015 Welsh Rd ..... OR 6-1099  
 Kelly Ronald L 1319 N 61 ..... TRntly 7-5868  
 Kelly Ronald W 9975 Hardy Rd ..... ORchrd 3-7841  
 Kelly Rose Mrs 436 W Courtland ..... GLadstn 5-6875  
 Kelly Roy 7256 Limekiln Pk ..... HA 4-5217  
 Kelly Rubin 1823 N 25 ..... CEnt 2-4308  
 Kelly Ruby 816 N Markoe ..... EV 7-2081  
 Kelly Russell L 3613 Haywd ..... VICTR 8-4232  
 Kelly Russell S 804 Tyson ..... PI grm 5-9036  
 Kelly Russell S Jr 7320 Tabor Rd ..... RA 5-3957  
 Kelly Ruth 7256 Limekiln 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 ergnt 6-1258  
 Kelly Ruth C 5425 Cathrine ..... GR 2-7107  
 Kelly S 2324 Cheltnhm Av ..... RA 4-0548  
 Kelly S L 411 Kerper ..... RA 5-5899  
 Kelly Salinas Guillermo 128 S 36 ..... BA 2-6684  
 Kelly Saml 310 E Cornwall ..... NE 4-1630  
 Kelly Saml F 3351 Ashville ..... DEVnshr 2-8083  
 Kelly Saml F 8054 Crispin ..... MAYfr 4-6371  
 Kelly Saml J 3436 N 16 ..... MA 5-8805  
 Kelly Sandra 4324 Manyk Av ..... IV 2-7807  
 Kelly Sara 4514 Pine ..... GR 6-6847  
 Kelly Sarah Mrs 228 Greenwich ..... FU Itn 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

# 601 KELLY J—KELLY W

Kelly Sheila A 5030 Greene ..... GE 8-2462  
 Kelly Shields M Mrs  
 Tulphckn & 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 ..... CHEstHI 7-5697  
 Kelly Steven 248 Apsley ..... GLadstn 5-9558  
 Kelly Susan T 4144 Levick ..... MA 4-5412  
 Kelly T B 533 Gerhard ..... IV 3-5812  
 Kelly T J 225 E Penn ..... VI 4-7161  
 Kelly T J 1419 Shunk ..... FUItn 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 ..... HO wrd 2-5319  
 Kelly Thos 46 E Clapier ..... GERmtn 8-8978  
 Kelly Thos 1338 S Newkirk ..... HO wrd 5-1781  
 Kelly Thos 1730 Oregon Av ..... DE 4-5989  
 Kelly Thos 5600 Spruce ..... GRnit 4-7531  
 Kelly Thos 544 E VanKirk ..... PIgrm 5-9067  
 Kelly Thos 7226 Walkr ..... DEVnshr 8-3445  
 Kelly Thos 2122 S 10 ..... HO 8-5620  
 Kelly Thos Jr 6065 N Philip ..... LIVmstn 9-8929  
 Kelly Thos Mrs 5631 N Fairhl ..... WA 7-1334  
 Kelly Thos Rev 1719 Morris ..... HO 8-0956  
 Kelly Thos A 9020 Ashton Rd ..... ORchrd 7-0923  
 Kelly Thos A 452 Howell ..... PIgrm 5-3579  
 Kelly Thos A 1903 S 20 ..... FUItn 9-1238  
 Kelly Thos A Jr 646 Allengrv ..... RA 5-3074  
 Kelly Thos A Jr 544 Vankirk ..... RANDif 5-1045  
 Kelly Thos B 6507 Newtown Av ..... PI 5-6498  
 Kelly Thos C 2613 S Hicks ..... FU Itn 9-3433

**KELLY THOMAS CATERERS**  
 Wigard Av ..... IV 2-3457  
 1215 Summer ..... LO 4-5575  
 Kelly Thos E 7523 Briar Rd ..... WAvrly 4-1709  
 Kelly Thos E 2514 S Gross ..... SARatga 6-0966  
 Kelly Thos E 3242 Wellington ..... MAYfr 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 G 4720 N 11 ..... DAVmpt 4-1172  
 Kelly Thos G 7124 Glench ..... 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 7-6665  
 Kelly Thos J 1678 Church St ..... JEFrsn 5-3051  
 Kelly Thos J Dorchnstr Apt ..... PE 5-7157  
 Kelly Thos J 725 Levick ..... FIDITY 2-9227  
 Kelly Thos J 1512 Lindbrgh Av Roslyn ..... OL 9-1599  
 Kelly Thos J 1942 E Moyamensing Av HO wrd 8-7233  
 Kelly Thos J 2637 S Muhlfeld ..... SARatga 6-9266  
 Kelly Thos J 264 Osborn ..... IV 2-4977  
 Kelly Thos J 441 Pensdole ..... IV 3-2740  
 Kelly Thos J 1327 N 19 ..... NEptn 5-7004  
 Kelly Thos J Jr 3417 N Dillman ..... DEvnsr 4-4313  
 Kelly Thos Jr Sr 4510 McKinley ..... DEVnshr 3-5740

**KELLY THOMAS J INC ins**  
 761 Huntngdn Pke Rockledge ..... RA 5-7200  
 Kelly Thos J Sons bldrs 1454 E Greenwd ..... 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 M 865 E Cornwall ..... RE 9-3822  
 Kelly Thos P 911 Brill ..... JEFrsn 5-3294  
 Kelly Thos P 2637 S Hobson ..... SARatga 7-2917  
 Kelly Thos P 3543 Nottingham La ..... NEptn 7-6468  
 Kelly Thos P 5911 Weymouth ..... PI grm 5-7777  
 Kelly Thos P 1909 Wiltier ..... HObrt 4-6625  
 Kelly Thos P Rev 700 N 67 ..... GR 3-4417  
 Kelly Thos V 5410 Bartram Dr ..... SARatga 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 ..... SARatga 9-7245  
 Kelly Vermel 2337 N 11 ..... PO 5-1179  
 Kelly Verma E 8220 Rockwell Av ..... RANDif 8-6948  
 Kelly Verne 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 PIgrm 5-8638  
 Kelly Vincent 7423 Shisler ..... RE gnt 9-9243  
 Kelly Vincent J 531 E Alleghny Av ..... NE 4-4535  
 Kelly Viola A 2560 N 16 ..... BALdwn 9-5380  
 Kelly W Boyer 6104 Bustletn Av ..... JEFrsn 5-7679  
 Kelly W Col 684 Rennard ..... OR 3-5428  
 Kelly Walter 162 W Fern ..... LIVmstn 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 Andow Rd ..... ORchrd 3-1169  
 Kelly Walter E 6080 Drexel Rd ..... TR 7-3316  
 Kelly Walter E 2316 Spruce ..... LOctr 4-2830  
 Kelly Walter J 5454 Belmar Ter ..... SA 6-0959  
 Kelly Walter Jr 6106 N Marshall ..... LIVmstn 8-5712  
 Kelly Walter L 262 E Clivdn ..... VI 4-0538  
 Kelly Weetona 6718 Chew ..... GERmtn 8-2400  
 Kelly Wesley 6265 Gillespie ..... DEVnshr 8-6178  
 Kelly Wilbert apwincs 4118 Mkt ..... EV 2-0241  
 Kelly Wm 1207 W Atlantic ..... BALdwn 5-8794  
 Kelly Wm 2514 E Auburn ..... GA 6-9811  
 Kelly Wm 5218 N Fairhl ..... DA 4-4788  
 Kelly Wm 5840 Florence Av ..... SARatga 4-1329  
 Kelly Wm 204 W Ruscomb ..... GLadstn 5-4922  
 Kelly Wm 1029 W Somerst ..... BA 8-7255  
 Kelly Wm 2034 S 68 St ..... SARatga 6-4235  
 Kelly Wm A 4532 Vista ..... DEVnshr 2-9474  
 Kelly Wm A Jr 5315 Arlntn ..... GRnwd 7-1871

**KELLY WILLIAM A INC haul**  
 1526 N Amer ..... PO 3-1475  
 1526 N Amer ..... PO 3-3321  
 Kelly Wm Adv Agency 1808 Rithnse 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 <sup>1</sup> | 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  |

<sup>1</sup> 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 break-even *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 <sup>1</sup>

| 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    |

<sup>1</sup> 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<sup>1</sup>

| Sample                        | Linotron <sup>2</sup><br>505 | Linotron<br>1010 | Fototronic<br>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.....          | 3.0000                       | .2300            | .2500             | .2433     |
| 6. Book catalog.....          | 24.7610                      | .3916            | .4000             | .4167     |
| 7. Hardware directory.....    | 5.9320                       | .3833            | .3333             | .4183     |
| 8. Telephone directory.....   | ( <sup>3</sup> )             | .5833            | .6500             | .5467     |

<sup>1</sup> 2 cycles; 1 in proof mode at low resolution and the other in high resolution unless otherwise indicated.

<sup>2</sup> 2 cycles; both in 650 line per inch resolution.

<sup>3</sup> 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 | .0113    | .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   | Percent |
|--------------------|----------|---------|
| 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  |

|                    | 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: HARDWARE 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. Computer processing: |      |          |          |
| 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:

$\frac{A}{\text{Photocomposer cycles in minutes (photocomposer cost per minute)}} = \frac{B}{\text{Cost to set sample page by conventional process}}$

$\frac{C}{\text{Computer cycles in minutes (cost of computer configuration per minute)}} - \frac{D}{\text{Initial keyboarding cycle in minutes}}$

$\frac{D_1}{\text{(Labor cost per minute + capital cost of keyboard per minute)}} - \frac{E}{\text{correction keyboarding cycle in minutes}}$

$\frac{D_1}{\text{(Labor cost per minute + capital cost of keyboard per minute)}} - \frac{F}{\text{Supply costs}}$

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

<sup>1</sup> This value is taken from item C in equation II.



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

|                                    | A       | B        | C      | C <sub>1</sub> | D      | D <sub>1</sub> | D <sub>2</sub> | E    | F        |
|------------------------------------|---------|----------|--------|----------------|--------|----------------|----------------|------|----------|
| <b>I. M-16 Linotron:</b>           |         |          |        |                |        |                |                |      |          |
| 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              |        |                |                |      |          |
| <b>II. 360-50 Linotron 1010:</b>   |         |          |        |                |        |                |                |      |          |
| 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    |
| <b>III. 360-50 Fototronic CRT:</b> |         |          |        |                |        |                |                |      |          |
| 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    |
| <b>IV. RCA 70/45 Videocomp:</b>    |         |          |        |                |        |                |                |      |          |
| 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    |
| <b>V. RCA 70/35 Videocomp:</b>     |         |          |        |                |        |                |                |      |          |
| 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    |

<sup>1</sup> 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 <sup>1</sup> | 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 <sup>1</sup> | Pages | Keyboards |
|-----------------------------------------------------------------|----------------------|-------|-----------|
| F. For sample VI—Book catalog:                                  |                      |       |           |
| Linotron 505.....                                               | ( <sup>2</sup> )     |       |           |
| 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.....                                      | ( <sup>2</sup> )     |       |           |
| Videocomp/45.....                                               | 2,383                | 5,698 | 49.00     |
| Videocomp/35.....                                               | 2,854                | 6,822 | 58.67     |
| H. For sample VIII—Telephone directory:                         |                      |       |           |
| Linotron 505.....                                               | ( <sup>3</sup> )     |       |           |
| 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 <sup>4</sup> .....(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     |

<sup>1</sup> Refers to minutes used per month of composer time.<sup>2</sup> Negative.<sup>3</sup> Did not set.<sup>4</sup> 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 <sub>1</sub> | D      | D <sub>1</sub> | D <sub>2</sub> | 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    |

<sup>1</sup> 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 <sup>1</sup> | 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 <sup>1</sup> | 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.....                                               | ( <sup>2</sup> )     |       |           |
| 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      |

<sup>1</sup> Refers to minutes used per month of composer time.<sup>2</sup> Did not set.<sup>3</sup> 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 <sub>1</sub> | D     | D <sub>1</sub> | D <sub>2</sub> | 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 | 1.5248   |
| 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    |

<sup>1</sup> 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 PHOTON  
713 (UNBALANCED SYSTEM)<sup>1</sup>

| System                                   | Minutes <sup>2</sup> | 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<sup>1</sup>

| System                                                          | Minutes <sup>2</sup> | 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     |
| Linotron 1010                                                   | (10.50)              | 1,109 | 7,591     |
| Harris Fototronic CRT                                           | (12.23)              | 1,292 | 7,316     |
| Videocomp/45                                                    | (8.56)               | 904   | 5,898     |
| Videocomp/35                                                    | (8.87)               | 937   | 6,114     |

<sup>1</sup> Cost of computer-composer imbalance included.<sup>2</sup> 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 <sub>1</sub> | D     | D <sub>1</sub> | D <sub>2</sub> | 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.

<sup>1</sup> 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 <sup>1</sup> | 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 <sup>1</sup> | 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     |
| Linotron 1010                                                   | (15.66)              | 1,654 | 11,315    |
| Harris Fototronic CRT                                           | (19.32)              | 2,041 | 11,553    |
| Videocomp/45                                                    | (12.42)              | 1,312 | 8,554     |
| Videocomp/35                                                    | (13.09)              | 1,382 | 9,015     |

<sup>1</sup> Refers to minutes used per month of composer time.

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

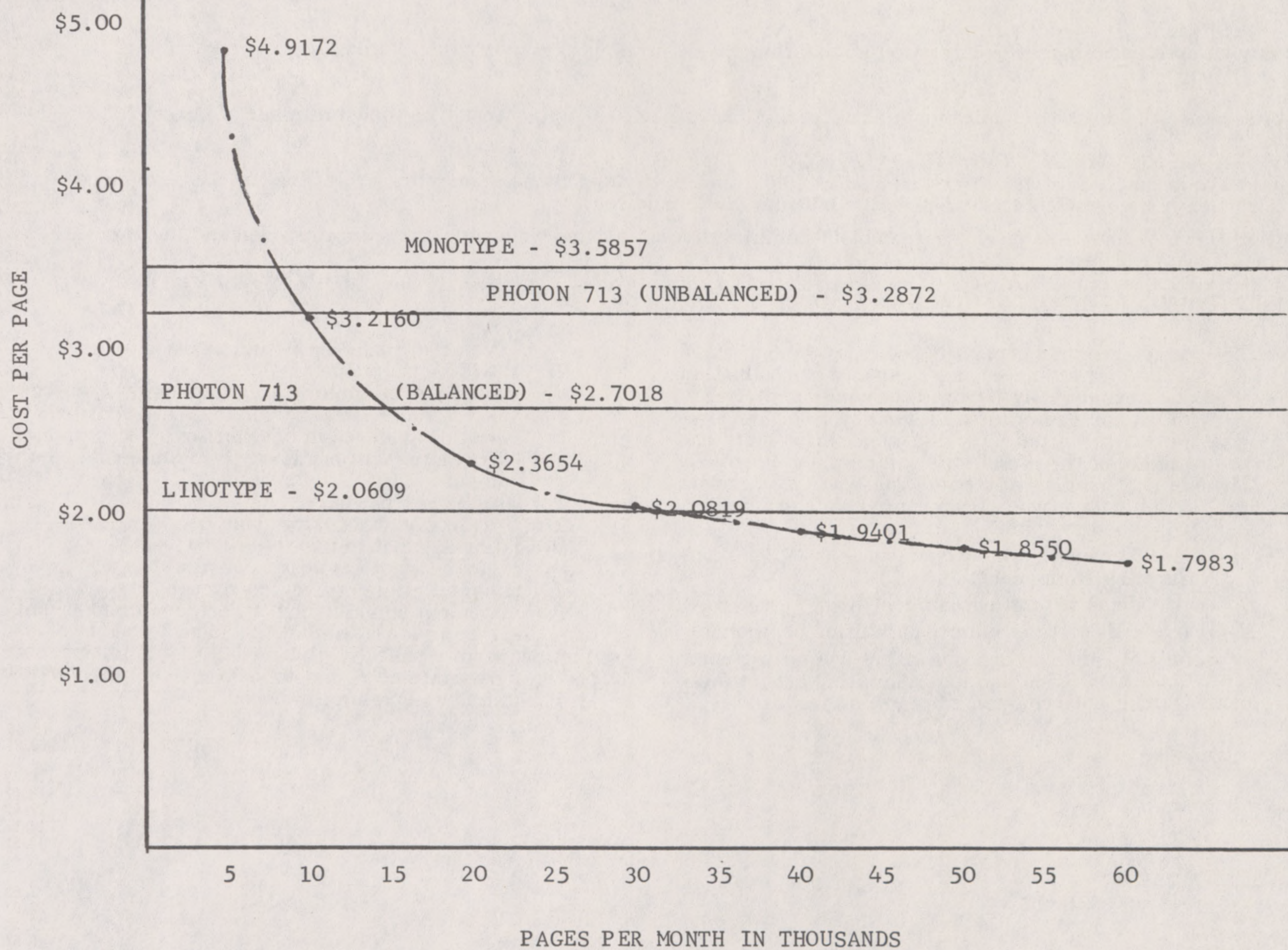


## LINOTRON 1010 vs CONVENTIONAL PROCESSES

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 (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:  $\frac{A}{X}$  Cost of producing sample by conventional process (unknown number of pages) =

$\frac{B}{C}$  Total monthly one shift operating costs of computer + Total monthly one shift operating costs of photocomposer +

$\frac{D}{D_1}$  (Initial keyboarding cycle in minutes (labor cost per minute + capital cost of keyboard per minute))

$\frac{X}{D_2}$  (unknown number of pages) +  $\frac{E}{D_1}$  correction keyboarding cycle in minutes (labor cost per minute +

$\frac{D_2}{X}$  capital cost of keyboard per minute)  $\frac{X}{F}$  (unknown number of pages) +  $\frac{X}{X}$  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 non-limiting 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 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 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 <sub>1</sub> | D <sub>2</sub> | 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   | 16,173.00   | 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  | 16,173.00   | 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 directory.....   | 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      |

<sup>1</sup> Charged with 4 minutes to strip galleys at \$.0812 per minute.

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

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

| System                                   | Minutes <sup>1</sup> | 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.....                        | ( <sup>2</sup> )     |        |           |
| Linotron 1010.....                       | 4,637                | 7,312  | 42.31     |

|                                                                 |                  |        |        |        |
|-----------------------------------------------------------------|------------------|--------|--------|--------|
| 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                                                    | 14,800           | 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                                                    | ( <sup>3</sup> ) |        |        |        |
| 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 <sup>4</sup>                                       | (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  |

<sup>1</sup> Refers to minutes of use per month of lower speed component which is generally the computer.

<sup>2</sup> Negative.

<sup>3</sup> Did not set.

<sup>4</sup> 505 includes 7 samples at 14.28 percent of total volume.

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



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

|                               | Factors  |          |            |        |                |                |      | F        |
|-------------------------------|----------|----------|------------|--------|----------------|----------------|------|----------|
|                               | A        | B        | C          | D      | D <sub>1</sub> | D <sub>2</sub> | E    |          |
| 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  | 28,574   | 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   | 14,714.00  | 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      |

<sup>1</sup> Charged with 4 minutes to strip galleys at \$0.0812 per minute.

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

| System                                   | Minutes <sup>1</sup> | 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 <sup>2</sup> | 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.....                                               | ( <sup>2</sup> )     | ----- | -----     |
| 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 <sup>3</sup> .....(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     |

<sup>1</sup> Refers to minutes of use per month of lower speed component which is generally the computer.

<sup>2</sup> Did not set.

<sup>3</sup> 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 <sub>1</sub> | D <sub>2</sub> | F    |
| I. M-16 Linotron 505:         |          |          |            |       |                |                |      |
| A. The Group.....             | \$3.2372 | 0        | \$7,031.07 | 12.11 | \$0.0812       | \$0.0054       | 0.42 |
| B. Policy.....                | 3.4645   | 0        | 7,031.07   | 17.10 | .0812          | .0054          | .55  |
| C. Prices and Production..... | 3.3309   | 0        | 7,031.07   | 15.57 | .0812          | .0054          | .48  |
| D. Pleistocene.....           | 4.3374   | 0        | 7,031.07   | 19.80 | .0812          | .0054          | .62  |
| E. American Bar.....          | 8.4926   | 0        | 7,031.07   | 35.25 | .0812          | .0054          | 1.10 |
| II. 360-50 Linotron 1010:     |          |          |            |       |                |                |      |
| A. The Group.....             | 3.2372   | \$28,574 | 17,012.00  | 12.11 | .0812          | .0054          | .42  |
| B. Policy.....                | 3.4645   | 28,574   | 17,012.00  | 17.10 | .0812          | .0054          | .55  |
| C. Prices and Production..... | 3.3309   | 28,574   | 17,012.00  | 15.57 | .0812          | .0054          | .48  |
| D. Pleistocene.....           | 4.3374   | 28,574   | 17,012.00  | 19.80 | .0812          | .0054          | .62  |
| E. American Bar.....          | 8.4926   | 28,574   | 17,012.00  | 35.25 | .0812          | .0054          | 1.10 |
| III. 360-30 Fototronic CRT:   |          |          |            |       |                |                |      |
| A. The Group.....             | 3.2372   | 16,173   | 14,714.00  | 12.11 | .0812          | .0054          | .42  |
| B. Policy.....                | 3.4645   | 16,173   | 14,714.00  | 17.10 | .0812          | .0054          | .55  |
| C. Prices and Production..... | 3.3309   | 16,173   | 14,714.00  | 15.57 | .0812          | .0054          | .48  |
| D. Pleistocene.....           | 4.3374   | 16,173   | 14,714.00  | 19.80 | .0812          | .0054          | .62  |
| E. American Bar.....          | 8.4926   | 16,173   | 14,714.00  | 35.25 | .0812          | .0054          | 1.10 |
| IV. RCA 70/45 Videocomp:      |          |          |            |       |                |                |      |
| A. The Group.....             | 3.2372   | 20,897   | 14,014.00  | 12.11 | .0812          | .0054          | .42  |
| B. Policy.....                | 3.4645   | 20,897   | 14,014.00  | 17.10 | .0812          | .0054          | .55  |
| C. Prices and Production..... | 3.3309   | 20,897   | 14,014.00  | 15.57 | .0812          | .0054          | .48  |
| D. Pleistocene.....           | 4.3374   | 20,897   | 14,014.00  | 19.80 | .0812          | .0054          | .62  |
| E. American Bar.....          | 8.4926   | 20,897   | 14,014.00  | 35.25 | .0812          | .0054          | 1.10 |
| V. RCA 70/35 Videocomp:       |          |          |            |       |                |                |      |
| A. The Group.....             | 3.2372   | 15,235   | 14,014.00  | 12.11 | .0812          | .0054          | .42  |
| B. Policy.....                | 3.4645   | 15,235   | 14,014.00  | 17.10 | .0812          | .0054          | .55  |
| C. Prices and Production..... | 3.3309   | 15,235   | 14,014.00  | 15.57 | .0812          | .0054          | .48  |
| D. Pleistocene.....           | 4.3374   | 15,235   | 14,014.00  | 19.80 | .0812          | .0054          | .62  |
| E. American Bar.....          | 8.4926   | 15,235   | 14,014.00  | 35.25 | .0812          | .0054          | 1.10 |

<sup>1</sup> 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 <sup>1</sup>U.S. DATA, EQUATION II—BREAK-EVEN RESULTS AGAINST PHOTON 713—UNBALANCED SYSTEM <sup>1</sup>—Continued

| System                                   | Minutes <sup>2</sup> | 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     |

| System                                                          | Minutes <sup>1</sup> | 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     |

<sup>1</sup> Cost of computer-composer imbalance included.

<sup>2</sup> 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.



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

|                               | A        | B           | C          | D     | D <sub>1</sub> | D <sub>2</sub> | 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      |

<sup>1</sup> 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)<sup>1</sup>

| System                                   | Minutes <sup>2</sup> | 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)<sup>1</sup>—Continued

| System                                                      | Minutes <sup>2</sup> | 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     |

<sup>1</sup> Cost of computer-composer imbalance not charged.

<sup>2</sup> Refers to minutes of use per month of lower speed component.

