January 27, 1966

MR. DONALD R. WIDRIG, JR.
Project MAC
Room 509
545 Technology Square
Cambridge, Massachusetts

Dear Mr. Widrig:

Attached is a copy of the "Progress Report, Computer Cost
Distribution Task Force", dated August 