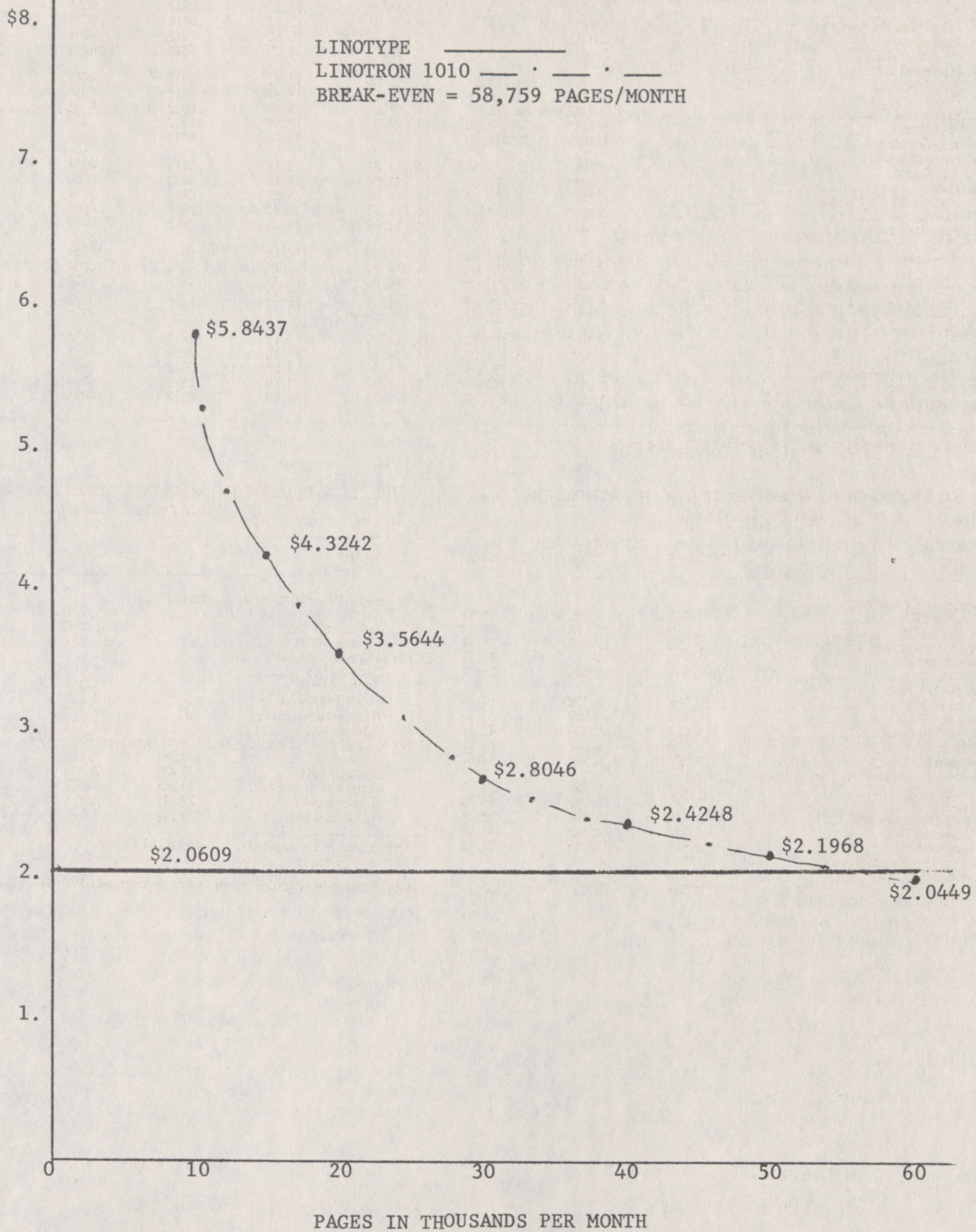
Note: Figures in parenthesis represent percentage use of shift to achieve break-even.



LINOTRON 1010 vs LINOTYPE  
FOR SAMPLE "THE GROUP"  
EQUATION II

LINOTYPE \_\_\_\_\_  
LINOTRON 1010 — • — • —  
BREAK-EVEN = 58,759 PAGES/MONTH

COST PER PAGE IN DOLLARS





### 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. Programmer 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. Programmer 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 <sup>1</sup> | 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 |

<sup>1</sup> \$.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    |

## UNITED KINGDOM COST PROCESS: LINOTYPE—SAMPLE: THE GROUP—Continued

| Function               | Time | Rate      | Cost      |
|------------------------|------|-----------|-----------|
| VI. House proof:       |      |           |           |
| A. Labor.....          | . 50 | \$0. 0263 | \$0. 0132 |
| VII. Supply costs..... |      |           | . 0947    |
| Total.....             |      |           | . 8777    |

|                    | Amount    | Percent |
|--------------------|-----------|---------|
| Cost summary:      |           |         |
| 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   |

|                    | Amount    | Percent |
|--------------------|-----------|---------|
| Cost summary:      |           |         |
| 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   |

|                    | Amount    | Percent |
|--------------------|-----------|---------|
| Cost summary:      |           |         |
| 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: HARDWARE 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. Insertion of corrections: |       |           |          |
| A. Labor.....                 | 29.0  | .0263     | .7627    |
| V. House proof:               |       |           |          |
| A. Labor.....                 | .9    | .0263     | .0237    |
| 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:

$$\frac{A}{\text{Photocomposer cycles in minutes}} \times \frac{X}{\text{(photocomposer cost per minute)}} = \frac{B}{\text{Cost to set sample page by conventional process}}$$

$C$   $C_1$   $D$   
Computer cycles in minutes (cost of computer configuration per minute)—Initial keyboarding cycle in minutes

$$\frac{D_1}{(\text{Labor cost per minute} + \text{capital cost of keyboard per minute})} - \text{correction keyboarding cycle in minutes}$$

$$(D_1 \text{ (Labor cost per minute)} + D_2 \text{ (capital cost of keyboard per minute)}) - F \text{ (Supply costs)}$$

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

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

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

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


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$$176$$

<sup>1</sup> This value is taken from item C in equation II.



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

|                                    | A       | B        | C      | C <sub>1</sub> | D      | D <sub>1</sub> | D <sub>2</sub> | E    | F        |
|------------------------------------|---------|----------|--------|----------------|--------|----------------|----------------|------|----------|
| <b>I. M-16 Linotron:</b>           |         |          |        |                |        |                |                |      |          |
| 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.....        |         |          |        |                |        |                |                |      |          |
| <b>II. 360-50 Linotron 1010:</b>   |         |          |        |                |        |                |                |      |          |
| 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    |
| <b>III. 360-30 Fototronic CRT:</b> |         |          |        |                |        |                |                |      |          |
| 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    |
| <b>IV. RCA 70/45 Videocomp:</b>    |         |          |        |                |        |                |                |      |          |
| 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    |
| <b>V. RCA 70/35 Videocomp:</b>     |         |          |        |                |        |                |                |      |          |
| 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  | 1.1630         | 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    |

<sup>1</sup> 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 <sup>1</sup> | Pages  | Keyboards |
|-------------------------------------------------|----------------------|--------|-----------|
| <b>A. For Sample I—The Group:</b>               |                      |        |           |
| Linotron 505.....                               | 22,347               | 21,629 | 25.66     |
| Linotron 1010.....                              | ( <sup>2</sup> )     |        |           |
| Harris Fototronic CRT.....                      | ( <sup>2</sup> )     |        |           |
| Videocomp/45.....                               | 9,932                | 88,919 | 105.51    |
| Videocomp/35.....                               | ( <sup>2</sup> )     |        |           |
| <b>B. For sample II—Policy:</b>                 |                      |        |           |
| 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     |
| <b>C. For sample III—Prices and Production:</b> |                      |        |           |
| 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     |
| <b>D. For sample IV—Pleistocene:</b>            |                      |        |           |
| Linotron 505.....                               | 18,098               | 8,618  | 16.66     |
| Linotron 1010.....                              | 6,712                | 44,747 | 86.53     |
| Harris Fototronic CRT.....                      | ( <sup>2</sup> )     |        |           |
| Videocomp/45.....                               | 4,159                | 26,543 | 51.33     |
| Videocomp/35.....                               | 4,532                | 28,924 | 55.93     |
| <b>E. For sample V—American Bar:</b>            |                      |        |           |
| Linotron 505.....                               | 13,370               | 4,459  | 15.35     |
| Linotron 1010.....                              | 4,355                | 18,933 | 65.17     |
| Harris Fototronic CRT.....                      | ( <sup>2</sup> )     |        |           |
| Videocomp/45.....                               | 3,228                | 13,269 | 45.68     |
| Videocomp/35.....                               | 3,593                | 14,766 | 50.83     |
| <b>F. For sample VI—Book catalog:</b>           |                      |        |           |
| Linotron 505.....                               | ( <sup>3</sup> )     |        |           |
| 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                                                    | 2,608    | 4,770  | 67.00  |
| I. For Linotype mix—(Each sample 12.5 percent of total volume): |          |        |        |
| Linotron 505                                                    | (390.91) | 41,281 | 7,274  |
| Linotron 1010                                                   | (38.99)  | 4,117  | 15,766 |
| Harris Fototronic CRT                                           | (2)      |        |        |
| Videocomp/45                                                    | (33.87)  | 3,577  | 13,318 |
| Videocomp/35                                                    | (39.45)  | 4,167  | 15,515 |

<sup>1</sup> Refers to minutes per month of composer time.

<sup>2</sup> Multiple shifts.

<sup>3</sup> Negative.

<sup>4</sup> Did not set.

<sup>5</sup> 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 <sub>1</sub> | D      | D <sub>1</sub> | D <sub>2</sub> | 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    |

<sup>1</sup> 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

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

| System                                   | Minutes <sup>1</sup> | 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      |

| System                                                          | Minutes <sup>1</sup> | 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.....                                               | ( <sup>2</sup> )     | ----- | -----     |
| 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 <sup>3</sup> .....(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     |

<sup>1</sup> Refers to minutes used per month of composer time.

<sup>2</sup> Did not set.

<sup>3</sup> 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 <sub>1</sub> | D     | D <sub>1</sub> | D <sub>2</sub> | 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 | 1.3052   |
| 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    |

<sup>1</sup> 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<sup>1</sup>

| 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<sup>1</sup>—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     |

<sup>1</sup> 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 <sub>1</sub> | D     | D <sub>1</sub> | D <sub>2</sub> | E    |
| I. M-16 Linotron:           |         |          |        |                |       |                |                |      |
| A. The Group                | 1.0332  | \$1.5947 | 0      | 0              | 12.11 | \$0.0263       | \$0.0054       | 0.42 |
| B. Policy                   | 1.6000  | 1.7227   | 0      | 0              | 17.10 | .0263          | .0054          | .55  |
| C. Prices and Production    | 1.3000  | 1.6449   | 0      | 0              | 15.57 | .0263          | .0054          | .48  |
| D. Pleistocene              | 2.1000  | 2.0812   | 0      | 0              | 19.80 | .0263          | .0054          | .62  |
| E. American Bar             | 3.0000  | 3.9515   | 0      | 0              | 35.25 | .0263          | .0054          | 1.10 |
| II. 360-50 Linotron 1010:   |         |          |        |                |       |                |                |      |
| A. The Group                | .1125   | 1.5947   | 0.1062 | \$2.0211       | 12.11 | .0263          | .0054          | .42  |
| B. Policy                   | .1166   | 1.7227   | .1394  | 2.0211         | 17.10 | .0263          | .0054          | .55  |
| C. Prices and Production    | .1216   | 1.6449   | .1162  | 2.0211         | 15.57 | .0263          | .0054          | .48  |
| D. Pleistocene              | .1500   | 2.0812   | .1693  | 2.0211         | 19.80 | .0263          | .0054          | .62  |
| E. American Bar             | .2300   | 3.9515   | .2722  | 2.0211         | 35.25 | .0263          | .0054          | 1.10 |
| III. 360-30 Fototronic CRT: |         |          |        |                |       |                |                |      |
| A. The Group                | .1333   | 1.5947   | .1000  | 1.2771         | 12.11 | .0263          | .0054          | .42  |
| B. Policy                   | .1666   | 1.7227   | .1666  | 1.2771         | 17.10 | .0263          | .0054          | .55  |
| C. Prices and Production    | .1666   | 1.6449   | .1666  | 1.2771         | 15.57 | .0263          | .0054          | .48  |
| D. Pleistocene              | .1666   | 2.0812   | .3666  | 1.2771         | 19.80 | .0263          | .0054          | .62  |
| E. American Bar             | .2500   | 3.9515   | 1.0666 | 1.2771         | 35.25 | .0263          | .0054          | 1.10 |
| IV. RCA 70/45 Videocomp:    |         |          |        |                |       |                |                |      |
| A. The Group                | .1117   | 1.5947   | .0720  | 1.7795         | 12.11 | .0263          | .0054          | .42  |
| B. Policy                   | .1300   | 1.7227   | .0787  | 1.7795         | 17.10 | .0263          | .0054          | .55  |
| C. Prices and Production    | .1250   | 1.6449   | .0707  | 1.7795         | 15.57 | .0263          | .0054          | .48  |
| D. Pleistocene              | .1567   | 2.0812   | .0983  | 1.7795         | 19.80 | .0263          | .0054          | .62  |
| E. American Bar             | .2433   | 3.9515   | .1830  | 1.7795         | 35.25 | .0263          | .0054          | 1.10 |
| V. RCA 70/35 Videocomp:     |         |          |        |                |       |                |                |      |
| A. The Group                | .1117   | 1.5947   | .1370  | 1.1630         | 12.11 | .0263          | .0054          | .42  |
| B. Policy                   | .1300   | 1.7227   | .1607  | 1.1630         | 17.10 | .0263          | .0054          | .55  |
| C. Prices and Production    | .1250   | 1.6449   | .1507  | 1.1630         | 15.57 | .0263          | .0054          | .48  |
| D. Pleistocene              | .1567   | 2.0812   | .1843  | 1.1630         | 19.80 | .0623          | .0054          | .62  |
| E. American Bar             | .2433   | 3.9515   | .3620  | 1.1630         | 35.25 | .0263          | .0054          | 1.10 |

<sup>1</sup> 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 <sup>1</sup>

| 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   | 2,038  | 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     |

<sup>1</sup> 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 (unknown number of pages) =

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

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

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

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:

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

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 non-limiting 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 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.



## UNITED KINGDOM

## UNITED KINGDOM INPUT VALUES FOR EXECUTION OF EQUATION II: LINOTYPE

|                             | Factors  |          |         |        |                |                |      |
|-----------------------------|----------|----------|---------|--------|----------------|----------------|------|
|                             | A        | B        | C       | D      | D <sub>1</sub> | D <sub>2</sub> | E    |
| I. M-16 Linotron 505:       |          |          |         |        |                |                |      |
| A. The Group                | \$0.8777 | 0        | \$5,084 | 12.11  | \$0.0263       | \$0.0054       | 0.42 |
| B. Policy                   | 1.2751   | 0        | 5,084   | 17.10  | .0263          | .0054          | .55  |
| C. Prices and Production    | 1.2665   | 0        | 5,084   | 15.57  | .0263          | .0054          | .48  |
| D. Pleistocene              | 1.5102   | 0        | 5,084   | 19.80  | .0263          | .0054          | .62  |
| E. American Bar             | 2.6503   | 0        | 5,084   | 35.25  | .0263          | .0054          | 1.10 |
| F. Book catalog             | 4.9598   | 0        | 5,084   | 59.25  | .0263          | .0054          | 1.86 |
| G. Hardware directory       | 4.6144   | 0        | 5,084   | 88.04  | .0263          | .0054          | 2.77 |
| H. Telephone directory      |          |          |         |        |                |                |      |
| II. 360-50 Linotron 1010:   |          |          |         |        |                |                |      |
| A. The Group                | .8777    | \$27,747 | 13,559  | 12.11  | .0263          | .0054          | .42  |
| B. Policy                   | 1.2751   | 27,747   | 13,559  | 17.10  | .0263          | .0054          | .55  |
| C. Prices and Production    | 1.2665   | 27,747   | 13,559  | 15.57  | .0263          | .0054          | .48  |
| D. Pleistocene              | 1.5102   | 27,747   | 13,559  | 19.80  | .0263          | .0054          | .62  |
| E. American Bar             | 2.6503   | 27,747   | 13,559  | 35.25  | .0263          | .0054          | 1.10 |
| F. Book catalog             | 4.9598   | 27,747   | 13,559  | 59.25  | .0263          | .0054          | 1.86 |
| G. Hardware directory       | 4.6144   | 27,747   | 13,559  | 88.04  | .0263          | .0054          | 2.77 |
| H. Telephone directory      | 9.3471   | 27,747   | 13,559  | 143.80 | .0263          | .0054          | 4.52 |
| III. 360-30 Fototronic CRT: |          |          |         |        |                |                |      |
| A. The Group                | .8777    | 13,889   | 12,344  | 12.11  | .0263          | .0054          | .42  |
| B. Policy                   | 1.2751   | 13,889   | 12,344  | 17.10  | .0263          | .0054          | .55  |
| C. Prices and Production    | 1.2665   | 13,889   | 12,344  | 15.57  | .0263          | .0054          | .48  |
| D. Pleistocene              | 1.5102   | 13,889   | 12,344  | 19.80  | .0263          | .0054          | .62  |
| E. American Bar             | 2.6503   | 13,889   | 12,344  | 35.25  | .0263          | .0054          | 1.10 |
| F. Book catalog             | 4.9598   | 13,889   | 12,344  | 59.25  | .0263          | .0054          | 1.86 |
| G. Hardware directory       | 4.6144   | 13,889   | 12,344  | 88.04  | .0263          | .0054          | 2.77 |
| H. Telephone directory      | 9.3471   | 13,889   | 12,344  | 143.80 | .0263          | .0054          | 4.52 |
| IV. RCA 70/45 Videocomp:    |          |          |         |        |                |                |      |
| A. The Group                | .8777    | 18,792   | 12,482  | 12.11  | .0263          | .0054          | .42  |
| B. Policy                   | 1.2751   | 18,792   | 12,482  | 17.10  | .0263          | .0054          | .55  |
| C. Prices and Production    | 1.2665   | 18,792   | 12,482  | 15.57  | .0263          | .0054          | .48  |
| D. Pleistocene              | 1.5102   | 18,792   | 12,482  | 19.80  | .0263          | .0054          | .62  |
| E. American Bar             | 2.6503   | 18,792   | 12,482  | 35.25  | .0263          | .0054          | 1.10 |
| F. Book catalog             | 4.9598   | 18,792   | 12,482  | 59.25  | .0263          | .0054          | 1.86 |
| G. Hardware directory       | 4.6144   | 18,792   | 12,482  | 88.04  | .0263          | .0054          | 2.77 |
| H. Telephone directory      | 9.3471   | 18,792   | 12,482  | 143.80 | .0263          | .0054          | 4.52 |
| V. RCA 70/35 Videocomp:     |          |          |         |        |                |                |      |
| A. The Group                | .8777    | 12,281   | 12,482  | 12.11  | .0263          | .0054          | .42  |
| B. Policy                   | 1.2751   | 12,281   | 12,482  | 17.10  | .0263          | .0054          | .55  |
| C. Prices and Production    | 1.2665   | 12,281   | 12,482  | 15.57  | .0263          | .0054          | .48  |
| D. Pleistocene              | 1.5102   | 12,281   | 12,482  | 19.80  | .0263          | .0054          | .62  |
| E. American Bar             | 2.6503   | 12,281   | 12,482  | 35.25  | .0263          | .0054          | 1.10 |
| F. Book catalog             | 4.9598   | 12,281   | 12,482  | 59.25  | .0263          | .0054          | 1.86 |
| G. Hardware directory       | 4.6144   | 12,281   | 12,482  | 88.04  | .0263          | .0054          | 2.55 |
| H. Telephone directory      | 9.3471   | 12,281   | 12,482  | 143.80 | .0263          | .0054          | 4.52 |

<sup>1</sup> Charged with 4 minutes to strip galleys at \$0.0263 per minute.

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

| System                                   | Minutes <sup>1</sup> | 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                             | ( <sup>2</sup> )     |         |           |
| Linotron 1010                            | 9,370                | 14,777  | 85.51     |

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

| System                                                          | Minutes <sup>1</sup> | 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                                                    | ( <sup>3</sup> )     |        |           |
| 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 <sup>4</sup>                                       | (390.91)             | 41,281 | 7,274     |
| Linotron 1010                                                   | (78.77)              | 8,318  | 27,535    |
| Harris Fototronic CRT                                           | (243.37)             | 25,700 | 18,921    |
| Videocomp/45                                                    | (66.15)              | 6,985  | 20,995    |
| Videocomp/35                                                    | (90.57)              | 9,564  | 16,697    |

<sup>1</sup> Refers to minutes of use per month of lower speed component which is generally the computer.

<sup>2</sup> Negative.

<sup>3</sup> Did not set.

<sup>4</sup> 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: MONOTYPE

|                             | Factors  |          |         |        |                |                |      |          |
|-----------------------------|----------|----------|---------|--------|----------------|----------------|------|----------|
|                             | A        | B        | C       | D      | D <sub>1</sub> | D <sub>2</sub> | 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      |

<sup>1</sup> Charged with 4 minutes to strip galleys at \$0.0263 per minute.

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

| System                                   | Minutes <sup>1</sup> | 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 <sup>1</sup> | 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 <sup>2</sup> ----- (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     |

<sup>1</sup> Refers to minutes of use per month of lower speed component which is generally the computer.

<sup>2</sup> 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 <sub>1</sub> | D <sub>2</sub> | E    |
| I. M-16 Linotron 505:         |          |          |           |       |                |                |      |
| A. The Group.....             | \$2.0591 | 0        | \$5,084   | 12.11 | \$0.0263       | \$0.0054       | 0.42 |
| B. Policy.....                | 2.2901   | 0        | 5,084     | 17.10 | .0263          | .0054          | .55  |
| C. Prices and Production..... | 2.0962   | 0        | 5,084     | 15.57 | .0263          | .0054          | .48  |
| D. Pleistocene.....           | 2.6761   | 0        | 5,084     | 19.80 | .0263          | .0054          | .62  |
| E. American Bar.....          | 5.0551   | 0        | 5,084     | 35.25 | .0263          | .0054          | 1.10 |
| II. 360-50 Linotron 1010:     |          |          |           |       |                |                |      |
| A. The Group.....             | 2.0591   | \$27,747 | 13,559    | 12.11 | .0263          | .0054          | .42  |
| B. Policy.....                | 2.2901   | 27,747   | 13,559    | 17.10 | .0263          | .0054          | .55  |
| C. Prices and Production..... | 2.0962   | 27,747   | 13,559    | 15.57 | .0263          | .0054          | .48  |
| D. Pleistocene.....           | 2.6761   | 27,747   | 13,559    | 19.80 | .0263          | .0054          | .62  |
| E. American Bar.....          | 5.0551   | 27,747   | 13,559    | 35.25 | .0263          | .0054          | 1.10 |
| III. 360-30 Fototronic CRT:   |          |          |           |       |                |                |      |
| A. The Group.....             | 2.0591   | 13,889   | 12,344    | 12.11 | .0263          | .0054          | .42  |
| B. Policy.....                | 2.2901   | 13,889   | 12,344    | 17.10 | .0263          | .0054          | .55  |
| C. Prices and Production..... | 2.0962   | 13,889   | 12,344    | 15.57 | .0263          | .0054          | .48  |
| D. Pleistocene.....           | 2.6761   | 13,889   | 12,344    | 19.80 | .0263          | .0054          | .62  |
| E. American Bar.....          | 5.0551   | 13,889   | 12,344    | 35.25 | .0263          | .0054          | 1.10 |
| V. RCA 70/45 Videocomp:       |          |          |           |       |                |                |      |
| A. The Group.....             | 2.0591   | 18,792   | 12,482.00 | 12.11 | .0263          | .0054          | .42  |
| B. Policy.....                | 2.2901   | 18,792   | 12,482.00 | 17.10 | .0263          | .0054          | .55  |
| C. Prices and Production..... | 2.0962   | 18,792   | 12,482.00 | 15.57 | .0263          | .0054          | .48  |
| D. Pleistocene.....           | 2.6761   | 18,792   | 12,482.00 | 19.80 | .0263          | .0054          | .62  |
| E. American Bar.....          | 5.0551   | 18,792   | 12,482.00 | 35.25 | .0263          | .0054          | 1.10 |
| V. RCA 70/35 Videocomp:       |          |          |           |       |                |                |      |
| A. The Group.....             | 2.0591   | 12,281   | 12,482.00 | 12.11 | .0263          | .0054          | .42  |
| B. Policy.....                | 2.2901   | 12,281   | 12,482.00 | 17.10 | .0263          | .0054          | .55  |
| C. Prices and Production..... | 2.0962   | 12,281   | 12,482.00 | 15.57 | .0263          | .0054          | .48  |
| D. Pleistocene.....           | 2.6761   | 12,281   | 12,482.00 | 19.80 | .0263          | .0054          | .62  |
| E. American Bar.....          | 5.0551   | 12,281   | 12,482.00 | 35.25 | .0263          | .0054          | 1.10 |

<sup>1</sup> 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 <sup>1</sup>

| System                                   | Minutes <sup>2</sup> | 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 <sup>1</sup>—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     |

<sup>1</sup> Cost of computer composer imbalance included.

<sup>2</sup> Refers to minutes of use per month of lower speed component.

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 (BALANCED)

|                             | Factors  |          |         |       |                |                |      |
|-----------------------------|----------|----------|---------|-------|----------------|----------------|------|
|                             | A        | B        | C       | D     | D <sub>1</sub> | D <sub>2</sub> | E    |
| I. M-16 Linotron 505:       |          |          |         |       |                |                |      |
| A. The Group                | \$1.5947 | 0        | \$5,084 | 12.11 | \$0.0263       | \$0.0054       | 0.42 |
| B. Policy                   | 1.7227   | 0        | 5,084   | 17.10 | .0263          | .0054          | .55  |
| C. Prices and Production    | 1.6449   | 0        | 5,084   | 15.57 | .0263          | .0054          | .48  |
| D. Pleistocene              | 2.0812   | 0        | 5,084   | 19.80 | .0263          | .0054          | .62  |
| E. American Bar             | 3.9515   | 0        | 5,084   | 35.25 | .0263          | .0054          | 1.10 |
| II. 360-50 Linotron 1010:   |          |          |         |       |                |                |      |
| A. The Group                | 1.5947   | \$27,747 | 13,559  | 12.11 | .0263          | .0054          | .42  |
| B. Policy                   | 1.7227   | 27,747   | 13,559  | 17.10 | .0263          | .0054          | .55  |
| C. Prices and Production    | 1.6449   | 27,747   | 13,559  | 15.57 | .0263          | .0054          | .48  |
| D. Pleistocene              | 2.0812   | 27,747   | 13,559  | 19.80 | .0263          | .0054          | .62  |
| E. American Bar             | 3.9515   | 27,747   | 13,559  | 35.25 | .0263          | .0054          | 1.10 |
| III. 360-30 Fototronic CRT: |          |          |         |       |                |                |      |
| A. The Group                | 1.5947   | 13,889   | 12,344  | 12.11 | .0263          | .0054          | .42  |
| B. Policy                   | 1.7227   | 13,889   | 12,344  | 17.10 | .0263          | .0054          | .55  |
| C. Prices and Production    | 1.6449   | 13,889   | 12,344  | 15.57 | .0263          | .0054          | .48  |
| D. Pleistocene              | 2.0812   | 13,889   | 12,344  | 19.80 | .0263          | .0054          | .62  |
| E. American Bar             | 3.9515   | 13,889   | 12,344  | 35.25 | .0263          | .0054          | 1.10 |
| IV. RCA 70/45 Videocomp:    |          |          |         |       |                |                |      |
| A. The Group                | 1.5947   | 18,792   | 12,482  | 12.11 | .0263          | .0054          | .42  |
| B. Policy                   | 1.7227   | 18,792   | 12,482  | 17.10 | .0263          | .0054          | .55  |
| C. Prices and Production    | 1.6449   | 18,792   | 12,482  | 15.57 | .0263          | .0054          | .48  |
| D. Pleistocene              | 2.0812   | 18,792   | 12,482  | 19.80 | .0263          | .0054          | .62  |
| E. American Bar             | 3.9515   | 18,792   | 12,482  | 35.25 | .0263          | .0054          | 1.10 |
| V. RCA 70/35 Videocomp:     |          |          |         |       |                |                |      |
| A. The Group                | 1.5947   | 12,281   | 12,482  | 12.11 | .0263          | .0054          | .42  |
| B. Policy                   | 1.7227   | 12,281   | 12,482  | 17.10 | .0263          | .0054          | .55  |
| C. Prices and Production    | 1.6449   | 12,281   | 12,482  | 15.57 | .0263          | .0054          | .48  |
| D. Pleistocene              | 2.0812   | 12,281   | 12,482  | 19.80 | .0263          | .0054          | .62  |
| E. American Bar             | 3.9515   | 12,281   | 12,482  | 35.25 | .0263          | .0054          | 1.10 |

<sup>1</sup> 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 <sup>1</sup>

| System                                                          | Minutes <sup>2</sup> | 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     |

<sup>1</sup> Cost of computer-composer imbalance excluded.

<sup>2</sup> 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.

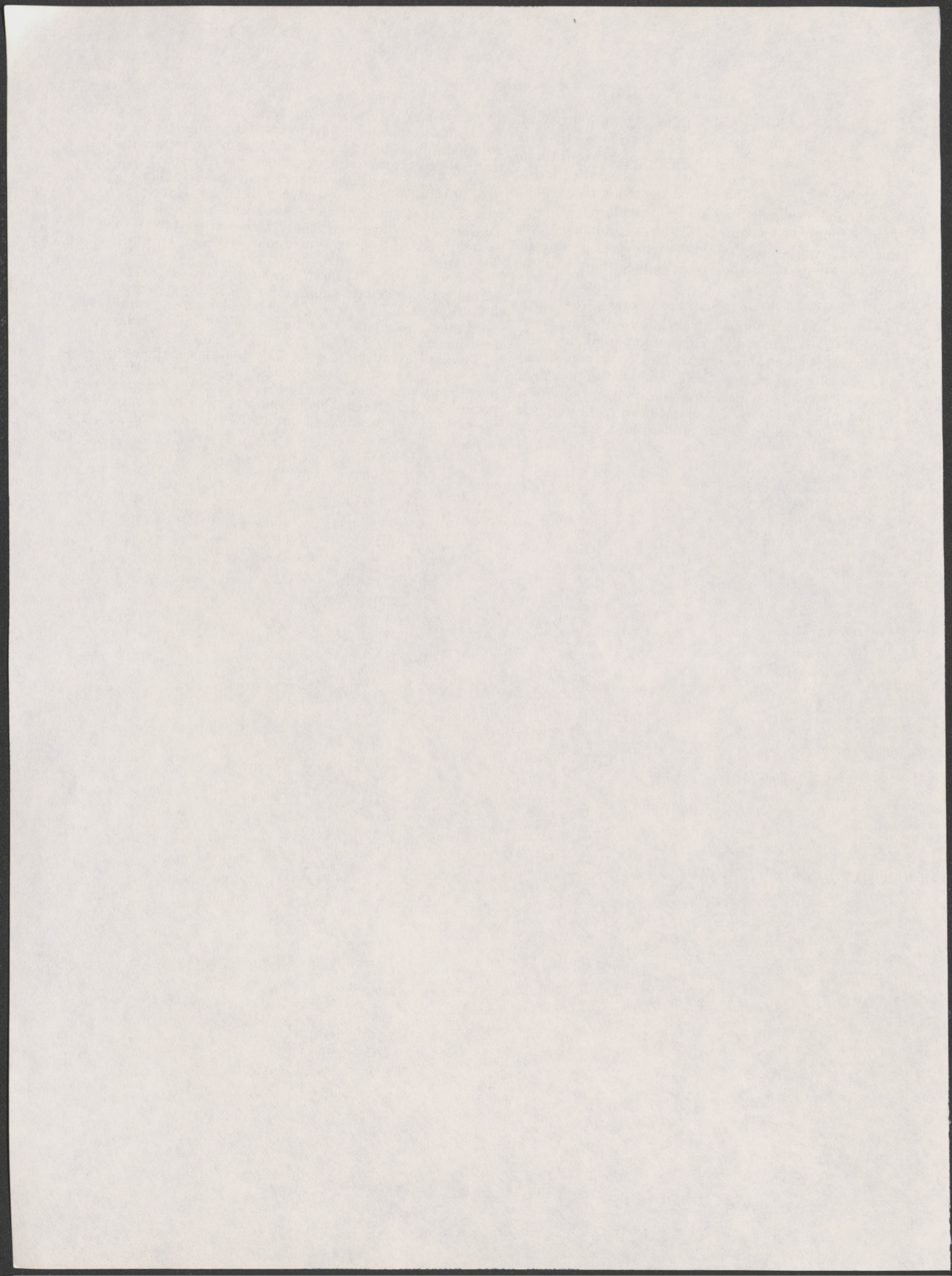
Within the past two decades computer speeds have increased at tremendous rates while computing costs have declined markedly. This augurs well for electronic composition; however, it must be remembered that sociological change lags behind technological change. It has been held in some quarters that the 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,<br>1967—<br>rate<br>per<br>hour | July 1, 1968        |                      |                                               |                  |
|-----------------------------------------|-----------------------------------------|---------------------|----------------------|-----------------------------------------------|------------------|
|                                         |                                         | Rate<br>per<br>hour | Hours<br>per<br>week | Employer contribution<br>to fund <sup>1</sup> |                  |
|                                         |                                         |                     |                      | Insur-<br>ance <sup>2</sup>                   | Pension          |
| BOOK AND JOB                            |                                         |                     |                      |                                               |                  |
| Bindery women.....                      | \$2.395                                 | \$2.620             | 37½                  | \$0.04                                        | \$0.12           |
| Bookbinders.....                        | 3.937                                   | 4.267               | 37½                  | 4.18                                          | .12              |
| Compositors, hand.....                  | 4.000                                   | 4.267               | 37½                  | 5.20                                          | .12              |
| Electrotypers.....                      | 4.110                                   | 4.180               | 37½                  |                                               |                  |
| Machine operators.....                  | 4.000                                   | 4.267               | 37½                  | 5.20                                          | .12              |
| Machine tenders (machinists).....       | 4.000                                   | 4.267               | 37½                  | 5.20                                          | .12              |
| Mailers.....                            | 3.730                                   | 3.730               | 37½                  | .20                                           | .07              |
| Photoengravers.....                     | 4.600                                   | 4.914               | 35                   | .24                                           | ( <sup>3</sup> ) |
| Press assistants and feeders:           |                                         |                     |                      |                                               |                  |
| Cylinder.....                           | 3.400                                   | 3.670               | 37½                  | .17                                           | .10              |
| 2-color or perfector.....               | 3.430                                   | 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                                   | 3.790               | 37½                  | .17                                           | .10              |
| 5-color McKee (running 4-color).....    | 3.570                                   | 3.840               | 37½                  | .17                                           | .10              |
| 5-color McKee.....                      | 3.640                                   | 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                                   | 3.770               | 37½                  | .17                                           | .10              |
| Single-color:                           |                                         |                     |                      |                                               |                  |
| 32 inches up to and including           |                                         |                     |                      |                                               |                  |
| 50 inches.....                          | 3.400                                   | 3.670               | 37½                  | .17                                           | .10              |
| 42 by 58 inches.....                    | 3.460                                   | 3.730               | 37½                  | .17                                           | .10              |
| 2-color and perfecting offset 24 by     |                                         |                     |                      |                                               |                  |
| 42 inches.....                          | 3.460                                   | 3.730               | 37½                  | .17                                           | .10              |
| Perfector 38 by 53 inches and 41 by     |                                         |                     |                      |                                               |                  |
| 54 inches.....                          | 3.460                                   | 3.730               | 37½                  | .17                                           | .10              |
| 2-color:                                |                                         |                     |                      |                                               |                  |
| Up to and including 50 inches.....      | 3.530                                   | 3.800               | 37½                  | .17                                           | .10              |
| Up to and including 60 inches.....      | 3.460                                   | 3.730               | 37½                  | .17                                           | .10              |
| 4-color sheet-fed, 25 by 38 inches..... | 3.420                                   | 3.790               | 37½                  | .17                                           | .10              |
| Royal Zenith:                           |                                         |                     |                      |                                               |                  |
| 2-color, 23 by 30 inches.....           | 3.460                                   | 3.730               | 37½                  | .17                                           | .10              |
| 2-unit web.....                         | 3.570                                   | 3.840               | 37½                  | .17                                           | .10              |
| 4-color sheet-fed, 43 by 60 inches..... | 3.500                                   | 3.770               | 37½                  | .17                                           | .10              |
| Webendorfer, double folder offset,      |                                         |                     |                      |                                               |                  |
| web fed.....                            | 3.570                                   | 3.840               | 37½                  | .17                                           | .10              |
| Web:                                    |                                         |                     |                      |                                               |                  |
| Single-color.....                       | 3.400                                   | 3.670               | 37½                  | .17                                           | .10              |
| 2-color.....                            | 3.480                                   | 3.750               | 37½                  | .17                                           | .10              |
| Web (high speed) and web offset up      |                                         |                     |                      |                                               |                  |
| to and including 40 inches.....         | 3.620                                   | 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                                   | 4.180               | 37½                  | .17                                           | .10              |
| 1 4-color Cottrell McKee.....           | 4.320                                   | 4.590               | 37½                  | .17                                           | .10              |
| 1 2-color sheet-fed Cottrell            |                                         |                     |                      |                                               |                  |
| rotary.....                             | 4.060                                   | 4.330               | 37½                  | .17                                           | .10              |
| Diddie-Glasser tandem—4 unit            |                                         |                     |                      |                                               |                  |
| web.....                                | 4.750                                   | 5.020               | 37½                  | .17                                           | .10              |
| 1 5-color:                              |                                         |                     |                      |                                               |                  |
| Cottrell McKee running 4                |                                         |                     |                      |                                               |                  |
| colors.....                             | 4.370                                   | 4.640               | 37½                  | .17                                           | .10              |
| Cottrell 36 by 48 inches,               |                                         |                     |                      |                                               |                  |
| sheet-fed rotary with pile              |                                         |                     |                      |                                               |                  |
| feeder running 2 colors.....            | 4.160                                   | 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]

|                                                                                      |                                         | July 1, 1968        |                      |                                               |         |
|--------------------------------------------------------------------------------------|-----------------------------------------|---------------------|----------------------|-----------------------------------------------|---------|
| Trade or occupation                                                                  | July 1,<br>1967—<br>rate<br>per<br>hour | Rate<br>per<br>hour | Hours<br>per<br>week | Employer contribution<br>to fund <sup>1</sup> |         |
|                                                                                      |                                         |                     |                      | Insur-<br>ance <sup>2</sup>                   | Pension |
| BOOK AND JOB—Continued                                                               |                                         |                     |                      |                                               |         |
| Pressmen, cylinder—Continued                                                         |                                         |                     |                      |                                               |         |
| 1 5-color—Continued                                                                  |                                         |                     |                      |                                               |         |
| Cottrell 36 by 48 inches,<br>sheet-fed rotary with pile<br>feeder running more than  |                                         |                     |                      |                                               |         |
| 2 colors.....                                                                        | 4.310                                   | 4.580               | 37½                  | .17                                           | .10     |
| Cottrell McKee running                                                               |                                         |                     |                      |                                               |         |
| 5 colors.....                                                                        | 4.450                                   | 4.720               | 37½                  | .17                                           | .10     |
| 1 perfecter, 1 2-color.....                                                          | 4.010                                   | 4.280               | 37½                  | .17                                           | .10     |
| 1 or 2 vertical Miehle; 1 or 2<br>Kelly; any cylinder press                          |                                         |                     |                      |                                               |         |
| 20 inches or under; 1 or 2<br>Miller (high speed); any<br>combination of above.....  |                                         |                     |                      |                                               |         |
| 3.910                                                                                | 4.180                                   | 37½                 | .17                  | .10                                           |         |
| Offset:                                                                              |                                         |                     |                      |                                               |         |
| 1-color:                                                                             |                                         |                     |                      |                                               |         |
| Up to 17 inches.....                                                                 | 3.290                                   | 3.560               | 37½                  | .17                                           | .10     |
| 17 to 20 inches.....                                                                 | 3.390                                   | 3.660               | 37½                  | .17                                           | .10     |
| 20 to 24 inches.....                                                                 | 3.910                                   | 4.180               | 37½                  | .17                                           | .10     |
| 24 to 42 inches.....                                                                 | 4.010                                   | 4.280               | 37½                  | .17                                           | .10     |
| 35 to 45 inches.....                                                                 | 4.060                                   | 4.330               | 37½                  | .17                                           | .10     |
| 42 to 58 inches.....                                                                 | 4.120                                   | 4.390               | 37½                  | .17                                           | .10     |
| 2-color:                                                                             |                                         |                     |                      |                                               |         |
| Attachment, running 2<br>colors up to 17 inches..                                    |                                         |                     |                      |                                               |         |
| 3.390                                                                                | 3.660                                   | 37½                 | .17                  | .10                                           |         |
| Up to and including                                                                  |                                         |                     |                      |                                               |         |
| 60 inches.....                                                                       | 4.340                                   | 4.610               | 37½                  | .17                                           | .10     |
| Perfecting 24 to 42<br>inches.....                                                   |                                         |                     |                      |                                               |         |
| 4.210                                                                                | 4.480                                   | 37½                 | .17                  | .10                                           |         |
| Up to and including                                                                  |                                         |                     |                      |                                               |         |
| 50 inches.....                                                                       | 4.260                                   | 4.530               | 37½                  | .17                                           | .10     |
| Royal Zenith:                                                                        |                                         |                     |                      |                                               |         |
| 2-color, 23 by 30 inches..                                                           | 4.210                                   | 4.480               | 37½                  | .17                                           | .10     |
| 2-unit web.....                                                                      | 4.380                                   | 4.650               | 37½                  | .17                                           | .10     |
| 4-color sheet-fed:                                                                   |                                         |                     |                      |                                               |         |
| 43 by 60 inches:                                                                     |                                         |                     |                      |                                               |         |
| Head.....                                                                            | 4.430                                   | 4.700               | 37½                  | .17                                           | .10     |
| Second.....                                                                          | 4.020                                   | 4.290               | 37½                  | .17                                           | .10     |
| 25 by 38 inches:                                                                     |                                         |                     |                      |                                               |         |
| Head.....                                                                            | 4.360                                   | 4.630               | 37½                  | .17                                           | .10     |
| Second.....                                                                          | 3.950                                   | 4.220               | 37½                  | .17                                           | .10     |
| 2-color, 17½ by 24¾<br>inches.....                                                   |                                         |                     |                      |                                               |         |
| 4.430                                                                                | 4.700                                   | 37½                 | .17                  | .10                                           |         |
| Perfector 38 t 53 inches and<br>41 by 54 inches.....                                 |                                         |                     |                      |                                               |         |
| 4.360                                                                                | 4.630                                   | 37½                 | .17                  | .10                                           |         |
| Foreign patent proof press...                                                        |                                         |                     |                      |                                               |         |
| 3.480                                                                                | 3.750                                   | 37½                 | .17                  | .10                                           |         |
| Webendorfer:                                                                         |                                         |                     |                      |                                               |         |
| 1st.....                                                                             | 4.380                                   | 4.650               | 37½                  | .17                                           | .10     |
| 2d.....                                                                              | 4.010                                   | 4.280               | 37½                  | .17                                           | .10     |
| Perfecting web-offset up to<br>and including 40 inches:                              |                                         |                     |                      |                                               |         |
| 1st.....                                                                             | 4.530                                   | 4.800               | 37½                  | .17                                           | .10     |
| 2d.....                                                                              | 4.060                                   | 4.330               | 37½                  | .17                                           | .10     |
| Web:                                                                                 |                                         |                     |                      |                                               |         |
| Magazine web, 2-color with<br>folder:                                                |                                         |                     |                      |                                               |         |
| 1st.....                                                                             | 4.280                                   | 4.550               | 37½                  | .17                                           | .10     |
| 2d (with presses over<br>46 inches).....                                             | 4.080                                   | 4.350               | 37½                  | .17                                           | .10     |
| High speed magazine web,<br>2-color with folder:                                     |                                         |                     |                      |                                               |         |
| 1st.....                                                                             | 4.480                                   | 4.750               | 37½                  | .17                                           | .10     |
| 2d.....                                                                              | 4.180                                   | 4.450               | 37½                  | .17                                           | .10     |
| Single-roll web:                                                                     |                                         |                     |                      |                                               |         |
| 46 inches or under...                                                                | 4.150                                   | 4.420               | 37½                  | .17                                           | .10     |
| Over 46 inches.....                                                                  | 4.200                                   | 4.470               | 37½                  | .17                                           | .10     |
| Second man on web press<br>(required on single-roll<br>running 60 inches or over)... |                                         |                     |                      |                                               |         |
| 4.000                                                                                | 4.270                                   | 37½                 | .17                  | .10                                           |         |
| Pressmen, platen:                                                                    |                                         |                     |                      |                                               |         |
| 1, 2, or 3 hand-fed.....                                                             | 3.680                                   | 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]

| July 1, 1968                                       |                                         |                     |                      |                                               |                    |
|----------------------------------------------------|-----------------------------------------|---------------------|----------------------|-----------------------------------------------|--------------------|
| Trade or occupation                                | July 1,<br>1967—<br>rate<br>per<br>hour | Rate<br>per<br>hour | Hours<br>per<br>week | Employer contribution<br>to fund <sup>1</sup> |                    |
|                                                    |                                         |                     |                      | Insur-<br>ance <sup>2</sup>                   | Pension            |
| NEWSPAPER                                          |                                         |                     |                      |                                               |                    |
| Compositors, hand, daywork .....                   | 4.510                                   | 11 4.829            | 35                   | 12.06%                                        | .077 <sup>10</sup> |
| Compositors, hand, nightwork .....                 | 4.680                                   | 11 5.000            | 35                   | 12.06%                                        | .077 <sup>10</sup> |
| Machine operators, daywork .....                   | 4.510                                   | 11 4.829            | 35                   | 12.06%                                        | .077 <sup>10</sup> |
| Machine operators, nightwork .....                 | 4.680                                   | 11 5.000            | 35                   | 12.06%                                        | .077 <sup>10</sup> |
| Machine tenders (machinists), day-<br>work .....   | 4.510                                   | 11 4.829            | 35                   | 12.06%                                        | .077 <sup>10</sup> |
| Machine tenders (machinists), night-<br>work ..... | 4.680                                   | 11 5.000            | 35                   | 12.06%                                        | .077 <sup>10</sup> |
| Mailers, daywork .....                             | 4.086                                   | 13 4.257            | 35                   | 12.05%                                        | .077 <sup>10</sup> |
| Mailers, nightwork .....                           | 4.229                                   | 13 4.400            | 35                   | 12.05%                                        | .077 <sup>10</sup> |
| Photoengravers, daywork .....                      | 4.692                                   | 11 5.007            | 35                   | .06%                                          |                    |
| Photoengravers, nightwork .....                    | 4.850                                   | 11 5.164            | 35                   | .06%                                          |                    |
| Pressmen, web, daywork .....                       | 4.310                                   | 4.480               | 35                   | .04%                                          | .143 <sup>10</sup> |
| Off-side colormen .....                            | 4.453                                   | 4.624               | 35                   | .04%                                          | .143 <sup>10</sup> |
| Web .....                                          | 4.310                                   | 4.481               | 35                   | .04%                                          | .143 <sup>10</sup> |
| Pressmen, web, nightwork .....                     | 4.453                                   | 4.624               | 35                   | .04%                                          | .143 <sup>10</sup> |
| Off-side colormen .....                            | 4.596                                   | 4.767               | 35                   | .04%                                          | .143 <sup>10</sup> |
| Pressmen-in-charge, daywork .....                  | 4.596                                   | 4.767               | 35                   | .04%                                          | .143 <sup>10</sup> |
| Pressmen-in-charge, nightwork .....                | 4.739                                   | 4.910               | 35                   | .04%                                          | .143 <sup>10</sup> |
| Stereotypers, daywork .....                        | 4.099                                   | 4.304               | 36¼                  | ( <sup>10</sup> )                             |                    |
| Stereotypers, nightwork .....                      | 4.615                                   | 4.815               | 32½                  | ( <sup>10</sup> )                             |                    |
| LITHOGRAPHY                                        |                                         |                     |                      |                                               |                    |
| Artists .....                                      | 4.880                                   | 14 5.070            | 35                   | 15.18%                                        | ( <sup>10</sup> )  |
| Cameramen:                                         |                                         |                     |                      |                                               |                    |
| Black and white .....                              | 4.280                                   | 14 4.470            | 35                   | 15.18%                                        | ( <sup>10</sup> )  |
| Color .....                                        | 4.880                                   | 14 5.070            | 35                   | 15.18%                                        | ( <sup>10</sup> )  |
| Platemakers:                                       |                                         |                     |                      |                                               |                    |
| Photocomposers .....                               | 4.360                                   | 14 4.550            | 35                   | 15.18%                                        | ( <sup>10</sup> )  |
| Vacuum frame .....                                 | 4.210                                   | 14 4.400            | 35                   | 15.18%                                        | ( <sup>10</sup> )  |
| Press assistants and feeders:                      |                                         |                     |                      |                                               |                    |
| Sheet-fed:                                         |                                         |                     |                      |                                               |                    |
| 1-color:                                           |                                         |                     |                      |                                               |                    |
| Up to and including 50<br>inches .....             | 3.320                                   | 17 3.470            | 35                   | 15.18%                                        | ( <sup>10</sup> )  |
| Over 50 inches .....                               | 3.370                                   | 17 3.520            | 35                   | 15.18%                                        | ( <sup>10</sup> )  |
| 2-color:                                           |                                         |                     |                      |                                               |                    |
| Up to and including 50<br>inches .....             | 3.420                                   | 17 3.570            | 35                   | 15.18%                                        | ( <sup>10</sup> )  |
| Over 50 and including<br>60 inches:                |                                         |                     |                      |                                               |                    |
| 1st .....                                          | 3.500                                   | 17 3.650            | 35                   | 15.18%                                        | ( <sup>10</sup> )  |
| 2d .....                                           | 2.640                                   | 17 2.790            | 35                   | 15.18%                                        | ( <sup>10</sup> )  |
| Over 60 inches:                                    |                                         |                     |                      |                                               |                    |
| 1st .....                                          | 3.500                                   | 17 3.650            | 35                   | 15.18%                                        | ( <sup>10</sup> )  |
| 2d .....                                           | 2.740                                   | 17 2.890            | 35                   | 15.18%                                        | ( <sup>10</sup> )  |
| 4-color:                                           |                                         |                     |                      |                                               |                    |
| Over 40 inches:                                    |                                         |                     |                      |                                               |                    |
| 1st .....                                          | 3.610                                   | 17 3.760            | 35                   | 15.18%                                        | ( <sup>10</sup> )  |
| 2d .....                                           | 2.830                                   | 17 2.980            | 35                   | 15.18%                                        | ( <sup>10</sup> )  |
| Mill sheeter .....                                 | 3.500                                   | 17 3.650            | 35                   | 15.18%                                        | ( <sup>10</sup> )  |
| Web:                                               |                                         |                     |                      |                                               |                    |
| 4-plate, perfecting 36 inches .....                | 3.580                                   | 17 3.730            | 35                   | 15.18%                                        | ( <sup>10</sup> )  |
| 12-plate, 1-roll 38 inches:                        |                                         |                     |                      |                                               |                    |
| 1st .....                                          | 4.020                                   | 17 4.170            | 35                   | 15.18%                                        | ( <sup>10</sup> )  |
| 2d .....                                           | 3.540                                   | 17 3.690            | 35                   | 15.18%                                        | ( <sup>10</sup> )  |

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,<br>1967—<br>rate<br>per<br>hour | July 1, 1968        |                      |                                               |         |
|---------------------|-----------------------------------------|---------------------|----------------------|-----------------------------------------------|---------|
|                     |                                         | Rate<br>per<br>hour | Hours<br>per<br>week | Employer contribution<br>to fund <sup>1</sup> |         |
|                     |                                         |                     |                      | Insur-<br>ance <sup>2</sup>                   | 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 | 15.18% | (10) |
| 2d -----                                       | 3.540 | 17 3.690 | 35 | 15.18% | (10) |
| Pressmen, offset:                              |       |          |    |        |      |
| Sheet-fed:                                     |       |          |    |        |      |
| 1-color:                                       |       |          |    |        |      |
| Up to 30 inches -----                          | 3.970 | 17 4.120 | 35 | 15.18% | (10) |
| Up to 60 inches -----                          | 4.230 | 14 4.420 | 35 | 15.18% | (10) |
| 2-color:                                       |       |          |    |        |      |
| Up to 60 inches -----                          | 4.760 | 14 4.950 | 35 | 15.18% | (10) |
| Over 60 inches -----                           | 5.030 | 14 5.220 | 35 | 15.18% | (10) |
| 4-color:                                       |       |          |    |        |      |
| Over 40 inches:                                |       |          |    |        |      |
| 1st -----                                      | 5.450 | 14 5.640 | 35 | 15.18% | (10) |
| 2d -----                                       | 4.560 | 14 4.750 | 35 | 15.18% | (10) |
| Web:                                           |       |          |    |        |      |
| 4-plate, perfecting 36 inches:                 |       |          |    |        |      |
| 1st -----                                      | 5.170 | 14 5.360 | 35 | 15.18% | (10) |
| 2d -----                                       | 4.280 | 14 4.470 | 35 | 15.18% | (10) |
| 12-plate, 1-roll 38 inches:                    |       |          |    |        |      |
| 1st -----                                      | 5.860 | 14 6.050 | 35 | 15.18% | (10) |
| 2d -----                                       | 4.750 | 14 4.940 | 35 | 15.18% | (10) |
| 16-plate, 2-roll with double folder 38 inches: |       |          |    |        |      |
| 1st -----                                      | 5.860 | 14 6.050 | 35 | 15.18% | (10) |
| 2d -----                                       | 4.750 | 14 4.940 | 35 | 15.18% | (10) |
| 3d -----                                       | 4.750 | 14 4.940 | 35 | 15.18% | (10) |
| Strippers:                                     |       |          |    |        |      |
| Black and white -----                          | 4.100 | 17 4.250 | 35 | 15.18% | (10) |
| Color -----                                    | 4.360 | 14 4.550 | 35 | 15.18% | (10) |

<sup>1</sup> 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.

<sup>2</sup> 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.

<sup>3</sup> Additional increase of 26 7/10 cents effective Mar. 31, 1969.

<sup>4</sup> Additional increase of 2 cents effective Apr. 1, 1969.

<sup>5</sup> Additional increase of 2 cents effective Jan. 1, 1969.

<sup>6</sup> Additional increase of 8 cents effective Nov. 19, 1968.

<sup>7</sup> This rate in effect prior to July 1, 1968; new scale in negotiation at time of survey.

<sup>8</sup> 1 percent.

<sup>9</sup> Additional increase of 26 cents effective Mar. 11, 1969.

<sup>10</sup> Agreement provides for this benefit; amount of payment not reported separately.

<sup>11</sup> Additional increase of 31 1/2 cents effective Oct. 1, 1968.

<sup>12</sup> Additional increase of 2 1/10 cents effective Oct. 1, 1968.

<sup>13</sup> Additional increase of 8 3/4 cents effective Oct. 1, 1968.

<sup>14</sup> Additional increase of 17 cents effective Dec. 1, 1968.

<sup>15</sup> Additional increase of 1 3/10 cents effective Mar. 1, 1969.

<sup>16</sup> 2 percent. Additional increase of 1 percent effective Dec. 1, 1968.

<sup>17</sup> Additional increase of 14 cents effective Dec. 1, 1968.



## Advance Salaries of Electronic Data Processing Occupations Summary

### 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; programmers, 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 programmers 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 programmers from information developed by the higher level analyst.

PROGRAMER, BUSINESS

(Digital-computer programmer)

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 programmer 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 programming 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 programmers primarily concerned with scientific and/or engineering problems.

For wage study purposes, programmers 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 programmers 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 programmer or supervisor. May assist higher level programmer 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 programmers.

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 programmer. 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 programmer; 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/                       | Middle range 2/ |                        |                                    | Mean 2/                       | Middle range 2/   |                     |                                    | Mean 2/                       | Middle range 2/   |
| <b>Men and women combined</b>            |                        |                                    |                               |                 |                        |                                    |                               |                   |                     |                                    |                               |                   |
| Systems analysts, business, class A ---- | 272                    | 38.5                               | \$240.00                      | \$234.00        | -                      | -                                  | -                             | -                 | 717                 | 39.0                               | \$251.50                      | \$231.00-\$271.00 |
| Manufacturing ----                       | 118                    | 39.5                               | 236.50                        | 233.00          | -                      | -                                  | -                             | -                 | 256                 | 38.5                               | 251.00                        | 232.50-270.50     |
| Nonmanufacturing ----                    | 154                    | 38.0                               | 242.50                        | 235.00          | -                      | -                                  | -                             | -                 | 251.50              | 461                                | 251.50                        | 229.00-271.00     |
| Systems analysts, business, class B ---- | 268                    | 38.5                               | 203.50                        | 206.00          | -                      | -                                  | -                             | -                 | 821                 | 38.5                               | 213.00                        | 193.50-232.50     |
| Manufacturing ----                       | 101                    | 39.0                               | 213.00                        | 214.00          | -                      | -                                  | -                             | -                 | 385                 | 38.5                               | 216.50                        | 197.00-239.50     |
| Nonmanufacturing ----                    | 167                    | 38.0                               | 197.50                        | 198.50          | -                      | -                                  | -                             | -                 | 436                 | 39.0                               | 210.00                        | 188.50-227.00     |
| Systems analysts, business, class C ---- | 124                    | 38.0                               | 162.50                        | 156.50          | -                      | -                                  | -                             | -                 | 326                 | 39.0                               | 179.00                        | 162.50-194.50     |
| Manufacturing ----                       | -                      | -                                  | -                             | -               | -                      | -                                  | -                             | -                 | 132                 | 39.0                               | 189.00                        | 170.50-208.50     |
| Nonmanufacturing ----                    | 102                    | 37.5                               | 157.00                        | 154.50          | -                      | -                                  | -                             | -                 | 194                 | 38.5                               | 172.50                        | 150.00-184.50     |
| Programers, business, class A ----       | 502                    | 39.0                               | 212.50                        | 209.00          | 74                     | 39.5                               | \$179.50                      | \$160.00-\$186.00 | 843                 | 38.5                               | 202.50                        | 180.00-223.00     |
| Manufacturing ----                       | 117                    | 39.5                               | 198.00                        | 204.00          | 51                     | 40.0                               | 183.50                        | 159.00-197.50     | 341                 | 38.0                               | 202.00                        | 179.00-223.50     |
| Nonmanufacturing ----                    | 385                    | 39.0                               | 216.50                        | 209.50          | -                      | -                                  | -                             | -                 | 502                 | 38.0                               | 203.50                        | 180.00-222.00     |
| Programers, business, class B ----       | 652                    | 38.5                               | 176.50                        | 167.50          | 60                     | 38.5                               | 158.00                        | 136.00-184.50     | 1,143               | 39.0                               | 175.50                        | 155.00-192.50     |
| Manufacturing ----                       | 157                    | 39.5                               | 175.00                        | 176.50          | -                      | -                                  | -                             | -                 | 427                 | 39.0                               | 172.00                        | 153.00-190.00     |
| Nonmanufacturing ----                    | 495                    | 38.5                               | 177.00                        | 165.00          | -                      | -                                  | -                             | -                 | 716                 | 38.5                               | 177.50                        | 155.50-196.50     |
| Programers, business, class C ----       | 441                    | 38.5                               | 139.00                        | 138.00          | 65                     | 39.0                               | 127.50                        | 117.00-137.50     | 767                 | 38.5                               | 148.50                        | 133.50-163.00     |
| Manufacturing ----                       | 102                    | 39.5                               | 145.50                        | 149.00          | -                      | -                                  | -                             | -                 | 239                 | 38.0                               | 146.50                        | 132.00-163.00     |
| Nonmanufacturing ----                    | 339                    | 38.0                               | 137.00                        | 131.50          | -                      | -                                  | -                             | -                 | 528                 | 39.0                               | 149.50                        | 134.00-163.00     |
| Digital-computer operators, class A ---- | 164                    | 39.0                               | 140.00                        | 136.50          | 78                     | 39.5                               | 135.00                        | 118.00-153.00     | 798                 | 39.0                               | 159.50                        | 144.50-172.50     |
| Manufacturing ----                       | 63                     | 39.5                               | 142.00                        | 139.00          | 61                     | 40.0                               | 139.00                        | 126.00-161.00     | 211                 | 39.0                               | 151.50                        | 139.50-161.50     |
| Nonmanufacturing ----                    | 101                    | 38.5                               | 139.00                        | 136.00          | -                      | -                                  | -                             | -                 | 587                 | 39.0                               | 162.50                        | 149.50-174.00     |
| Digital-computer operators, class B ---- | 541                    | 39.0                               | 127.50                        | 126.50          | 98                     | 39.5                               | 118.50                        | 100.00-132.00     | 1,340               | 38.5                               | 136.00                        | 121.00-148.00     |
| Manufacturing ----                       | 235                    | 39.5                               | 118.00                        | 116.00          | 53                     | 39.5                               | 130.00                        | 103.50-151.00     | 460                 | 38.5                               | 131.50                        | 117.50-144.00     |
| Nonmanufacturing ----                    | 306                    | 38.5                               | 135.00                        | 137.50          | -                      | -                                  | -                             | -                 | 880                 | 39.0                               | 138.00                        | 126.00-149.00     |
| Digital-computer operators, class C ---- | 197                    | 38.0                               | 113.50                        | 113.50          | 88                     | 38.5                               | 102.50                        | 88.50-111.50      | 606                 | 39.0                               | 116.00                        | 103.00-128.00     |
| Manufacturing ----                       | -                      | -                                  | -                             | -               | -                      | -                                  | -                             | -                 | 173                 | 38.5                               | 123.50                        | 110.50-133.50     |
| Nonmanufacturing ----                    | 160                    | 37.5                               | 115.00                        | 115.00          | 56                     | 38.0                               | 97.00                         | 86.50-109.50      | 433                 | 39.0                               | 113.00                        | 101.50-126.00     |
| <b>Men</b>                               |                        |                                    |                               |                 |                        |                                    |                               |                   |                     |                                    |                               |                   |
| Systems analysts, business, class A ---- | 265                    | 39.0                               | 240.50                        | 224.00          | -                      | -                                  | -                             | -                 | 629                 | 39.0                               | 250.00                        | 230.50-271.00     |
| Manufacturing ----                       | 118                    | 39.5                               | 236.50                        | 233.00          | -                      | -                                  | -                             | -                 | 254                 | 38.5                               | 251.00                        | 232.50-271.00     |
| Nonmanufacturing ----                    | 147                    | 39.0                               | 243.50                        | 206.50          | -                      | -                                  | -                             | -                 | 375                 | 39.0                               | 249.00                        | 227.00-271.00     |
| Systems analysts, business, class B ---- | 259                    | 38.0                               | 204.50                        | 204.50          | -                      | -                                  | -                             | -                 | 704                 | 38.5                               | 214.50                        | 195.50-234.00     |
| Manufacturing ----                       | 99                     | 39.0                               | 213.50                        | 214.00          | -                      | -                                  | -                             | -                 | 333                 | 38.5                               | 219.50                        | 200.00-241.00     |
| Nonmanufacturing ----                    | 160                    | 37.0                               | 199.00                        | 192.00          | -                      | -                                  | -                             | -                 | 371                 | 39.0                               | 210.00                        | 189.00-225.50     |
| Systems analysts, business, class C ---- | 98                     | 37.5                               | 163.50                        | 162.00          | -                      | -                                  | -                             | -                 | 252                 | 39.0                               | 183.50                        | 166.00-201.50     |
| Manufacturing ----                       | -                      | -                                  | -                             | -               | -                      | -                                  | -                             | -                 | 113                 | 39.0                               | 190.50                        | 170.00-212.50     |
| Nonmanufacturing ----                    | 79                     | 36.5                               | 157.00                        | 159.50          | -                      | -                                  | -                             | -                 | 139                 | 39.0                               | 178.00                        | 165.00-189.00     |
| Programers, business, class A ----       | 477                    | 39.0                               | 214.00                        | 210.00          | 74                     | 39.5                               | 179.50                        | 160.00-186.00     | 700                 | 39.0                               | 205.00                        | 182.50-227.00     |
| Manufacturing ----                       | 105                    | 40.0                               | 201.00                        | 210.00          | 51                     | 40.0                               | 183.50                        | 159.00-197.50     | 297                 | 38.5                               | 202.00                        | 177.50-224.00     |
| Nonmanufacturing ----                    | 372                    | 39.0                               | 218.00                        | 210.00          | -                      | -                                  | -                             | -                 | 403                 | 39.0                               | 207.00                        | 185.50-229.50     |
| Programers, business, class B ----       | 594                    | 39.0                               | 179.00                        | 169.00          | 59                     | 38.5                               | 158.00                        | 136.00-185.00     | 851                 | 39.0                               | 177.00                        | 159.00-193.50     |
| Manufacturing ----                       | 143                    | 39.5                               | 177.50                        | 179.50          | -                      | -                                  | -                             | -                 | 326                 | 39.0                               | 175.50                        | 159.50-192.00     |
| Nonmanufacturing ----                    | 451                    | 38.5                               | 179.50                        | 166.00          | -                      | -                                  | -                             | -                 | 525                 | 38.5                               | 178.00                        | 159.00-196.00     |
| Programers, business, class C ----       | 335                    | 39.0                               | 140.50                        | 138.50          | -                      | -                                  | -                             | -                 | 460                 | 38.5                               | 150.50                        | 135.50-164.00     |
| Manufacturing ----                       | 96                     | 39.5                               | 147.50                        | 150.00          | -                      | -                                  | -                             | -                 | 161                 | 38.5                               | 153.50                        | 138.50-168.00     |
| Nonmanufacturing ----                    | 239                    | 38.5                               | 137.50                        | 137.50          | -                      | -                                  | -                             | -                 | 299                 | 38.5                               | 160.50                        | 145.00-161.50     |
| Digital-computer operators, class A ---- | 164                    | 39.0                               | 140.00                        | 124.00          | 62                     | 39.5                               | 129.50                        | 114.50-137.00     | 741                 | 39.0                               | 160.50                        | 145.00-173.00     |
| Manufacturing ----                       | 63                     | 40.0                               | 142.00                        | 140.00          | -                      | -                                  | -                             | -                 | 192                 | 39.0                               | 151.50                        | 139.00-162.00     |
| Nonmanufacturing ----                    | 101                    | 38.5                               | 139.00                        | 136.00          | -                      | -                                  | -                             | -                 | 549                 | 38.5                               | 163.50                        | 150.00-174.50     |
| Digital-computer operators, class B ---- | 508                    | 39.0                               | 128.50                        | 136.50          | 75                     | 39.0                               | 122.50                        | 99.00-140.00      | 1,094               | 38.5                               | 137.50                        | 122.00-148.50     |
| Manufacturing ----                       | 215                    | 39.0                               | 119.00                        | 130.50          | -                      | -                                  | -                             | -                 | 418                 | 38.5                               | 131.00                        | 117.50-143.50     |
| Nonmanufacturing ----                    | 293                    | 39.0                               | 136.00                        | 138.00          | -                      | -                                  | -                             | -                 | 676                 | 39.0                               | 141.50                        | 127.50-150.50     |
| Digital-computer operators, class C ---- | 168                    | 38.0                               | 114.00                        | 114.00          | -                      | -                                  | -                             | -                 | 451                 | 39.0                               | 118.50                        | 104.50-129.50     |
| Manufacturing ----                       | -                      | -                                  | -                             | -               | -                      | -                                  | -                             | -                 | 127                 | 39.0                               | 124.00                        | 110.50-135.00     |
| Nonmanufacturing ----                    | 140                    | 37.5                               | 115.00                        | 114.50          | -                      | -                                  | -                             | -                 | 324                 | 39.0                               | 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 $\frac{1}{2}$ (standard) | Weekly earnings $\frac{1}{2}$ (standard) |                            | Number of workers         | Average weekly hours $\frac{1}{2}$ (standard) | Weekly earnings $\frac{1}{2}$ (standard) |                            | Number of workers     | Average weekly hours $\frac{1}{2}$ (standard) | Weekly earnings $\frac{1}{2}$ (standard) |                            |
|                                          |                        |                                               | Mean $\frac{2}{2}$                       | Middle range $\frac{2}{2}$ |                           |                                               | Mean $\frac{2}{2}$                       | Middle range $\frac{2}{2}$ |                       |                                               | Mean $\frac{2}{2}$                       | Middle range $\frac{2}{2}$ |
|                                          |                        |                                               |                                          |                            |                           |                                               |                                          |                            |                       |                                               |                                          |                            |
| Men and women combined                   |                        |                                               |                                          |                            |                           |                                               |                                          |                            |                       |                                               |                                          |                            |
| Systems analysts, business, class A ---- | 71                     | 39.0                                          | \$224.00                                 | \$213.50-\$233.50          | 232                       | 39.5                                          | \$231.50                                 | \$232.00                   | 88                    | 39.5                                          | \$223.00                                 | \$206.50-\$237.50          |
| Manufacturing -----                      | -                      | -                                             | -                                        | -                          | 123                       | 39.5                                          | 224.00                                   | 228.00                     | -                     | -                                             | -                                        | -                          |
| Nonmanufacturing -----                   | -                      | -                                             | -                                        | -                          | 109                       | 39.5                                          | 239.50                                   | 247.50                     | 59                    | 39.0                                          | 221.50                                   | 206.00- 235.50             |
| Systems analysts, business, class B ---- | 87                     | 39.5                                          | 192.00                                   | 174.00- 202.50             | 179                       | 39.5                                          | 197.00                                   | 199.00                     | 83                    | 39.5                                          | 187.00                                   | 172.00- 205.00             |
| Manufacturing -----                      | -                      | -                                             | -                                        | -                          | 85                        | 39.0                                          | 188.00                                   | 187.50                     | -                     | -                                             | -                                        | -                          |
| Nonmanufacturing -----                   | -                      | -                                             | -                                        | -                          | 94                        | 39.5                                          | 205.50                                   | 202.50                     | 64                    | 39.0                                          | 181.50                                   | 167.00- 200.50             |
| Systems analysts, business, class C ---- | 51                     | 39.0                                          | 189.00                                   | 180.50- 196.00             | 80                        | 40.0                                          | 174.50                                   | 174.50                     | -                     | -                                             | -                                        | -                          |
| Manufacturing -----                      | -                      | -                                             | -                                        | -                          | 63                        | 40.0                                          | 170.00                                   | 171.00                     | -                     | -                                             | -                                        | -                          |
| Nonmanufacturing -----                   | -                      | -                                             | -                                        | -                          | 161                       | 39.5                                          | 201.50                                   | 200.50                     | 112                   | 40.0                                          | 194.50                                   | 169.50- 218.50             |
| Programers, business, class A ----       | 78                     | 39.5                                          | 164.00                                   | 146.00- 177.50             | 94                        | 39.5                                          | 196.50                                   | 202.00                     | -                     | -                                             | -                                        | -                          |
| Manufacturing -----                      | -                      | -                                             | -                                        | -                          | 67                        | 39.0                                          | 208.00                                   | 195.00                     | 63                    | 39.5                                          | 186.50                                   | 163.50- 215.00             |
| Nonmanufacturing -----                   | -                      | -                                             | -                                        | -                          | 244                       | 39.5                                          | 161.50                                   | 162.00                     | 211                   | 39.5                                          | 158.50                                   | 143.50- 179.00             |
| Programers, business, class B ----       | 179                    | 39.0                                          | 159.00                                   | 142.00- 178.00             | 144                       | 40.0                                          | 167.50                                   | 169.00                     | 52                    | 40.0                                          | 159.00                                   | 137.00- 190.50             |
| Manufacturing -----                      | 69                     | 40.0                                          | 158.50                                   | 138.00- 177.00             | 100                       | 38.5                                          | 152.50                                   | 151.00                     | 159                   | 39.5                                          | 158.50                                   | 145.00- 173.50             |
| Nonmanufacturing -----                   | 110                    | 38.5                                          | 159.00                                   | 144.50- 180.50             | 104                       | 39.0                                          | 134.50                                   | 133.00                     | 79                    | 39.5                                          | 140.50                                   | 127.50- 152.50             |
| Programers, business, class C ----       | 68                     | 39.5                                          | 132.50                                   | 120.50- 142.00             | 60                        | 39.5                                          | 148.00                                   | 147.50                     | -                     | -                                             | -                                        | -                          |
| Manufacturing -----                      | -                      | -                                             | -                                        | -                          | 98                        | 39.0                                          | 147.50                                   | 145.50                     | 71                    | 39.5                                          | 136.50                                   | 127.00- 148.50             |
| Nonmanufacturing -----                   | -                      | -                                             | -                                        | -                          | 61                        | 39.5                                          | 149.00                                   | 146.00                     | 97                    | 40.0                                          | 133.50                                   | 115.00- 160.00             |
| Digital-computer operators, class A ---- | 69                     | 39.0                                          | 145.50                                   | 134.00- 157.50             | 302                       | 39.0                                          | 126.00                                   | 124.50                     | 66                    | 39.5                                          | 133.00                                   | 111.00- 161.50             |
| Manufacturing -----                      | -                      | -                                             | -                                        | -                          | 165                       | 39.5                                          | 137.00                                   | 136.00                     | 264                   | 39.5                                          | 117.00                                   | 104.00- 127.00             |
| Nonmanufacturing -----                   | -                      | -                                             | -                                        | -                          | 137                       | 39.0                                          | 113.00                                   | 109.00                     | 54                    | 40.0                                          | 124.50                                   | 104.50- 131.50             |
| Digital-computer operators, class B ---- | 240                    | 39.0                                          | 124.00                                   | 110.00- 136.50             | 109                       | 39.5                                          | 113.00                                   | 113.00                     | 210                   | 39.5                                          | 115.00                                   | 104.00- 126.00             |
| Manufacturing -----                      | 98                     | 40.0                                          | 130.00                                   | 114.00- 140.50             | 68                        | 40.0                                          | 117.00                                   | 116.00                     | 89                    | 40.0                                          | 104.00                                   | 93.50- 118.50              |
| Nonmanufacturing -----                   | 142                    | 39.0                                          | 120.00                                   | 108.00- 133.50             | -                         | -                                             | -                                        | -                          | 70                    | 40.0                                          | 101.00                                   | 90.50- 116.50              |
| Digital-computer operators, class C ---- | 167                    | 39.0                                          | 102.00                                   | 86.00- 114.00              | -                         | -                                             | -                                        | -                          | -                     | -                                             | -                                        | -                          |
| Manufacturing -----                      | 63                     | 38.5                                          | 113.50                                   | 98.50- 135.50              | -                         | -                                             | -                                        | -                          | -                     | -                                             | -                                        | -                          |
| Nonmanufacturing -----                   | 104                    | 39.5                                          | 95.00                                    | 82.00- 104.50              | -                         | -                                             | -                                        | -                          | -                     | -                                             | -                                        | -                          |
| Men                                      |                        |                                               |                                          |                            |                           |                                               |                                          |                            |                       |                                               |                                          |                            |
| Systems analysts, business, class A ---- | 68                     | 39.0                                          | 225.00                                   | 214.50- 234.00             | 216                       | 39.5                                          | 232.50                                   | 232.50                     | 83                    | 39.5                                          | 224.50                                   | 207.00- 238.00             |
| Manufacturing -----                      | -                      | -                                             | -                                        | -                          | 120                       | 39.5                                          | 225.00                                   | 229.00                     | -                     | -                                             | -                                        | -                          |
| Nonmanufacturing -----                   | -                      | -                                             | -                                        | -                          | 96                        | 39.5                                          | 242.00                                   | 250.00                     | 54                    | 39.0                                          | 223.50                                   | 206.50- 236.50             |
| Systems analysts, business, class B ---- | 85                     | 39.5                                          | 192.50                                   | 173.50- 204.00             | 150                       | 39.5                                          | 198.00                                   | 200.00                     | 82                    | 39.5                                          | 187.50                                   | 172.50- 205.50             |
| Manufacturing -----                      | -                      | -                                             | -                                        | -                          | 81                        | 39.5                                          | 188.50                                   | 189.00                     | -                     | -                                             | -                                        | -                          |
| Nonmanufacturing -----                   | -                      | -                                             | -                                        | -                          | 69                        | 39.5                                          | 209.50                                   | 204.50                     | 63                    | 39.0                                          | 181.50                                   | 168.50- 201.00             |
| Systems analysts, business, class C ---- | 50                     | 39.0                                          | 189.50                                   | 180.50- 196.50             | 53                        | 40.0                                          | 177.00                                   | 175.00                     | -                     | -                                             | -                                        | -                          |
| Manufacturing -----                      | -                      | -                                             | -                                        | -                          | -                         | -                                             | -                                        | -                          | -                     | -                                             | -                                        | -                          |
| Nonmanufacturing -----                   | -                      | -                                             | -                                        | -                          | -                         | -                                             | -                                        | -                          | -                     | -                                             | -                                        | -                          |
| Programers, business, class A ----       | 65                     | 39.5                                          | 164.50                                   | 146.00- 177.00             | 138                       | 39.5                                          | 203.50                                   | 202.00                     | 103                   | 40.0                                          | 196.50                                   | 174.00- 218.50             |
| Manufacturing -----                      | -                      | -                                             | -                                        | -                          | 86                        | 39.5                                          | 197.00                                   | 202.00                     | -                     | -                                             | -                                        | -                          |
| Nonmanufacturing -----                   | -                      | -                                             | -                                        | -                          | 52                        | 39.0                                          | 213.50                                   | 202.50                     | 54                    | 39.5                                          | 188.00                                   | 165.00- 215.50             |
| Programers, business, class B ----       | 152                    | 39.5                                          | 161.50                                   | 143.50- 181.00             | 183                       | 39.5                                          | 164.50                                   | 164.50                     | 173                   | 39.5                                          | 160.00                                   | 145.00- 180.00             |
| Manufacturing -----                      | 67                     | 40.0                                          | 158.50                                   | 138.00- 177.50             | 119                       | 40.0                                          | 169.50                                   | 171.00                     | -                     | -                                             | -                                        | -                          |
| Nonmanufacturing -----                   | 85                     | 39.0                                          | 163.50                                   | 148.00- 187.50             | 64                        | 39.0                                          | 155.50                                   | 160.00                     | 132                   | 39.5                                          | 157.00                                   | 144.50- 173.00             |
| Programers, business, class C ----       | -                      | -                                             | -                                        | -                          | 71                        | 39.0                                          | 142.50                                   | 145.00                     | 60                    | 39.5                                          | 142.50                                   | 127.50- 161.00             |
| Manufacturing -----                      | -                      | -                                             | -                                        | -                          | 52                        | 39.5                                          | 151.00                                   | 150.50                     | -                     | -                                             | -                                        | -                          |
| Nonmanufacturing -----                   | -                      | -                                             | -                                        | -                          | 92                        | 39.0                                          | 149.50                                   | 146.00                     | 52                    | 39.0                                          | 137.50                                   | 126.00- 149.00             |
| Digital-computer operators, class A ---- | 66                     | 39.0                                          | 147.00                                   | 135.00- 157.50             | 58                        | 39.5                                          | 150.00                                   | 147.00                     | 96                    | 40.0                                          | 133.50                                   | 115.00- 160.00             |
| Manufacturing -----                      | -                      | -                                             | -                                        | -                          | -                         | -                                             | -                                        | -                          | -                     | -                                             | -                                        | -                          |
| Nonmanufacturing -----                   | -                      | -                                             | -                                        | -                          | 221                       | 39.5                                          | 133.00                                   | 130.50                     | 65                    | 39.5                                          | 133.00                                   | 111.00- 161.50             |
| Digital-computer operators, class B ---- | 188                    | 39.0                                          | 126.50                                   | 114.50- 138.50             | 148                       | 39.5                                          | 136.50                                   | 132.50                     | 214                   | 39.5                                          | 118.50                                   | 103.50- 128.50             |
| Manufacturing -----                      | 79                     | 40.0                                          | 132.50                                   | 120.00- 142.50             | 73                        | 39.0                                          | 125.50                                   | 130.50                     | -                     | -                                             | -                                        | -                          |
| Nonmanufacturing -----                   | 109                    | 38.5                                          | 122.50                                   | 110.50- 135.00             | 76                        | 40.0                                          | 115.00                                   | 114.50                     | 165                   | 39.0                                          | 116.50                                   | 101.50- 128.50             |
| Digital-computer operators, class C ---- | 111                    | 38.5                                          | 107.50                                   | 92.50- 121.00              | 57                        | 40.0                                          | 118.50                                   | 119.50                     | 86                    | 40.0                                          | 104.50                                   | 95.00- 119.00              |
| Manufacturing -----                      | 59                     | 38.5                                          | 114.50                                   | 99.00- 136.00              | -                         | -                                             | -                                        | -                          | -                     | -                                             | -                                        | -                          |
| Nonmanufacturing -----                   | 52                     | 39.0                                          | 99.50                                    | 87.50- 114.00              | -                         | -                                             | -                                        | -                          | 67                    | 40.0                                          | 102.00                                   | 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/ |                                                                       |                                    | Mean 2/                       | Median 2/ |                            |                                    | Mean 2/                       | Median 2/         |
| Men and women combined                   |                            |                                    |                               |           |                                                                       |                                    |                               |           |                            |                                    |                               |                   |
| Systems analysts, business, class A ---- | 38                         | 38.5                               | \$203.00                      | \$194.50  | 1,163                                                                 | 40.0                               | \$275.50                      | \$270.50  | -                          | -                                  | -                             | -                 |
| Manufacturing -----                      | -                          | -                                  | -                             | -         | 399                                                                   | 40.0                               | 275.50                        | 270.00    | -                          | -                                  | -                             | -                 |
| Nonmanufacturing -----                   | -                          | -                                  | -                             | -         | 764                                                                   | 40.0                               | 275.50                        | 270.00    | -                          | -                                  | -                             | -                 |
| Systems analysts, business, class B ---- | 37                         | 38.5                               | 203.50                        | 194.50    | 1,049                                                                 | 40.0                               | 275.50                        | 270.00    | -                          | -                                  | -                             | -                 |
| Manufacturing -----                      | -                          | -                                  | -                             | -         | 544                                                                   | 40.0                               | 226.00                        | 223.50    | -                          | -                                  | -                             | -                 |
| Nonmanufacturing -----                   | -                          | -                                  | -                             | -         | 505                                                                   | 40.0                               | 203.50                        | 199.00    | -                          | -                                  | -                             | -                 |
| Systems analysts, business, class C ---- | -                          | -                                  | -                             | -         | 362                                                                   | 40.0                               | 181.50                        | 178.50    | -                          | -                                  | -                             | -                 |
| Manufacturing -----                      | -                          | -                                  | -                             | -         | 187                                                                   | 40.0                               | 197.50                        | 196.50    | -                          | -                                  | -                             | -                 |
| Nonmanufacturing -----                   | -                          | -                                  | -                             | -         | 175                                                                   | 40.0                               | 164.50                        | 165.00    | -                          | -                                  | -                             | -                 |
| Programers, business, class A ----       | 44                         | 38.5                               | 172.00                        | 170.50    | 426                                                                   | 39.5                               | 228.00                        | 231.50    | 44                         | 39.5                               | \$197.50                      | \$168.00-\$214.50 |
| Manufacturing -----                      | -                          | -                                  | -                             | -         | 201                                                                   | 40.0                               | 246.00                        | 249.00    | 32                         | 40.0                               | 196.00                        | 175.50- 219.50    |
| Nonmanufacturing -----                   | -                          | -                                  | -                             | -         | 225                                                                   | 39.5                               | 211.50                        | 209.00    | -                          | -                                  | -                             | -                 |
| Programers, business, class B ----       | 43                         | 38.5                               | 172.50                        | 171.00    | 998                                                                   | 39.5                               | 186.50                        | 185.50    | 81                         | 39.5                               | 152.00                        | 138.00- 167.00    |
| Manufacturing -----                      | -                          | -                                  | -                             | -         | 478                                                                   | 40.0                               | 177.00                        | 177.50    | 61                         | 39.5                               | 148.50                        | 138.00- 164.50    |
| Nonmanufacturing -----                   | -                          | -                                  | -                             | -         | 520                                                                   | 39.0                               | 177.00                        | 173.00    | -                          | -                                  | -                             | -                 |
| Programers, business, class C ----       | 34                         | 38.5                               | 128.50                        | 129.50    | 434                                                                   | 40.0                               | 138.00                        | 137.00    | -                          | -                                  | -                             | -                 |
| Manufacturing -----                      | -                          | -                                  | -                             | -         | 262                                                                   | 40.0                               | 168.50                        | 167.50    | -                          | -                                  | -                             | -                 |
| Nonmanufacturing -----                   | -                          | -                                  | -                             | -         | 172                                                                   | 39.5                               | 141.50                        | 139.00    | -                          | -                                  | -                             | -                 |
| Digital-computer operators, class A ---- | 33                         | 38.5                               | 128.50                        | 130.00    | 816                                                                   | 40.0                               | 158.00                        | 158.50    | 32                         | 40.0                               | 137.50                        | 131.00- 139.00    |
| Manufacturing -----                      | -                          | -                                  | -                             | -         | 481                                                                   | 40.0                               | 159.50                        | 160.50    | -                          | -                                  | -                             | -                 |
| Nonmanufacturing -----                   | -                          | -                                  | -                             | -         | 335                                                                   | 39.5                               | 156.50                        | 156.00    | 27                         | 40.0                               | 133.50                        | 131.00- 134.00    |
| Digital-computer operators, class B ---- | 108                        | 38.5                               | 118.00                        | 123.00    | 1,263                                                                 | 40.0                               | 142.50                        | 140.50    | 116                        | 39.5                               | 120.00                        | 104.00- 133.00    |
| Manufacturing -----                      | -                          | -                                  | -                             | -         | 585                                                                   | 40.0                               | 146.50                        | 146.50    | -                          | -                                  | -                             | -                 |
| Nonmanufacturing -----                   | -                          | -                                  | -                             | -         | 678                                                                   | 39.5                               | 139.50                        | 136.00    | 96                         | 39.0                               | 117.50                        | 102.50- 131.00    |
| Digital-computer operators, class C ---- | 38                         | 39.5                               | 93.00                         | 92.50     | 445                                                                   | 39.5                               | 119.00                        | 117.50    | 35                         | 40.0                               | 100.50                        | 92.00- 104.00     |
| Manufacturing -----                      | -                          | -                                  | -                             | -         | 144                                                                   | 40.0                               | 121.50                        | 119.50    | -                          | -                                  | -                             | -                 |
| Nonmanufacturing -----                   | -                          | -                                  | -                             | -         | 301                                                                   | 39.5                               | 117.50                        | 117.00    | -                          | -                                  | -                             | -                 |
| Men                                      |                            |                                    |                               |           |                                                                       |                                    |                               |           |                            |                                    |                               |                   |
| Systems analysts, business, class A ---- | 37                         | 38.5                               | 204.00                        | 194.50    | 1,130                                                                 | 40.0                               | 276.50                        | 270.50    | -                          | -                                  | -                             | -                 |
| Manufacturing -----                      | -                          | -                                  | -                             | -         | 374                                                                   | 40.0                               | 276.50                        | 270.50    | -                          | -                                  | -                             | -                 |
| Nonmanufacturing -----                   | -                          | -                                  | -                             | -         | 756                                                                   | 40.0                               | 276.50                        | 270.50    | -                          | -                                  | -                             | -                 |
| Systems analysts, business, class B ---- | 36                         | 38.5                               | 204.00                        | 195.00    | 954                                                                   | 40.0                               | 217.00                        | 215.00    | -                          | -                                  | -                             | -                 |
| Manufacturing -----                      | -                          | -                                  | -                             | -         | 488                                                                   | 40.0                               | 229.00                        | 226.00    | -                          | -                                  | -                             | -                 |
| Nonmanufacturing -----                   | -                          | -                                  | -                             | -         | 466                                                                   | 40.0                               | 205.00                        | 200.50    | -                          | -                                  | -                             | -                 |
| Systems analysts, business, class C ---- | -                          | -                                  | -                             | -         | 306                                                                   | 40.0                               | 183.00                        | 180.00    | -                          | -                                  | -                             | -                 |
| Manufacturing -----                      | -                          | -                                  | -                             | -         | 153                                                                   | 40.0                               | 200.50                        | 203.50    | -                          | -                                  | -                             | -                 |
| Nonmanufacturing -----                   | -                          | -                                  | -                             | -         | 133                                                                   | 40.0                               | 166.00                        | 167.00    | -                          | -                                  | -                             | -                 |
| Programers, business, class A ----       | 37                         | 38.5                               | 176.50                        | 175.00    | 379                                                                   | 39.5                               | 226.50                        | 231.50    | 41                         | 39.5                               | 191.50                        | 169.50- 216.00    |
| Manufacturing -----                      | -                          | -                                  | -                             | -         | 164                                                                   | 40.0                               | 245.50                        | 248.00    | 32                         | 40.0                               | 196.00                        | 175.50- 219.50    |
| Nonmanufacturing -----                   | -                          | -                                  | -                             | -         | 215                                                                   | 39.5                               | 212.00                        | 209.50    | -                          | -                                  | -                             | -                 |
| Programers, business, class B ----       | 51                         | 38.5                               | 156.50                        | 156.00    | 882                                                                   | 39.5                               | 187.50                        | 187.00    | 74                         | 39.5                               | 154.50                        | 139.00- 167.50    |
| Manufacturing -----                      | -                          | -                                  | -                             | -         | 424                                                                   | 40.0                               | 197.00                        | 196.00    | -                          | -                                  | -                             | -                 |
| Nonmanufacturing -----                   | -                          | -                                  | -                             | -         | 458                                                                   | 39.0                               | 178.50                        | 176.00    | 58                         | 39.5                               | 148.50                        | 137.50- 164.50    |
| Programers, business, class C ----       | 45                         | 38.5                               | 155.50                        | 156.00    | 439                                                                   | 40.0                               | 158.00                        | 156.50    | -                          | -                                  | -                             | -                 |
| Manufacturing -----                      | -                          | -                                  | -                             | -         | 216                                                                   | 40.0                               | 167.50                        | 166.50    | -                          | -                                  | -                             | -                 |
| Nonmanufacturing -----                   | -                          | -                                  | -                             | -         | 216                                                                   | 40.0                               | 143.00                        | 142.50    | -                          | -                                  | -                             | -                 |
| Digital-computer operators, class A ---- | 28                         | 38.5                               | 130.50                        | 132.50    | 1,133                                                                 | 39.5                               | 158.00                        | 158.00    | 32                         | 40.0                               | 137.50                        | 131.00- 139.00    |
| Manufacturing -----                      | -                          | -                                  | -                             | -         | 771                                                                   | 39.5                               | 159.00                        | 159.50    | -                          | -                                  | -                             | -                 |
| Nonmanufacturing -----                   | -                          | -                                  | -                             | -         | 445                                                                   | 40.0                               | 143.00                        | 142.50    | -                          | -                                  | -                             | -                 |
| Digital-computer operators, class B ---- | 27                         | 39.0                               | 148.50                        | 151.50    | 326                                                                   | 39.5                               | 156.50                        | 156.00    | 27                         | 40.0                               | 133.50                        | 131.00- 134.00    |
| Manufacturing -----                      | -                          | -                                  | -                             | -         | 531                                                                   | 40.0                               | 147.50                        | 150.00    | 95                         | 39.5                               | 118.00                        | 101.50- 131.00    |
| Nonmanufacturing -----                   | -                          | -                                  | -                             | -         | 1,116                                                                 | 39.5                               | 144.00                        | 142.00    | 83                         | 39.5                               | 115.50                        | 100.00- 129.00    |
| Digital-computer operators, class C ---- | 91                         | 39.0                               | 122.00                        | 125.50    | 422                                                                   | 39.5                               | 119.00                        | 117.50    | -                          | -                                  | -                             | -                 |
| Manufacturing -----                      | -                          | -                                  | -                             | -         | 136                                                                   | 39.5                               | 121.00                        | 119.50    | -                          | -                                  | -                             | -                 |
| Nonmanufacturing -----                   | -                          | -                                  | -                             | -         | 286                                                                   | 39.5                               | 118.00                        | 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 areas studied between September 1968 and April 1969)

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

$\frac{1}{2}$ / 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.

$\frac{2}{2}$ / 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.



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

Re computer typesetting survey.

E. R. LANNON, Esq.,  
Assistant Administrator for Administration, Computer Type-  
setting 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<br>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-programming 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 11½ 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 10½ 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 11½ inch print region. All titles in true Italic.

#### SUMMARY OF COMPOSITION TIME (SECONDS)<sup>1</sup>

| Spectra 70/35, 65K, 30KB tapes<br>for a VideoComp with 65K<br>memory |                                   |           |
|----------------------------------------------------------------------|-----------------------------------|-----------|
| Page                                                                 | Internal<br>elapsed<br>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     |

<sup>1</sup> 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)<sup>1</sup>

| Spectra 70/45, 131K, 60KB tapes<br>for a VideoComp with 65K<br>memory |                                   |           |
|-----------------------------------------------------------------------|-----------------------------------|-----------|
| Page                                                                  | Internal<br>elapsed time<br>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     |

<sup>1</sup> 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<sup>1</sup> (SECONDS PER A STOPWATCH)

| VideoComp 70/800 series (65K)   |               |              |       |               |              |       |
|---------------------------------|---------------|--------------|-------|---------------|--------------|-------|
| Page                            | Proof mode    |              |       | Final mode    |              |       |
|                                 | Over-<br>head | Run-<br>ning | Total | Over-<br>head | Run-<br>ning | 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 |

<sup>1</sup> 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)                   | (2)      | (3)                   | (4)      | (5)                                        | (6)                                        |
|----------------------|--------------|--------------|----------------|----------------|-----------------------|----------|-----------------------|----------|--------------------------------------------|--------------------------------------------|
|                      |              |              |                |                | 70/45                 |          | 70/35                 |          | 70/45, 2 cycles,<br>processing,<br>minutes | 70/35, 2 cycles,<br>processing,<br>minutes |
|                      | 1 page 70/45 | 1 page 70/35 | 10 pages 70/45 | 10 pages 70/35 | 1 page<br>composition | Overhead | 1 page<br>composition | Overhead |                                            |                                            |
|                      | (A)          | (B)          | (C)            | (D)            | (E)                   | (F)      | (G)                   | (H)      | (I)                                        | (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 VIDEOCOMP TYPESETTING AND FONT LOAD CALCULATIONS—STOPWATCH TIME IN SECONDS

|                      | 10 page,<br>high resolution | 10 page,<br>low resolution | Total   | Font load, high | Font load, low | 2 cycles, 1 proof,<br>1 final | 2 cycles, compo-<br>sition, minutes |
|----------------------|-----------------------------|----------------------------|---------|-----------------|----------------|-------------------------------|-------------------------------------|
|                      | (A)                         | (B)                        | (C)     | (D)             | (E)            | (F)                           | (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= $\frac{F}{60}$ .

## VIDEOCOMP SYSTEMS—MINIMUM SPECTRA 70 CONFIGURATION

| Model                     | Description                                    | Unit price       |                  | Units<br>required | Total price |         | Monthly<br>maintenance<br>charge |
|---------------------------|------------------------------------------------|------------------|------------------|-------------------|-------------|---------|----------------------------------|
|                           |                                                | Purchase         | Lease            |                   | Purchase    | Lease   |                                  |
| 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.....                 | ( <sup>1</sup> ) | ( <sup>1</sup> ) | 1                 |             |         | ( <sup>1</sup> )                 |
| 70/564.....               | Disk storage unit.....                         | 25,510           | 535              | 1                 | 25,510      | 535     | 68.75                            |
| 506.....                  | Disk pack.....                                 | 360              | 12               | 3                 | 1,018       | 36      | ( <sup>2</sup> )                 |
| 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                         |

<sup>1</sup> No charge.

<sup>2</sup> Time and material.

## SPECTRA 70/45 CONFIGURATION

| Model             | Description                           | Unit price       |                  | Units<br>required | Total price |         | Monthly<br>maintenance<br>charge |
|-------------------|---------------------------------------|------------------|------------------|-------------------|-------------|---------|----------------------------------|
|                   |                                       | Purchase         | Lease            |                   | Purchase    | Lease   |                                  |
| 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.....        | ( <sup>1</sup> ) | ( <sup>1</sup> ) | 1                 |             |         | ( <sup>1</sup> )                 |
| 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                            |

<sup>1</sup> No charge.



## PRICE SCHEDULE, 70/800 VIDEOCOMP SERIES

| Model or feature No. | Description                          | Sales price | Monthly lease | Monthly <sup>1</sup> 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 <sup>2</sup> |             | 595           |                                  |
|                      | A 8051A Universal film cassette      |             | 795           |                                  |

<sup>1</sup> Applies only to systems sold outright.

<sup>2</sup> 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 ems).

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..... 15,092

<sup>1</sup> 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. ems) 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 lead, 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.





**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.

## **FONT<sup>1</sup>**

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<sup>1</sup>**

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.

<sup>1</sup>Capabilities stated are hardware capabilities and depend functionally upon availability of fonts.



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

---

<sup>1</sup>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

|                                                         |   |
|---------------------------------------------------------|---|
| Basic 70/800 Series Physical Characteristics            | A |
| VideoComp Command Set                                   | B |
| Character Point Sizes                                   | C |
| Character Resolution and Granularities                  | D |
| Average Character Storage Requirements                  | E |
| Typical Drawing Scanning Modes and Storage Requirements | F |
| Output Material Types and Cassette Capacity             | G |
| Scan Input Film Format                                  | H |
| System Timings                                          | I |



**APPENDIX A**  
**BASIC 70/800 SERIES PHYSICAL CHARACTERISTICS**

| COMPONENT          | HEIGHT<br>(Inches) | WIDTH<br>(Inches) | DEPTH<br>(Inches) | WEIGHT<br>(Lbs. ) | POWER<br>(KVA) <sup>1</sup> | HEAT<br>LOAD<br>(Btu/Hr.) |
|--------------------|--------------------|-------------------|-------------------|-------------------|-----------------------------|---------------------------|
| Photocopy Unit     | 67                 | 137               | 28                | 2,500             | 8                           | 20,000 <sup>2</sup>       |
| 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<br>Photocopy Unit     | 100 feet |
| Control Unit to<br>Magnetic Tape Unit | 35 feet  |

<sup>1</sup>208 Volt, 3 Phase, 60 Hertz.

<sup>2</sup>10,000 if dryer exhausts to outside.



# APPENDIX B VIDEOCOMP COMMAND SET

| <u>CODE<sup>1</sup></u> | <u>COMMAND NAME</u>                                   |
|-------------------------|-------------------------------------------------------|
| 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 <sup>3</sup>                       |
| 15                      | Space Forward SSI <sup>3</sup>                        |
| 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 <sup>2</sup>                       |
| 30                      | Page Orientation (Requires Feature F8013)             |
| 31                      | Space Forward HCI <sup>2</sup>                        |
| 32                      | Horizontal and Vertical Rules                         |
| 34                      | String Call (Requires Feature F8011)                  |
| 37                      | Drawing Write MT <sup>4</sup> (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                             |

<sup>1</sup>Decimal equivalent of the hexadecimal command code.

<sup>2</sup>HCI - Horizontal Counting Increment.

<sup>3</sup>SSI - Stroke Spacing Increment.

<sup>4</sup>MT - Magnetic Tape.



**APPENDIX C**  
**CHARACTER POINT SIZES**

| SIZE<br>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)<sup>1</sup>**

**FONT TYPE I**

| GRANULARITY<br>MODE             | GRANULARITY <sup>2</sup>   |                                 | EQUIVALENT RESOLUTION <sup>2</sup> |                                   |
|---------------------------------|----------------------------|---------------------------------|------------------------------------|-----------------------------------|
|                                 | HORIZONTAL<br>(Strokes/Em) | VERTICAL<br>(Increments/<br>Em) | HORIZONTAL<br>(Strokes/Inch)       | VERTICAL<br>(Increments/<br>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                          |
| <b>FONT TYPE II<sup>3</sup></b> |                            |                                 |                                    |                                   |
| 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                               |

<sup>1</sup>Character sizes, font types, and granularities indicated are hardware capabilities only. Use of these capabilities depends upon availability of the necessary font files.

<sup>2</sup>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.

<sup>3</sup>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 <sup>1</sup>**

| 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<br>(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<br>(est.)                    | 1500 | 1500 | 700 |

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

| SCANNING<br>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**

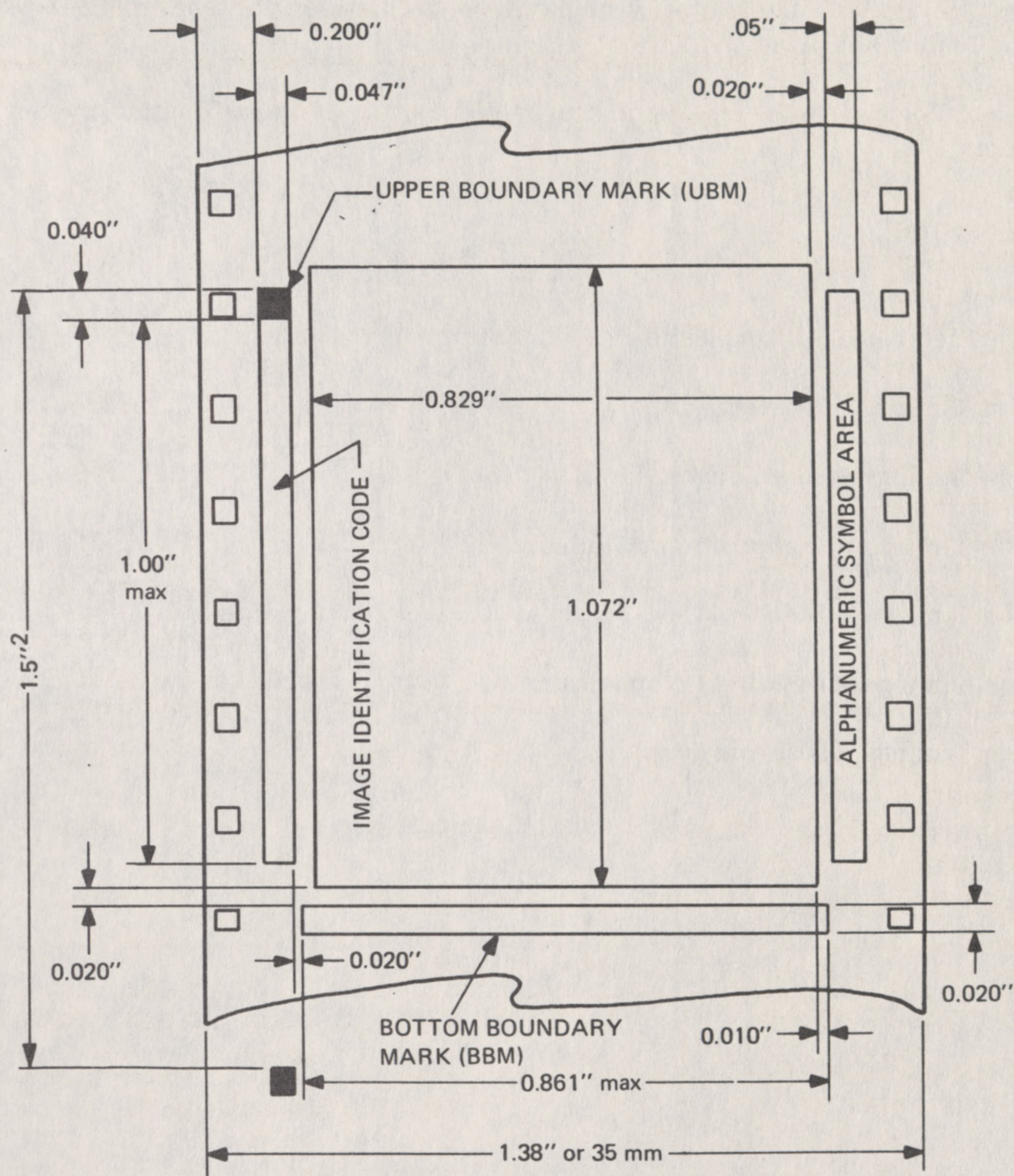
| FOR 70 mm THROUGH 310mm OUTPUT VIA PRIMARY LENS             |                                             |                  |                        |
|-------------------------------------------------------------|---------------------------------------------|------------------|------------------------|
| 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 <sup>1</sup>                     | 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 <sup>2</sup>                                             | 42 (with 8x enlargement)                    |                  |                        |
| 70                                                          | 13.5                                        |                  |                        |
| 100                                                         | 20.5                                        |                  |                        |
| 150                                                         | 32.5                                        |                  |                        |
| 250                                                         | 56                                          |                  |                        |
| 310                                                         | 70                                          |                  |                        |

<sup>1</sup>Not recommended for continuous processing.

<sup>2</sup>Requires Secondary Lens Feature, F8010.



# APPENDIX H SCAN INPUT FILM FORMAT<sup>1</sup>



<sup>1</sup> Drawing is not to scale and tolerances are not shown. All dimensions are given in inches.

<sup>2</sup> 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 . . . . . | I-2 |
| Function Timings - Magnetic Tape . . . . .              | I-3 |
| Function Timings - Film/Paper Advance . . . . .         | I-3 |
| Function Timings - Composition of Rules . . . . .       | I-3 |
| Function Timings - Disc . . . . .                       | I-3 |
| Function Timings - Drawing Composition . . . . .        | I-4 |
| Function Timings - Drawing Scan . . . . .               | I-4 |



AVERAGE ELECTRONIC WRITING TIME PER CHARACTER<sup>1</sup>

| TYPE I                  |                         |                   |       |               |               |
|-------------------------|-------------------------|-------------------|-------|---------------|---------------|
| SIZE RANGE              | POINT <sup>2</sup> 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 <sup>2</sup> |                         | 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         |

<sup>1</sup>Times are in milliseconds, and are for true-size output.

<sup>2</sup>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

| <u>READ FUNCTION</u> | <u>AVERAGE READ TIME</u>                                        |
|----------------------|-----------------------------------------------------------------|
| Start and Stop Time  | 16 msec.                                                        |
| Data Transfer        | 30K Bytes/Sec.                                                  |
| Time/Block           | $16 \pm N/30$ (N = Number of characters in thousands per block) |

## FUNCTION TIMINGS - FILM/PAPER ADVANCE

| <u>ADVANCING FUNCTION</u> | <u>AVERAGE TIMING</u> |
|---------------------------|-----------------------|
| 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

| <u>HORIZONTAL RULES</u> | <u>AVERAGE WRITING SPEED</u> |
|-------------------------|------------------------------|
| 1 Point                 | 3.5 msec. per inch           |
| 2 Point                 | 4.4 msec. per inch           |
| <u>VERTICAL RULES</u>   |                              |
| 1 Point                 | 0.9 msec. per inch           |
| 2 Point                 | 1.7 msec. per inch           |

## FUNCTION TIMINGS - DISC

| <u>FUNCTION</u>                          | <u>AVERAGE TIMING</u> |
|------------------------------------------|-----------------------|
| Seek Time (Average)                      | 75 msec.              |
| Adjacent Cylinder<br>Seek Time (Average) | 25 msec.              |
| Latency Time (Average)                   | 12.5 msec.            |
| Data Transfer Time<br>(Per 1000 Bytes)   | 7 msec.               |



## FUNCTION TIMINGS - DRAWING COMPOSITION

| MODE | RESOLUTION                                | MSEC./SQ. INCH | SEC./MAX. AREA DRAWING* |
|------|-------------------------------------------|----------------|-------------------------|
|      | HORIZONTAL<br>Strokes/Inch<br>(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<br>(Strokes/Inch) | VERTICAL<br>(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        |

<sup>1</sup>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 <sup>1</sup> | 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           |

<sup>1</sup> Composition execution time will typically be reduced 1/3 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 pre-processing 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. HCLP 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 <sup>1</sup> | 2d selector channel..... | 1     | \$185  | \$7,430  |
| 2311 <sup>1</sup> | 2d disk drive.....       | 1     | 570    | 24,745   |
| 2401 <sup>2</sup> | 60 KC tape units.....    | 3     | 1,455  | 66,060   |
| Total.....        |                          |       | 10,619 | 479,174  |

<sup>1</sup> Add to minimum configuration.

<sup>2</sup> 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).....                                              | 112       |         |
| 5. Fonts (special characters, artwork customer supplied).....                       | 150       |         |
| 6. 100-pica capacity.....                                                           | 65,000    | 1,855   |
| 7. Software, book package (PAGATEXT).....                                           | 25,000    |         |
| 8. Software, general purpose compiler (HCS).....                                    | 40,000    | 550     |
| 9. Yearly maintenance agreement contract, per month (included in leased price)..... | 1,500     |         |
| 10. Video screen monitor.....                                                       | 3,500     | 95      |

<sup>1</sup> Paid-up license only.

## FOTOTRONIC SYSTEM

Film and photographic paper specifications and prices.<sup>1</sup>—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.)

<sup>1</sup> All prices are subject to change without notice.

| Intertype part number          | Width<br>(picas) | Price per 100-foot roll |                   |                   |               |
|--------------------------------|------------------|-------------------------|-------------------|-------------------|---------------|
|                                |                  | 1 to 9<br>rolls         | 10 to 19<br>rolls | 20 to 49<br>rolls | 50 or<br>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 <sup>1</sup> 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         |

<sup>1</sup> 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.

<sup>1</sup> 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 line 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).

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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 &amp; 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 <sup>1</sup> |
|----------------------------------|--------|----------------------------|
| 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                     |

<sup>1</sup> 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.

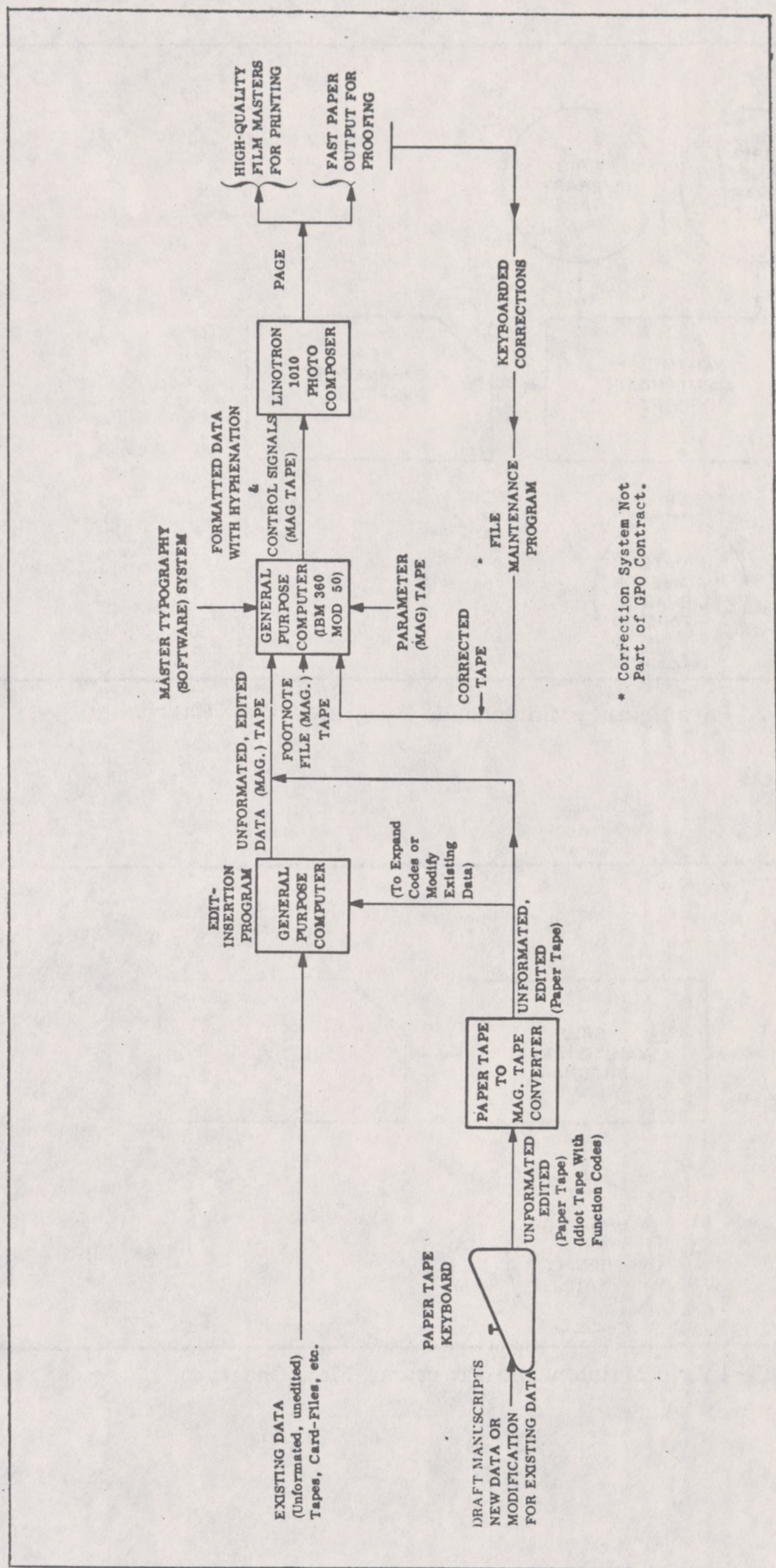
The Grid Maintenance Program is used to (1) create a Grid Library Tape; (2) Update an old Grid Library Tape, by changing widths for characters on old grids; or (3) add widths for characters on new grids. The program combines inputs from the current Grid Library Tape (an old tape that needs updating),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





\* Correction System Not  
Part of GPO Contract.

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



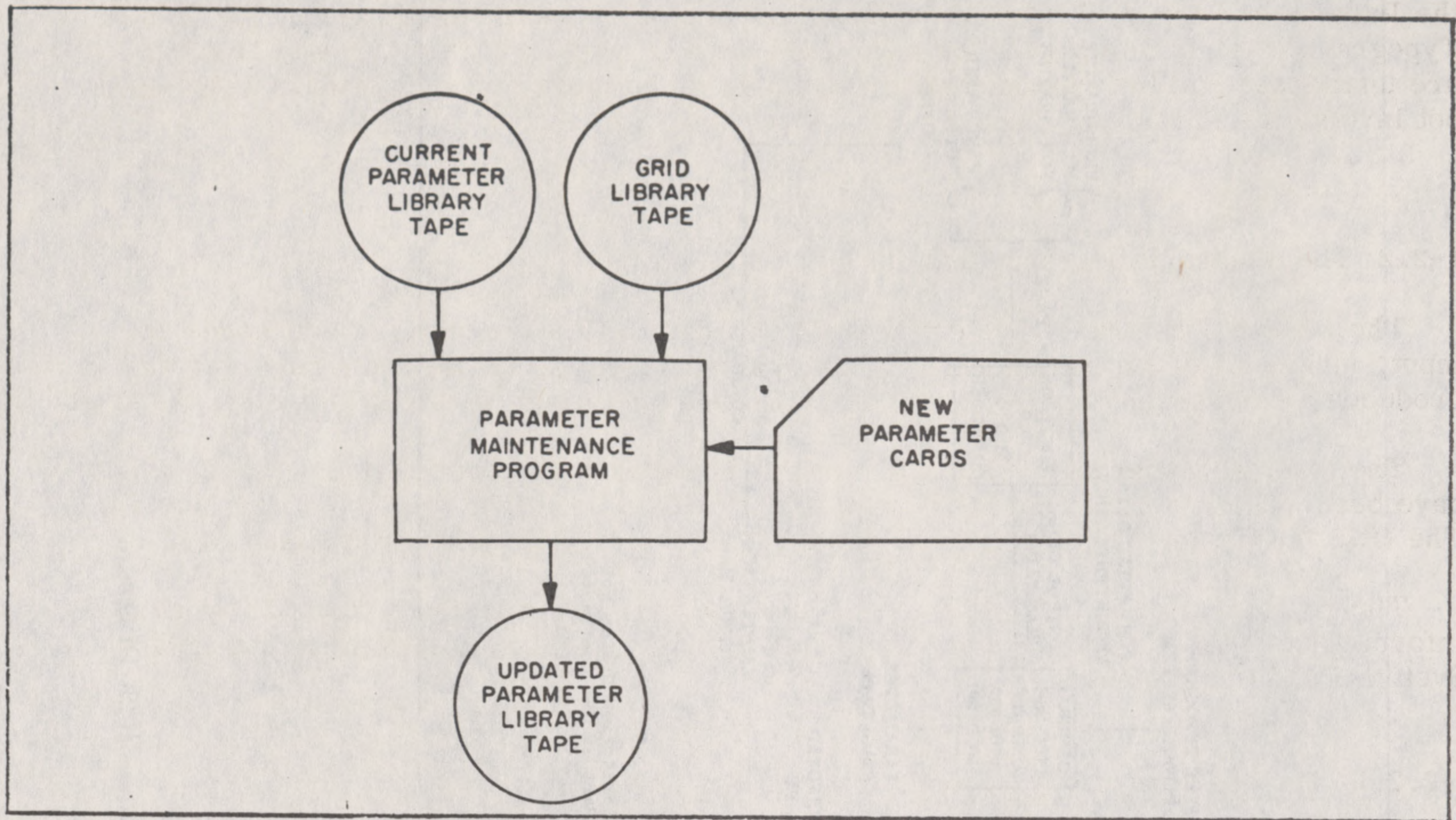


Figure 1-3 Parameter. Maintenance Program, Flow Chart.

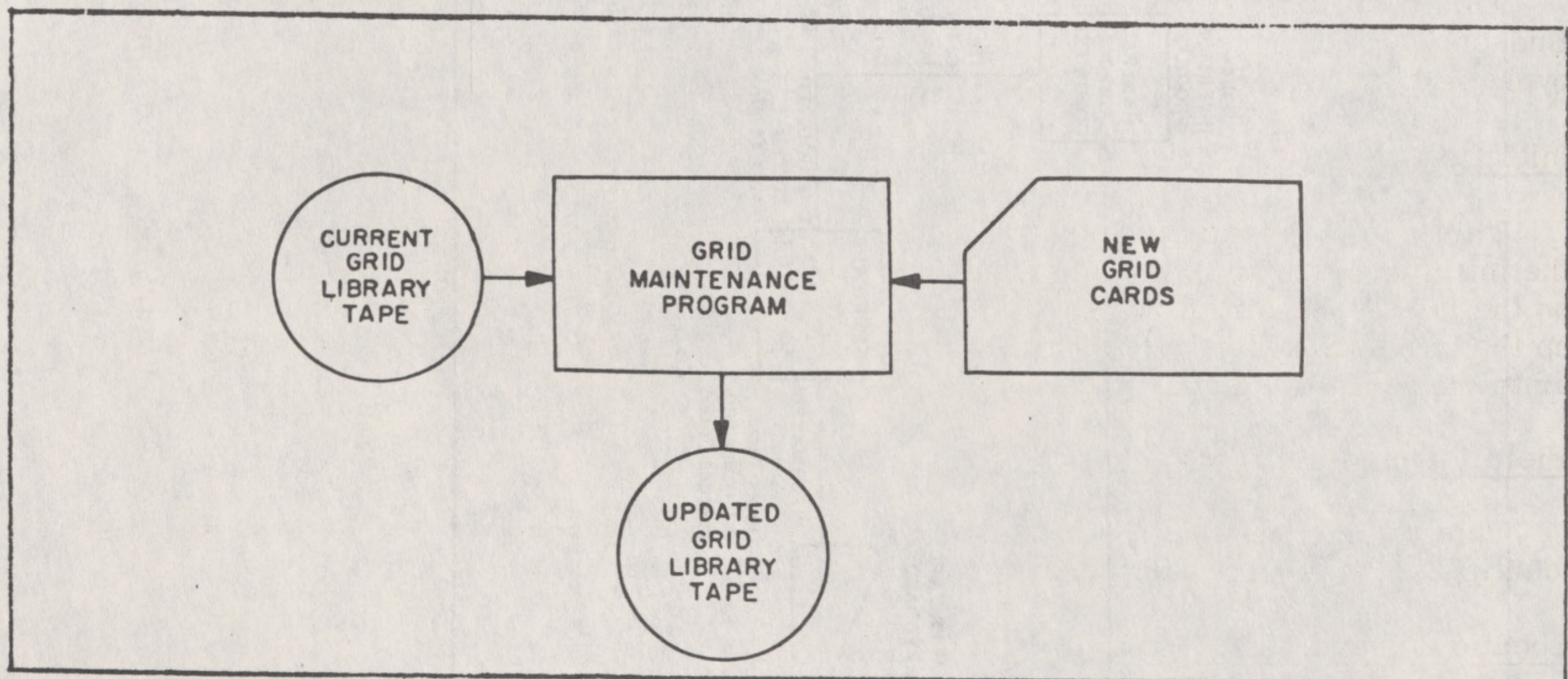


Figure 1-4 Grid Maintenance Program, Flow Chart



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.



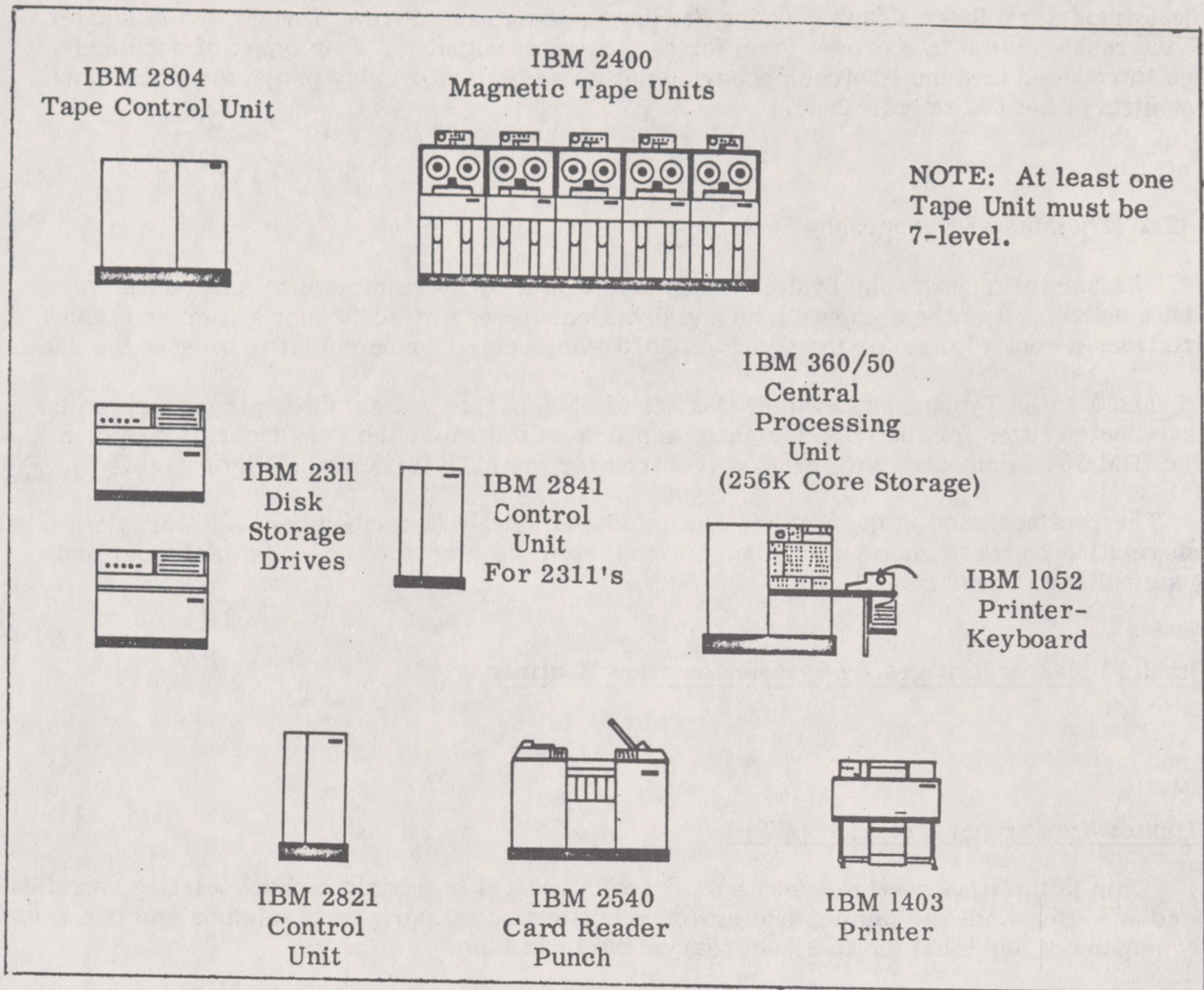


Figure 1-5 IBM 360 Computer Configuration Required for the Linotron 1010 Master Typography System.

#### 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-



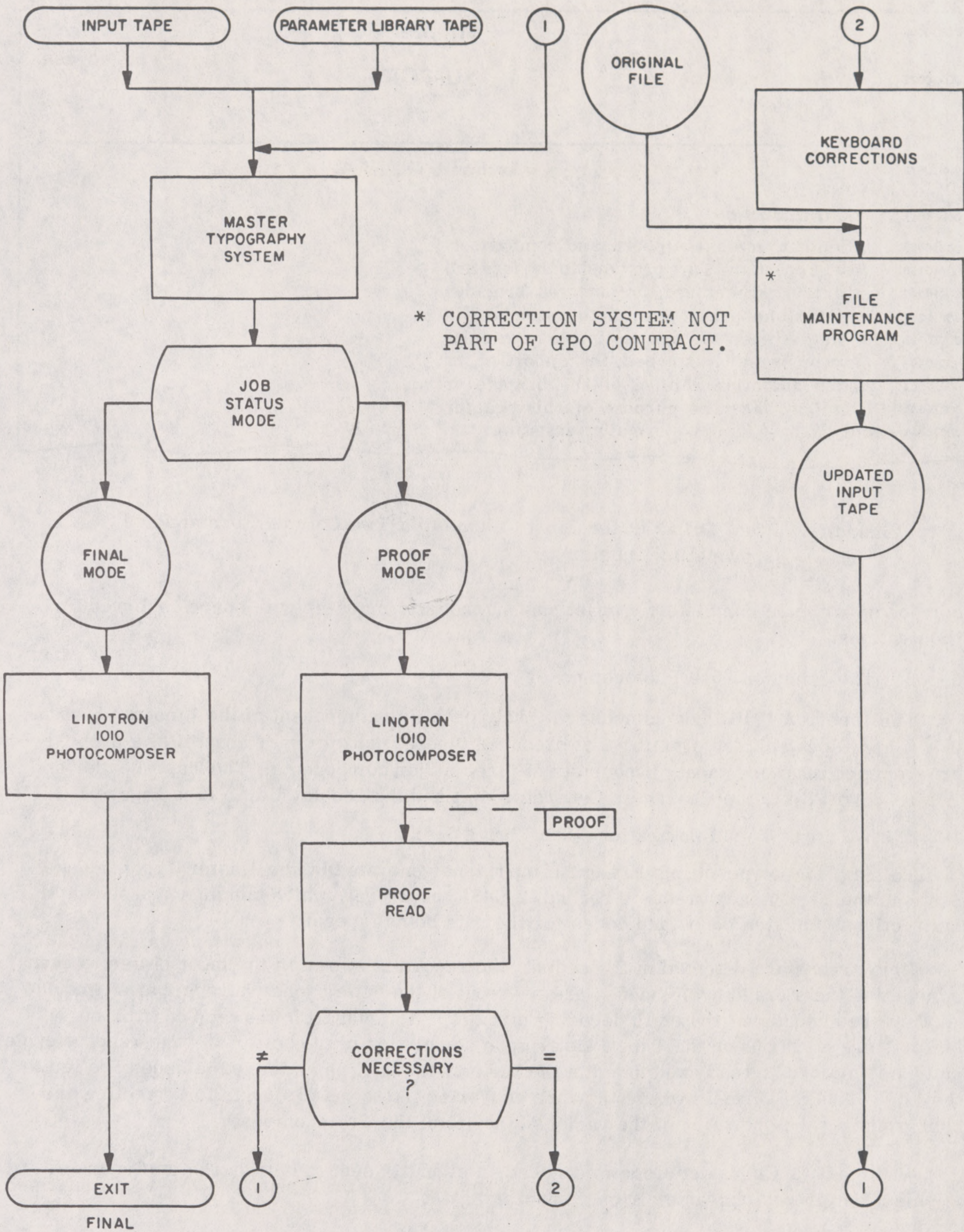


Figure 1-6 The Linotron 1010 System, Flow Diagram



|          |                                                |
|----------|------------------------------------------------|
| 00010006 | <b>Chapter 3</b>                               |
| 00010022 | <b>SUPPORT</b>                                 |
| 00010032 | <b>Section I. GENERAL</b>                      |
| 00010063 | <b><u>44. Introduction</u></b>                 |
| 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.



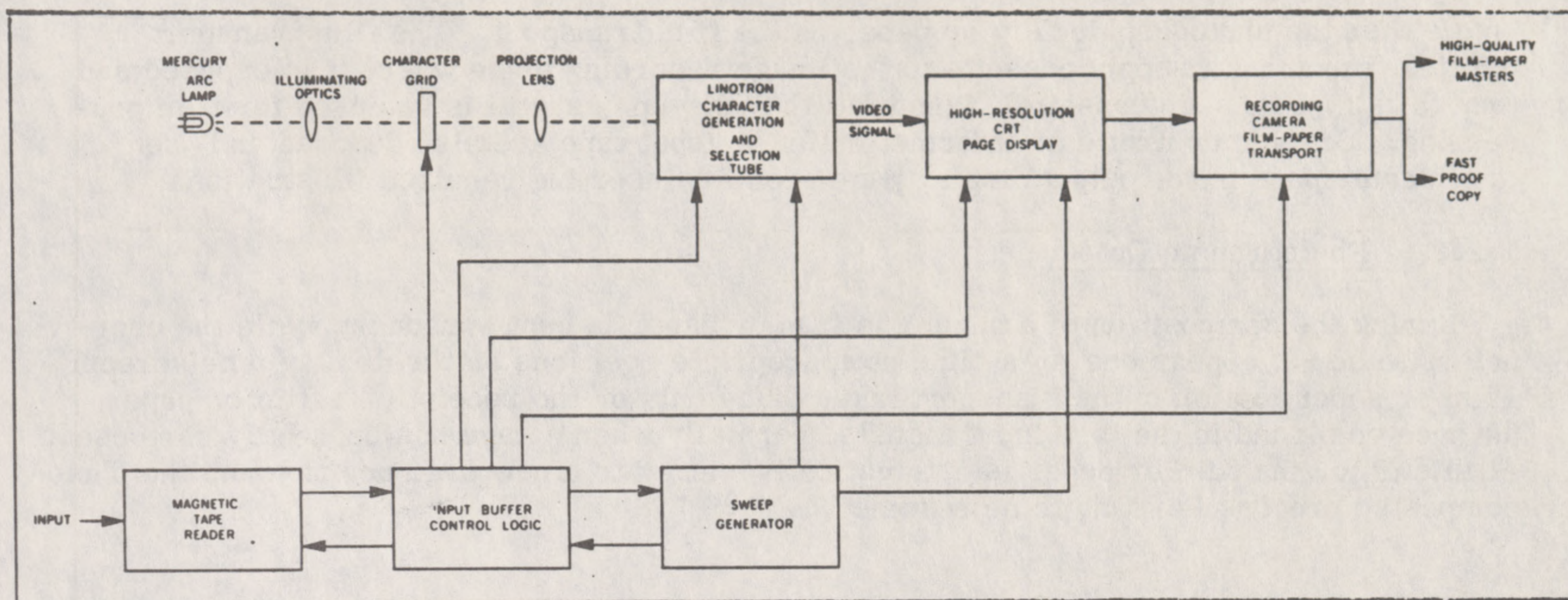


Figure 1-8. Block Diagram of Linotron 1010 Photocomposer

### 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 photo-composing 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<br>(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:

$$.1125(\$1.6110) + \$0.0367 + \$1.0851 + \$0.2120 \text{ or } \$1.5150$$

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   |



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<br>page over 5 years).....                        |        |        | .00101    |
| IV. Computer cycle: A. 0.2722 minutes at<br>\$2.0495.....                              |        |        | .55790    |
| V. Subtotal.....                                                                       |        |        | 1.55211   |
| VI. Composer cost per month (exclusive of sys-<br>tems programmers).....               |        |        | \$14,374  |
| VII. Number of pages per month required to<br>break even with Linotype—Equation I..... |        |        | 5,394     |
| VIII. Number of 1-shift keyboards required to<br>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 origin-

ally 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 overhead 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 Merganthaler 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<sup>1</sup>

## 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<br>(sec.) | Wait time <sup>1</sup><br>(sec.) |
|---------|--------------------|----------------------------------|
| EQI     | 140.95             | 212.71                           |
| EQII    | 79.00              | 272.76                           |

<sup>1</sup> 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 <sub>16</sub> | (6416) <sub>10</sub> |
| EQII | 1C78 <sub>16</sub> | (7288) <sub>10</sub> |

Load Module Size is as follows:

|      |                    |                        |
|------|--------------------|------------------------|
| EQI  | 6C18 <sub>16</sub> | (27,672) <sub>10</sub> |
| EQII | 6F80 <sub>16</sub> | (28,544) <sub>10</sub> |

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 <sup>2</sup> | ISN 0002 <sup>2</sup> |
| 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

2nd card—Computer Model card

set 1 { 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]                                                                                 |

<sup>1</sup> Equation Roman numeral one, Equation Roman numeral two respectively.

<sup>2</sup> Refer to attached listings.

### 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 Key punch Coding Sheet.







LEVEL 18 ( SEPT 69 )

OS/360 FORTRAN H

DATE 70.204/14.06.20

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

```

** ** ** ** **
DIMENSION ASPDTG(10)
REAL*8 A(8),B(8),C(8),C1,D(8),D1,D2,D12,E(8),F(8),CMONLY
REAL*8 CDTITL,TITLE(8),PRCNT(8),PERCEN(8),PERTOT
REAL*8 CPTYPD,CPTYPM,MODELS(3),DS(2),SMPL(8),DATLIT,ORIGIN
REAL*8 FORMAT(8),PROCES(4),MIX,MODLS(3),SETS(2),CPT(4,2),SMPLT(9,5
1),ONE,DELTA(18),DATA,CNTY(2),PATRIA(2)
REAL*8 SIGMAA,SIGMAB,SIGMAC,SIGMAD,SIGMAE,W(18),SIGMAF
REAL*8 TOPHLF,X,BFMIN,PAGES,KEYBD
DATA CNTY(1)/6HU.S.A./
DATA CNTY(2)/6H U.K. /
DATA CPT(1,1)/4HLINO/
DATA CPT(1,2)/4HTYPE/
DATA CPT(2,1)/4HMONO/
DATA CPT(2,2)/4HTYPE/
DATA CPT(3,1)/4HPHOT/
DATA CPT(3,2)/4HON /
DATA CPT(4,1)/4HPH B/
DATA CPT(4,2)/4HLNCE/
DATA DATA/6HDATA: /
DATA DELTA(1)/5H+100%/
DATA DELTA(2)/5H +90%/
DATA DELTA(3)/5H +80%/
DATA DELTA(4)/5H +70%/
DATA DELTA(5)/5H +60%/
DATA DELTA(6)/5H +50%/
DATA DELTA(7)/5H +40%/
DATA DELTA(8)/5H +30%/
DATA DELTA(9)/5H +20%/
DATA DELTA(10)/5H +10%/
DATA DELTA(11)/5H ZERC/
DATA DELTA(12)/5H -10%/
DATA DELTA(13)/5H -20%/
DATA DELTA(14)/5H -30%/
DATA DELTA(15)/5H -40%/
DATA DELTA(16)/5H -50%/
DATA DELTA(17)/5H -60%/
DATA DELTA(18)/5H -70%/
DATA FORMAT(1)/1HA/
DATA FORMAT(2)/1HE/
DATA FORMAT(3)/1HG/
DATA FORMAT(4)/1HH/
DATA FORMAT(5)/1HL/
DATA FORMAT(6)/1HP/
DATA FORMAT(7)/1HT/
DATA FORMAT(8)/1HY/
DATA MIX/4H MIX: /
DATA MODLS(1)/6HNO. OF/
DATA MODLS(2)/6H COMPU/
DATA MODLS(3)/6HTERS: /
DATA ONE/4H ONE: /
DATA PATRIA(1)/1H /

```

ISN 0002  
ISN 0003  
ISN 0004  
ISN 0005  
ISN 0006  
  
ISN 0007  
ISN 0008  
ISN 0009  
ISN 0010  
ISN 0011  
ISN 0012  
ISN 0013  
ISN 0014  
ISN 0015  
ISN 0016  
ISN 0017  
ISN 0018  
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ISN 0051

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7MAY

7MAY

ISN 0052 DATA PATRIA (2)/1HB/  
 ISN 0053 DATA PROCES (1)/1HL/  
 ISN 0054 DATA PROCES (2)/1HM/  
 ISN 0055 DATA PROCES (3)/1HP/  
 ISN 0056 DATA PROCES (4)/1HB/  
 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)/6HNP 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)/6HATAICG/  
 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)/6HRECTCR/  
 ISN 0097 DATA SMPLT (8,4)/6HY /  
 ISN 0098 DATA SMPLT (8,5)/6H /  
 ISN 0099 DATA SMPLT (9,1)/6HMX /  
 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),  
 W (12),W (13),W (14),W (15),W (16),W (17),W (18)/1.90,1.81,1.72,  
 1



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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/
      READ (5,100) MODELS(1),MODELS(2),MODELS(3),N
      IF (MODELS(1) .NE. MODLS(1)) GO TO 51
      IF (MODELS(2) .NE. MODLS(2)) GO TO 51
      IF (MODELS(3) .NE. MODLS(3)) GO TO 51
      DO 60 I=1,N
      READ (5,102)
      READ (5,104) DS(1),DS(2),NN
      IF (DS(1) .NE. SETS(1)) GO TO 52
      IF (DS(2) .NE. SETS(2)) GO TO 52
      DO 61 KMAC=1,NN
      WRITE (6,101)
      CALL SPDATE(ASPD TG)
      WRITE (6,505) (ASPD TG(JDTG),JDTG=4,10)
      WRITE (6,102)
      WRITE (6,105)
      C      PAGE OVERFLOW NEEDED
      INGLE = 0
      READ(5,106) CDTITL,(TITLE(IJ),PRCNT(IJ),IJ=1,8),CPTYPH,NNN
      IF (CDTITL .EQ. ONE) GO TO 62
      IF (CDTITL .EQ. MIX) GO TO 63
      GO TO 53
      62 INGLE = 1
      63 PERTOT = DABS(PRCNT(1)+PRCNT(2)+PRCNT(3)+PRCNT(4)+PRCNT(5) +
1      PRCNT(6)+PRCNT(7)+PRCNT(8)-100.)
      IF (PERTOT .GT. 0.1) GO TO 54
      1 NDATA = 0
      DO 7 MN=1,8
      7 PERCENT(MN) = PRCNT(MN)/100.
      DO 9 J=1,NNN
      READ (5,108) DATLIT,CPTYPD,SMPL(J),B(J), CHONLY,D(J),E(J),A(J),
1      C(J),F(J),C1,ORIGIN
      IF (DATLIT .NE. DATA) GO TO 49
      NDATA = NDATA+1
      IF (CPTYPH .NE. CPTYPD) GO TO 56
      IF (NDATA-NNN) 9,9,57
      9 CONTINUE
      IF (ORIGIN .EQ. PATRIA(1)) GO TO 73
      IF (ORIGIN .EQ. PATRIA(2)) GO TO 74
      GO TO 49
      73 LAND = 1
      D1 = 0.0812
      GO TO 75
      74 LAND = 2
      D1 = 0.0263
      75 D2 = 0.0054
      DO 11 LBLOOP=1,18
      LABOR FACTOR = 90% CF B & D1 DELTAS.
      D12 = D1*(LBLOOP) + D2
      SIGMAA = A(1)*PERCENT(1)+A(2)*PERCENT(2)+A(3)*PERCENT(3) +
1      A(4)*PERCENT(4)+A(5)*PERCENT(5)+A(6)*PERCENT(6) +
2      A(7)*PERCENT(7)+A(8)*PERCENT(8)
      SIGMAB = B(1)*PERCENT(1)+B(2)*PERCENT(2)+B(3)*PERCENT(3) +

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ISN 0105
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ISN 0161

ISN 0162

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|          |        |                                                                                                                                                                         |                   |
|----------|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| ISN 0163 | 1<br>2 | B (4) *PERCEN (4) +B (5) *PERCEN (5) +B (6) *PERCEN (6) +<br>B (7) *PERCEN (7) +B (8) *PERCEN (8)                                                                       | 13MAY 18<br>18MAY |
|          |        | SIGMAC = C (1) *PERCEN (1) +C (2) *PERCEN (2) +C (3) *PERCEN (3) +<br>C (4) *PERCEN (4) +C (5) *PERCEN (5) +C (6) *PERCEN (6) +<br>C (7) *PERCEN (7) +C (8) *PERCEN (8) |                   |
| ISN 0164 | 1<br>2 | SIGMAD = D (1) *PERCEN (1) +D (2) *PERCEN (2) +D (3) *PERCEN (3) +<br>D (4) *PERCEN (4) +D (5) *PERCEN (5) +D (6) *PERCEN (6) +<br>D (7) *PERCEN (7) +D (8) *PERCEN (8) |                   |
| ISN 0165 | 1<br>2 | SIGMAE = E (1) *PERCEN (1) +E (2) *PERCEN (2) +E (3) *PERCEN (3) +<br>E (4) *PERCEN (4) +E (5) *PERCEN (5) +E (6) *PERCEN (6) +<br>E (7) *PERCEN (7) +E (8) *PERCEN (8) |                   |
| ISN 0166 | 1<br>2 | SIGMAF = F (1) *PERCEN (1) +F (2) *PERCEN (2) +F (3) *PERCEN (3) +<br>F (4) *PERCEN (4) +F (5) *PERCEN (5) +F (6) *PERCEN (6) +<br>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                                                                                                                                                        |                   |
| ISN 0171 | 3      | FUTURE: MAKE LABEL 50 A SUBROUTINE ENTRY POINT                                                                                                                          |                   |
| ISN 0172 |        | BEMIN = CMONLY/X                                                                                                                                                        |                   |
| ISN 0174 |        | IF (BEMIN .GT. 10560.) GO TO 4                                                                                                                                          |                   |
| ISN 0175 |        | PAGES = BEMIN/SIGMAA                                                                                                                                                    |                   |
| ISN 0176 |        | KEYBD = (PAGES*(SIGMAD+SIGMAE)/60.0)/176.0                                                                                                                              |                   |
|          |        | GO TO 5                                                                                                                                                                 |                   |
|          |        | RESID1=60.0*C1(J)                                                                                                                                                       |                   |
|          |        | RESID2=C(J)*PAGES                                                                                                                                                       |                   |
|          |        | RESID3=RESID2/60.0                                                                                                                                                      |                   |
|          |        | RESID = (228.8-RESID3)*RESID1                                                                                                                                           |                   |
| ISN 0177 | 4      | IEXTRA=1                                                                                                                                                                |                   |
| ISN 0178 | 5      | IF (LBLOOP .GT. 1) GO TO 8                                                                                                                                              |                   |
| ISN 0180 |        | IF (CPTYPH .EQ. PROCES (1)) GO TO 21                                                                                                                                    |                   |
| ISN 0182 |        | IF (CPTYPH .EQ. PROCES (2)) GO TO 22                                                                                                                                    |                   |
| ISN 0184 |        | IF (CPTYPH .EQ. PROCES (3)) GO TO 23                                                                                                                                    |                   |
| ISN 0186 |        | IF (CPTYPH .EQ. PROCES (4)) GO TO 25                                                                                                                                    |                   |
| 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                                                                                                                                                                |                   |
| ISN 0195 | 25     | II = 4                                                                                                                                                                  |                   |
| 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                                                                                                                                                                |                   |



|          |                                                                     |  |       |
|----------|---------------------------------------------------------------------|--|-------|
| 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                                         |  |       |
| ISN 0235 | WRITE (6,753) DELTA(LBLCCF)                                         |  | 13MAY |
| ISN 0236 | GO TO 10                                                            |  | 13MAY |
| ISN 0237 | 6 IF (INGLE-1) 41,42,71                                             |  | 18MAY |
| ISN 0238 | 41 WRITE (6,109) X, BEMIN, PAGES, KEYED, DELTA(LBLOOP)              |  | 13MAY |
| ISN 0239 | GO TO 11                                                            |  | 7MAY  |
| ISN 0240 | 42 WRITE (6,109) X, BEMIN, PAGES, KEYBD, DELTA(LBLOOP)              |  | 7MAY  |
| ISN 0241 | 11 IEXTRA = 0                                                       |  | 20MAY |
| ISN 0242 | 10 IEXTRA = 0                                                       |  |       |
| ISN 0243 | IF (JJ-9) 64,55,64                                                  |  |       |
| ISN 0244 | 55 WRITE (6,111) (TITLE(IL),PRCNT(IL),IL=1,8)                       |  |       |
| ISN 0245 | 64 WRITE (6,199) CNTY(LAND)                                         |  |       |
| 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)                 |  |       |
| 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 | GC 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                                                             |  |       |



|          |                                                                                                                                                                                                                                                   |                                             |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|
| 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 PHOTOCOPO<br>1SITION VS. CONVENTIONAL',/43X,'BASED ON PURCHASED COMPUTER TIME (EQ<br>2UATION I)')                                                                                     |                                             |
| ISN 0277 | 105 FORMAT (1H0/1X,'CONVENTIONAL PROCESS',14X,'SAMPLE',21X,'BREAKEVEN:<br>1'//62X,'COST PER MINUTE',5X,'MINUTES',5X,' PAGES',5X,'KEYBOARDS',<br>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,')')                                                                                                                                                                                                                    |                                             |
| ISN 0282 | 201 FORMAT (1H+, 'DATA FOR THE ABOVE ARE AS FOLLOWS: '//6X,2A4,6X,5A<br>16//4X,'A',9X,'B',6X,'C',7X,'C1',6X,'D',7X,'D1',6X,'E',7X,<br>2'F',4X,'MNTHLY COST',2X,' '//1X,F7.4,2X,F7.4,2X,2(F6.4,2X),<br>3 F6.2,2X,2(F6.4,2X),F5.2,2X,F6.4,3X,F8.2)) | 7MAY<br>7MAY<br>18MAY<br>18MAY22<br>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                                                                                                                                                                                                                                               |                                             |



[illegible]



[illegible]



## \*\*\*\*\* F O R T R A N   C R O S S   R E F F E R E N C E   L I S T I N G \*\*\*\*\*

| LABEL | DEFINED | REFERENCES                                        | CROSS REFERENCE |
|-------|---------|---------------------------------------------------|-----------------|
| 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 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                                              |                 |
| 100   | 0271    | 0250 0252 0254 0256 0258 0260 0262 0264 0266 0268 |                 |
| 101   | 0276    | 0105                                              |                 |
| 102   | 0272    | 0120                                              |                 |
| 104   | 0273    | 0113 0123 0114                                    |                 |



PAGE 010

## \*\*\*\*\* F O R T R A N   C R O S S   R E F E R E N C E   L I S T I N G \*\*\*\*\*

| LABEL | DEFINED | REFERENCES |
|-------|---------|------------|
| 105   | 0277    | 0124       |
| 106   | 0274    | 0126       |
| 107   | 0278    | 0232       |
| 108   | 0275    | 0140       |
| 109   | 0279    | 0238       |
| 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\*      NC      DIAGNOSTICS GENERATED

\*\*\*\*\* END OF COMPILE \*\*\*\*\*



F88-LEVEL LINKAGE EDITOR OPTIONS SPECIFIED MAP,LET,LIST  
 VARIABLE OPTIONS USED - SIZE=(102400,16384)  
 DEFAULT OPTION(S) USED

## MODULE MAP

| CONTROL SECTION |        |        | ENTRY    |          |          |          | ENTRY    |          |          |          |
|-----------------|--------|--------|----------|----------|----------|----------|----------|----------|----------|----------|
| NAME            | ORIGIN | LENGTH | NAME     | LOCATION | NAME     | LOCATION | NAME     | LOCATION | NAME     | LOCATION |
| EQONE           | 00     | 1910   |          |          |          |          |          |          |          |          |
| IHCECOMH*       | 1910   | F31    | IBCOM#   | 1910     | FDIOCS#  | 19CC     | INTSWTCH | 282E     |          |          |
| IHCCOMH2*       | 2848   | 581    | SEQDASD  | 2AE4     |          |          |          |          |          |          |
| SPDATE *        | 2DD0   | 346    | ADCON#   | 3118     | PCVAOUTP | 31C2     | FCVLOUTP | 3252     | FCVZOUTP | 33A2     |
| IHCFCVTH*       | 3118   | 1195   | PCVIOUTP | 3748     | FCVEOUTP | 3C4A     | FCVCOUTP | 3E64     | INT6SWCH | 414B     |
| IHCFFNTH*       | 42B0   | 512    | ARITH#   | 42B0     | ADJSWTCH | 461C     |          |          |          |          |
| IHCFIOS*        | 47C8   | 129C   | FIOCS#   | 47C8     | FIOCSBEP | 47CE     |          |          |          |          |
| IHCUIOPT *      | 5A68   | 328    |          |          |          |          |          |          |          |          |
| IHCERRM *       | 5D90   | 5BC    | ERRMON   | 5D90     | IHCERRE  | 5DA8     |          |          |          |          |
| IHCUIATBL*      | 6350   | 638    |          |          |          |          |          |          |          |          |
| IHCETRCH*       | 6988   | 28E    | IHCETRCH | 6988     | ERRTRA   | 6990     |          |          |          |          |

ENTRY ADDRESS 00  
 TOTAL LENGTH 6C18

\*\*\*\*\*MAIN DOES NOT EXIST BUT HAS BEEN ADDED TO DATA SET



```

IEF285I SYS1.FORTLIB
IEF285I VOL SER NOS= CPERES.
IEF285I SYS1.LINKLIB
IEF285I VOL SER NOS= CPELNK.
IEF285I SYS70195.T150215.SF000.WNMEQI.R0000211
IEF285I VOL SER NOS= CPE235.
IEF285I SYS70195.T150215.RF000.WNMEQI.S0000212
IEF285I VOL SER NOS= CPE232.
IEF285I SYS70195.T150215.RF000.WNMEQI.S0000212
IEF285I VOL SER NOS= CPE232.
IEF285I SYS70195.T150215.RF000.WNMEQI.G0SET
IEF285I VOL SER NOS= CPE231.
IEF285I SYS70195.T150215.RF000.WNMEQI.SYSUT1
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. CUMUL. JOB=000046.41 SEC. **
CPU TIME=000003.24 SEC. WAIT TIME=000032.38 SEC. IDLE TIME=000010.79 SEC. I/O ACTIVITY= 764**E88A COMPUTER CENTER **
*****
XXGO EXEC PGM=*.LKED.SYSLMOD,COND=(4,LT,LKED)
XXFT05F001 DD DDNAME=SYSIN
//GO.FT06F001 DD SYSOUT=Z
X/FT06F001 DD SYSOUT=A
XXFT07F001 DD SYSOUT=B
//GO.SYSIN DD *
//SYSUDUMP DD SYSOUT=A
//
IEF236I ALLOC. FOR WNMEQI GO 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.G0SET
IEF285I VOL SER NOS= CPE231.
IEF285I SYS70195.T150215.RF000.WNMEQI.S0000215
IEF285I VOL SER NOS= CPE232.
IEF285I SYS70195.T150215.RF000.WNMEQI.S0000215
IEF285I VOL SER NOS= CPE232.
IEF285I SYS70195.T150215.SF000.WNMEQI.R0000213
IEF285I VOL SER NOS= CPE335.
IEF285I SYS70195.T150215.SF000.WNMEQI.R0000214
IEF285I VOL SER NOS= CPE334.
IEF285I SYS70195.T150215.SF000.WNMEQI.R0000216
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. CUMUL. JOB=000523.94 SEC. **
CPU TIME=000140.95 SEC. WAIT TIME=000212.71 SEC. IDLE TIME=000118.82 SEC. I/O ACTIVITY= 13,682**E88A COMPUTER CENTER **
*****
IEF285I SYS70195.T150215.RF000.WNMEQI.G0SET
IEF285I VOL SER NOS= CPE231.

```

64000014  
72000014

80000014  
88000014

DELETED



COMPILER OPTIONS - NAME= EQTWO,OPT=02,LINECNT=56,SOURCE,EBCDIC,NOLIST,NODECK,LOAD,NOMAF,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 *****
C DIMENSION ASPDTG(10)
ISN 0002 REAL*8 FORMAT(8),PROCES(4),MIX,MODLS(3),SETS(2),CPT(4,2),SMPLT(9,5) 7MAY
ISN 0003 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 CDITIL,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,SIGMAE,SIGMAC,SIGMAD,SIGMAE,SIGMAO,SIGMAU,SIGMAF 1MAY
ISN 0010 REAL*8 BOTHLF,X1,X23,X123,KEYBDS
ISN 0011 DATA CNTY(1)/6HU.S.A./
ISN 0012 DATA CNTY(2)/6H U.K./
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/
ISN 0020 DATA CPT(4,2)/4HLNCE/
ISN 0021 DATA DATA/6HLATA: /
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)/6WTERS: /
ISN 0034 DATA ONE/4HONE:/
ISN 0035 DATA PATRIA(1)/1H /
ISN 0036 DATA PATRIA(2)/1HB/
ISN 0037 DATA PROCES(1)/1HL/
ISN 0038 DATA PROCES(2)/1HM/
ISN 0039 DATA PROCES(3)/1HP/
ISN 0040 DATA PROCES(4)/1HB/
ISN 0041 DATA SETS(1)/6HDATA S/
ISN 0042 DATA SETS(2)/6HETS: /
ISN 0043 DATA SMPLT(1,1)/6HGROUP /
ISN 0044 DATA SMFLT(1,2)/6H /
ISN 0045 DATA SMPLT(1,3)/6H /
ISN 0046 DATA SMPLT(1,4)/6H /
ISN 0047 DATA SMFLT(1,5)/6H /
ISN 0048 DATA SMPLT(2,1)/6HPOLICY/
ISN 0049 DATA SMPLT(2,2)/6H /
```



```

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)/6HDUCTION/
ISN 0057 DATA SMPLT (3,5)/6HPLAN/
ISN 0058 DATA SMPLT (4,1)/6HPIEIST/
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)/6HMAN 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)/6HMX /
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. MODIS(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(ASPDG)
ISN 0106 WRITE (6,505) (ASPDG(JDTG), JDTG=4, 10)
ISN 0107 WRITE (6,102)
ISN 0108 WRITE (6,105)

```



| ISN  | Code | Statement                                                                   | Comments |
|------|------|-----------------------------------------------------------------------------|----------|
| 0109 | C    | PAGE OVERFLOW NEEDED                                                        |          |
| 0110 |      | INGLE = 0                                                                   |          |
| 0111 |      | READ(5,106) CDTITL,(TITLE(IJ),PRCNT(IJ),IJ=1,8),CPTYPM,NNN                  |          |
| 0112 |      | IF (CDTITL.EQ. ONE) GO TO 62                                                |          |
| 0113 |      | IF (CDTITL.EQ. MIX) GO TO 63                                                |          |
| 0114 |      | GO TO 53                                                                    |          |
| 0115 |      | 62 INGLE = 1                                                                |          |
| 0116 |      | 63 PERTOT = DABS(PRCNT(1)+PRCNT(2)+PRCNT(3)+PRCNT(4)+PRCNT(5) +             |          |
| 0117 |      | 1 PRCNT(6)+PRCNT(7)+PRCNT(8)-100.)                                          |          |
| 0118 |      | IF (PERTOT.GT. 0.1) GO TO 54                                                |          |
| 0119 |      | 4 NDATA = 0                                                                 |          |
| 0120 |      | DC 7 MN=1,8                                                                 |          |
| 0121 |      | 7 PERCEN(MN) = PRCNT(MN)/100.                                               |          |
| 0122 |      | DO 9 JAY=1,NNN                                                              |          |
| 0123 |      | READ(5,108) DATLIT,CPTYPD,SMPL(JAY),A(JAY),B,C,D(JAY),                      |          |
| 0124 |      | 1 E(JAY),POSCYC(JAY),PUTCYC(JAY),SETPOS,SFTPUT,F(JAY),ORIGIN,IBMRCA1MAY 12M |          |
| 0125 |      | IF (DATLIT.NE. DATA) GO TO 49                                               |          |
| 0126 |      | NDATA = NDATA+1                                                             |          |
| 0127 |      | IF (CPTYPM.NE. CPTYPD) GO TO 56                                             |          |
| 0128 |      | IF (NDATA-NNN) 9,9,57                                                       |          |
| 0129 |      | 9 CONTINUE                                                                  |          |
| 0130 |      | IF (ORIGIN.EQ. PATRIA(1)) GO TO 73                                          |          |
| 0131 |      | IF (ORIGIN.EQ. PATRIA(2)) GO TO 74                                          |          |
| 0132 |      | GC TO 49                                                                    |          |
| 0133 |      | 73 LAND = 1                                                                 |          |
| 0134 |      | D1 = 0.0812                                                                 |          |
| 0135 |      | GO TO 75                                                                    |          |
| 0136 |      | 74 LAND = 2                                                                 |          |
| 0137 |      | D1 = 0.0263                                                                 |          |
| 0138 |      | D2 = 0.0054                                                                 |          |
| 0139 |      | D12 = D1+D2                                                                 |          |
| 0140 |      | IF (IBMRCA.EQ. 1) GO TO 600                                                 |          |
| 0141 |      | DC 601 JAY=1,NNN                                                            |          |
| 0142 |      | 601 F(JAY)=0.20                                                             |          |
| 0143 |      | 600 SIGMAF = F(1)*PERCEN(1)+F(2)*PERCEN(2)+F(3)*PERCEN(3) +                 |          |
| 0144 |      | 1 F(4)*PERCEN(4)+F(5)*PERCEN(5)+F(6)*PERCEN(6) +                            |          |
| 0145 |      | 2 F(7)*PERCEN(7)+F(8)*PERCEN(8)                                             |          |
| 0146 |      | SIGMAA = A(1)*PERCEN(1)+A(2)*PERCEN(2)+A(3)*PERCEN(3) +                     |          |
| 0147 |      | 1 A(4)*PERCEN(4)+A(5)*PERCEN(5)+A(6)*PERCEN(6) +                            |          |
| 0148 |      | 2 A(7)*PERCEN(7)+A(8)*PERCEN(8)                                             |          |
| 0149 |      | SIGMAB = B                                                                  |          |
| 0150 |      | SIGMAC = C                                                                  |          |
| 0151 |      | SIGMAD = D(1)*PERCEN(1)+D(2)*PERCEN(2)+D(3)*PERCEN(3) +                     |          |
| 0152 |      | 1 D(4)*PERCEN(4)+D(5)*PERCEN(5)+D(6)*PERCEN(6) +                            |          |
| 0153 |      | 2 D(7)*PERCEN(7)+D(8)*PERCEN(8)                                             |          |
| 0154 |      | SIGMAE = E(1)*PERCEN(1)+E(2)*PERCEN(2)+E(3)*PERCEN(3) +                     |          |
| 0155 |      | 1 E(4)*PERCEN(4)+E(5)*PERCEN(5)+E(6)*PERCEN(6) +                            |          |
| 0156 |      | 2 E(7)*PERCEN(7)+E(8)*PERCEN(8)                                             |          |
| 0157 |      | SIGMAO = POSCYC(1)*PERCEN(1)+POSCYC(2)*PERCEN(2) +                          |          |
| 0158 |      | 1 POSCYC(3)*PERCEN(3)+POSCYC(4)*PERCEN(4) +                                 |          |
| 0159 |      | 2 POSCYC(5)*PERCEN(5)+POSCYC(6)*PERCEN(6) +                                 |          |
| 0160 |      | 3 POSCYC(7)*PERCEN(7)+POSCYC(8)*PERCEN(8)                                   |          |
| 0161 |      | SIGMAU = PUTCYC(1)*PERCEN(1)+PUTCYC(2)*PERCEN(2) +                          |          |
| 0162 |      | 1 PUTCYC(3)*PERCEN(3)+PUTCYC(4)*PERCEN(4) +                                 |          |



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ISN 0156      2      PUTCYC(5)*PERCEN(5)+PUTCYC(6)*PERCEN(6)+
ISN 0157      3      PUTCYC(7)*PERCEN(7)+PUTCYC(8)*PERCEN(8)
ISN 0158      BC = SIGMAB+SIGMAC
                BOTHLF = SIGMAA-SIGMAD*D12-SIGMAE*D12-SIGMAP
                IF (BOTHLF-0.) 3,50,3
C              3  X1 = BC/BOTHLF
                IF (SIGMAO.GT. SIGMAU) GO TO 700
                IF ((X1*SIGMAU) .GT. 72300.) GO TO 710
                GO TO 701
ISN 0159      700 IF ((X1*SIGMAO) .GT. 72300.) GO TO 710
ISN 0160      701 IF (X1-(10560./SIGMAO)) 1,1,2
ISN 0161      1  IF (SIGMAU.EQ. 0.) GO TO 10
ISN 0162      IF (X1-(10560./SIGMAU)) 10,10,14
ISN 0163      2  IF (SIGMAU.EQ. 0.) GO TO 15
ISN 0164      IF (X1-(10560./SIGMAU)) 15,15,25
ISN 0165      * * * * *
ISN 0166      * * * * *
ISN 0167      * * * * *
ISN 0168      * * * * *
ISN 0169      * * * * *
ISN 0170      * * * * *
ISN 0171      * * * * *
ISN 0172      * * * * *
ISN 0173      * * * * *
C              ALL LIMITS ARE WITH RESPECT TO PAGES ONLY
C              * * * * *
C              COMPUTER LIMITING:
C              14 LIMIT = 1
                G=10560./SIGMAU
                H=SIGMAB
                I=SIGMAC
                H1=SIGMAU
C              H2=SFTPUT
                J=G
                XF = 10560./SIGMAO
                I1 = 0.
                I2 = 0.
                ISWT = 1
                END OF ROUTINE.
C              GO TO 46
C              COMPOSER LIMITING:
                15 LIMIT = 2
                G=10560./SIGMAO
                H=SIGMAC
                I=SIGMAB
                H1=SIGMAO
                H2=SFTPOS
                J=G
                IF (SIGMAU.NE. 0.) GO TO 350
                ONE MILLION IS USED SO THAT XF WILL ALWAYS BE .GT. X123
                XF = 1000000.
                GO TO 351
ISN 0174      350 XF = 10560./SIGMAU
ISN 0175      351 I1 = 0.
ISN 0176      I2 = 0.
ISN 0177      ISWT = 2
ISN 0178      END OF ROUTINE.
C              GO TO 46
C              BOTH COMPUTER & COMPOSER LIMITING:
                25 LIMIT = 3

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1MAY

12MAY  
12MAY  
12MAY  
12MAY  
12MAY

FOR RCA SPECTRA, EXTRA SHIFT MACHINE COST = ZERO



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ISN 0203      C      IF (SIGMAU-SIGMAO) 30,30,16
ISN 0204      30      G=10560./SIGMAU
ISN 0205      H=SIGMAC
ISN 0206      I=SIGMAB
ISN 0207      H1=SIGMAO
ISN 0208      H2=SFTPOS
ISN 0209      J=10560./SIGMAO
ISN 0210      I1=SIGMAU
ISN 0211      I2=SFTPUT
ISN 0212      ISWT = 3
ISN 0213      GO TO 46
ISN 0214      C      END OF SUBROUTINE.
ISN 0215      C      COMPUTER MORE LIMITING:
ISN 0216      16      G=10560./SIGMAO
ISN 0217      H=SIGMAB
ISN 0218      I=SIGMAC
ISN 0219      H1=SIGMAU
ISN 0220      H2=SFTPUT
ISN 0221      J=10560./SIGMAU
ISN 0222      I1=SIGMAO
ISN 0223      I2=SFTPOS
ISN 0224      ISWT = 3
ISN 0225      C      END OF SUBROUTINE.
ISN 0226      C      END OF ROUTINE.
ISN 0227      46      X23 = (H+I+H1*H2*(G-J)+SIGMAF*G+SIGMAD*D12*G+SIGMAE*D12*G-SIGMAA*
ISN 0228      1      G ) / (SIGMAA-H1*H2-I1*I2-SIGMAF-SIGMAD*D12-SIGMAE*D12)
ISN 0229      X123 = G+X23
ISN 0230      IF (SIGMAO.GT. SIGMAU) GO TO 702
ISN 0231      IF ((X123*SIGMAU) .GT. 72300.) GO TO 710
ISN 0232      GO TO 703
ISN 0233      702      IF ((X123*SIGMAO) .GT. 72300.) GO TO 710
ISN 0234      703      IF (ISWT.EQ. 3) GO TO 305
ISN 0235      IF (X123.LE. XF) GO TO 305
ISN 0236      GO TO (300,301), ISWT
ISN 0237      GO TO 71
ISN 0238      300      I1 = SIGMAO
ISN 0239      I2=SFTPOS
ISN 0240      GO TO 304
ISN 0241      301      I1 = SIGMAU
ISN 0242      I2=SFTPUT
ISN 0243      304      X23 = (H+I+H1*H2*(G-J)+SIGMAF*G+SIGMAD*D12*G+SIGMAE*D12*G-SIGMAA*
ISN 0244      1      G ) / (SIGMAA-H1*H2-I1*I2-SIGMAF-SIGMAD*D12-SIGMAE*D12)
ISN 0245      X123 = G+X23
ISN 0246      IF (SIGMAO.GT. SIGMAU) GO TO 704
ISN 0247      IF ((X123*SIGMAU) .GT. 72300.) GO TO 710
ISN 0248      GO TO 305
ISN 0249      704      IF ((X123*SIGMAO) .GT. 72300.) GO TO 710
ISN 0250      305      KEYBDS = X123*(SIGMAD+SIGMAE)/10560.
ISN 0251      GO TO 400
ISN 0252      10      LIMIT = 4
ISN 0253      KEYBDS = X1*(SIGMAL+SIGMAE)/10560.
ISN 0254      X123 = X1
ISN 0255      GO TO 400
ISN 0256      12MAY
ISN 0257

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8MAY

1MAY  
1MAY18MAY  
18MAY  
18MAY  
20MAY  
8MAY 18M

8MAY

1MAY  
1MAY18MAY  
18MAY  
18MAY  
20MAY

12MAY



|          |                                                                      |          |       |
|----------|----------------------------------------------------------------------|----------|-------|
| ISN 0258 | 710 NEG = 0                                                          |          |       |
| ISN 0259 | 400 IF (CPTYPM .EQ. PROCES (1))                                      | GO TO 21 | 12MAY |
| 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 |       |
| ISN 0267 | GO TO 59                                                             |          |       |
| ISN 0268 | 21 II = 1                                                            |          | 7MAY  |
| ISN 0269 | GO TO 24                                                             |          | 7MAY  |
| ISN 0270 | 22 II = 2                                                            |          |       |
| ISN 0271 | GO TO 24                                                             |          |       |
| ISN 0272 | 23 II = 3                                                            |          |       |
| ISN 0273 | GO TO 24                                                             |          |       |
| ISN 0274 | 26 II = 4                                                            |          |       |
| 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                                       |          |       |
| ISN 0313 | 90 WRITE (6, 113)                                                    |          |       |
| ISN 0314 | GO TO 193                                                            |          |       |
| ISN 0315 | 91 WRITE (6, 115)                                                    |          |       |
| ISN 0316 | GO TO 193                                                            |          |       |
| ISN 0317 | 92 WRITE (6, 117)                                                    |          |       |
| ISN 0318 | 193 IF (NEG .EQ. 1) GO TO 93                                         |          |       |
| ISN 0320 | WRITE (6, 751)                                                       |          |       |
| ISN 0321 | NEG = 1                                                              |          |       |
| ISN 0322 | GO TO 43                                                             |          |       |
| ISN 0323 | 93 IF (INGIE-1) 41, 42, 71                                           |          |       |
| ISN 0324 | 41 WRITE (6, 109) X123, KEYEDS, X1                                   |          |       |
| ISN 0325 | GO TO 43                                                             |          |       |

18MAY

18MAY

18MAY

12MAY18

12MAY

12MAY

12MAY



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ISN 0326 42 WRITE (6,109) X123,KEYBDS,X1
ISN 0327 GO TO 64
ISN 0328 43 IF (JJ-9) 64,55,64
ISN 0329 55 WRITE(6,111) (TITLE(IL),PRCNT(IL),IL=1,8)
ISN 0330 64 WRITE (6,199) CNTY(LAND)
ISN 0331 61 WRITE (6,201) (CPT(II,KK),KK=1,2), (SMPLT(JJ,KK),KK=1,5),(A(JAY),
1 B,C,D(JAY),D1,D2,E(JAY),F(JAY), POSCYC(JAY),PUTCYC(JAY),
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)
ISN 0361 101 FORMAT (1H1,29X,'COMPARISON OF COMPOSING PROCESSES: CRT PHOTOCOMPO
1 SITION VS. CONVENTIONAL',/39X,'BASED ON A PURCHASED COMPUTER (EQUA
2 TIONS IIA & IIB)')
ISN 0362 105 FORMAT (1H0/1X,'CONVENTIONAL PROCESS',10X,'SAMPLE',28X,'BREAK EVEN:
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,'')')
ISN 0370 201 FORMAT (1H+,
16///4X,'A',8X,'B',9X,'C',9X,'D',6X,'D1',6X,'D2',6X,'E',7X,'F',4X,'
2 POSCYC',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///)

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18MAY  
7MAY  
7MAY  
7MAY  
1MAY

1MAY 12M

7MAY  
7MAY



ISN 0372  
ISN 0373  
ISN 0374  
ISN 0375  
ISN 0376  
ISN 0377  
ISN 0378  
ISN 0379  
ISN 0380  
ISN 0381  
ISN 0382  
ISN 0383  
ISN 0384

751 FORMAT (1H,65X,'NEGATIVE')  
949 FORMAT (1H0///X,'DATA CARD INVALID')  
950 FORMAT (1H0///X,'X EQUALS ZERO!')  
951 FORMAT (1H0///X,'NO. CARD INVALID')  
952 FORMAT (1H0///X,'SET CARD INVALID')  
953 FORMAT (1H0///X,'TITLE CARD INVALID')  
954 FORMAT (1H0///X,'PERCENTAGES INVALID')  
956 FORMAT (1H0///X,'PROCESSES MIXED')  
957 FORMAT (1H0///X,'TOO MUCH DATA')  
959 FORMAT (1H0///X,'TYPE CODE INVALID')  
970 FORMAT (1H0///X,'SAMPLE CODE INVALID')  
971 FORMAT (1H0///X,'SWITCH-2 ERROR')  
END

12MAY







| ***** F O R T R A N C R O S S R E F E R E N C E L I S T I N G ***** |                            |      |      |      |      |      |      |      |      | PAGE 010 |       |       |       |       |       |       |       |      |      |
|---------------------------------------------------------------------|----------------------------|------|------|------|------|------|------|------|------|----------|-------|-------|-------|-------|-------|-------|-------|------|------|
| SYMBOL                                                              | INTERNAL STATEMENT NUMBERS |      |      |      |      |      |      |      |      |          |       |       |       |       |       |       |       |      |      |
|                                                                     | 0003                       | 0043 | 0044 | 0045 | 0046 | 0047 | 0048 | 0049 | 0050 | 0051     | 0052  | 0053  | 0054  | 0055  | 0056  | 0057  | 0058  | 0059 | 0060 |
| SMPLT                                                               | 0061                       | 0062 | 0063 | 0064 | 0065 | 0066 | 0067 | 0068 | 0069 | 0070     | 0071  | 0072  | 0073  | 0074  | 0075  | 0076  | 0077  | 0078 | 0079 |
| TITLE                                                               | 0080                       | 0081 | 0082 | 0083 | 0084 | 0085 | 0086 | 0087 | 0311 | 0331     |       |       |       |       |       |       |       |      |      |
| ASPD TG                                                             | 0005                       | 0110 | 0329 |      |      |      |      |      |      |          |       |       |       |       |       |       |       |      |      |
| BOTH LF                                                             | 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 | 00277    | 00279 | 00281 | 00283 | 00285 | 00287 | 00289 | 00291 |      |      |
| 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  | 0155  | 0155  | 0155  | 0155  | 0155  | 0155 | 0154 |
| 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 | 0243 | 0243 | 0243     |       |       |       |       |       |       |       |      |      |
| SIGMAB                                                              | 0009                       | 0150 | 0156 | 0176 | 0189 | 0206 | 0215 |      |      |          |       |       |       |       |       |       |       |      |      |



## \*\*\*\*\* FORTRAN CROSS REFERENCE LISTING\*\*\*\*\*

| LABEL | DEFINED | REFERENCES                                        | CROSS REFERENCE LISTING            |
|-------|---------|---------------------------------------------------|------------------------------------|
| 1     | 0168    | 0167 0167                                         |                                    |
| 2     | 0171    | 0167                                              |                                    |
| 3     | 0159    | 0158 0158                                         |                                    |
| 4     | 0120    |                                                   |                                    |
| 7     | 0122    | 0121                                              |                                    |
| 9     | 0131    | 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                                              |                                    |
| 46    | 0223    | 0185 0201 0213                                    |                                    |
| 49    | 0334    | 0125 0136                                         |                                    |
| 50    | 0336    | 0158                                              |                                    |
| 51    | 0338    | 0090                                              |                                    |
| 52    | 0340    | 0092 0094                                         |                                    |
| 53    | 0342    | 0101                                              |                                    |
| 54    | 0344    | 0115                                              |                                    |
| 55    | 0329    | 0118                                              |                                    |
| 56    | 0346    | 0328                                              |                                    |
| 57    | 0348    | 0128                                              |                                    |
| 59    | 0350    | 0130                                              |                                    |
| 60    | 0332    | 0267                                              |                                    |
| 61    | 0331    | 0096                                              |                                    |
| 62    | 0116    | 0103                                              |                                    |
| 63    | 0117    | 0111                                              |                                    |
| 64    | 0330    | 0113                                              |                                    |
| 70    | 0352    | 0327 0328                                         |                                    |
| 71    | 0354    | 0293                                              |                                    |
| 73    | 0137    | 0237 0323                                         |                                    |
| 74    | 0140    | 0132                                              |                                    |
| 75    | 0142    | 0134                                              |                                    |
| 88    | 0355    | 0139                                              |                                    |
|       |         | 0333                                              |                                    |
|       |         | 0335 0337 0339 0341 0343 0345 0347 0349 0351 0353 |                                    |



\*\*\*\*\* F O R T R A N C R O S S R E F E R E N C E L I S T I N G \*\*\*\*\*

| 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    | 0330                          |
| 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 CCMPILATION \*\*\*\*\*



F88-LEVEL LINKAGE EDITOR OPTIONS SPECIFIED MAP,LET,LIST  
 VARIABLE OPTIONS USED - SIZE=(102400,16384)  
 DEFAULT OPTION(S) USED

## MODULE MAP

| CONTROL SECTION |        |        | ENTRY     |          |          |          |          |          |
|-----------------|--------|--------|-----------|----------|----------|----------|----------|----------|
| NAME            | ORIGIN | LENGTH | NAME      | LOCATION | NAME     | LOCATION | NAME     | LOCATION |
| EQ TWO          | 00     | 1C78   |           |          |          |          |          |          |
| IHCECOMH*       | 1C78   | F31    | IBCOM#    | 1C78     | FDIOCS#  | 1D34     | INTSWTCH | 2B96     |
| IHCCOMH2*       | 2BB0   | 581    | SEQDASD   | 2E4C     |          |          |          |          |
| SPDATE *        | 3138   | 346    |           |          |          |          |          |          |
| IHCFCVTH*       | 3480   | 1195   | ADCON#    | 3480     | FCVAOUTP | 352A     | FCVLOUTP | 35BA     |
|                 |        |        | FCVIOU TP | 3AB0     | PCVEOUTP | 3FB2     | FCVCOUTP | 41CC     |
| IHCEFNTH*       | 4618   | 512    | ARITH#    | 4618     | ADJSWTCH | 4984     |          | 370A     |
| IHCEFIOS*       | 4B30   | 129C   | FIOCS#    | 4B30     | FIOCSBEP | 4B36     | INT6SWCH | 44B3     |
| IHCUIOPT *      | 5ED0   | 328    |           |          |          |          |          |          |
| IHCERRM *       | 60F8   | 5BC    | ERRMON    | 60F8     | IHCERRE  | 6110     |          |          |
| IHCUTATBL*      | 66B8   | 638    |           |          |          |          |          |          |
| IHCETRCH*       | 6CF0   | 28E    | IHCTRCH   | 6CF0     | ERRTRA   | 6CF8     |          |          |

ENTRY ADDRESS 00  
 TOTAL LENGTH 6F80

\*\*\*\*\*MAIN DOES NOT EXIST BUT HAS BEEN ADDED TO DATA SET



```

IEF2851 SYS1.FORTLIB
IEF2851 VOL SER NOS= CPERES.
IEF2851 SYS1.LINKLIB
IEF2851 VOL SER NOS= CPELNK.
IEF2851 SYS70195.T162525.SF000.WNMEQII.R0000082
IEF2851 VOL SER NOS= CPE335.
IEF2851 SYS70195.T162525.RF000.WNMEQII.S0000083
IEF2851 VOL SER NOS= CPE232.
IEF2851 SYS70195.T162525.RF000.WNMEQII.S0000083
IEF2851 VOL SER NOS= CPE232.
IEF2851 SYS70195.T162525.RF000.WNMEQII.G0SET
IEF2851 VOL SER NOS= CPE330.
IEF2851 SYS70195.T162525.RF000.WNMEQII.SYSUT1
IEF2851 VOL SER NOS= CPE232.
*****
OS/360 RELEASE NO. 18 CURRENT DAY=195 TIME=17:22 JOB WNMEQII STEP LKED RUN TIME=000038.70 SEC. CUMUL.JOB=000038.70 SEC. **
CPU TIME=000003.62 SEC. WAIT TIME=000026.59 SEC. IDLE TIME=000008.49 SEC. I/O ACTIVITY= 772**EBSA COMPUTER CENTER **
*****
XXGO EXEC PGM=*,LKED.SYSLMOD,COND=(4,LT,LKED)
XXFT05F001 DD DDNAME=SYSIN
//GO.FT06F001 DD SYSOUT=Z
X/FT06F001 DD SYSOUT=A
XXFT07F001 DD SYSOUT=B
//GO.SYSIN DD *
//
IEF2361 ALLOC. FOR WNMEQII GO STEP1
IEF2371 330 ALLOCATED TO PGM=*.DD
IEF2371 332 ALLOCATED TO FT05F001.
IEF2371 235 ALLOCATED TO FT06F001
IEF2371 335 ALLOCATED TO FT07F001
IEF2851 SYS70195.T162525.RF000.WNMEQII.G0SET
IEF2851 VOL SER NOS= CPE330.
IEF2851 SYS70195.T162525.RF000.WNMEQII.S0000086
IEF2851 VOL SER NOS= CPE232.
IEF2851 SYS70195.T162525.RF000.WNMEQII.S0000086
IEF2851 VOL SER NOS= CPE232.
IEF2851 SYS70195.T162525.SF000.WNMEQII.R0000084
IEF2851 VOL SER NOS= CPE235.
IEF2851 SYS70195.T162525.SF000.WNMEQII.R0000085
IEF2851 VOL SER NOS= CPE335.
*****
OS/360 RELEASE NO. 18 CURRENT DAY=195 TIME=17:28 JOB WNMEQII STEP GO RUN TIME=000385.23 SEC. CUMUL.JOB=000428.03 SEC. **
CPU TIME=000079.00 SEC. WAIT TIME=000272.76 SEC. IDLE TIME=000033.47 SEC. I/O ACTIVITY= 9,422**EBSA COMPUTER CENTER **
*****
IEF2851 SYS70195.T162525.RF000.WNMEQII.G0SET
IEF2851 VOL SER NOS= CPE330.

```

64000014

72000014

80000014

88000014



# 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. Feavvour.    |
| Computer Typesetting Research Project—University of<br>Newcastle-upon-Tyne. | Mr. C. J. Duncan.      |
| Sun Printers Ltd.....                                                       | Dr. Lindsey Molyneux.  |
| Petty and Sons Ltd.....                                                     | Mr. F. E. J. Rothwell. |
|                                                                             | Mr. H. Tolson.         |

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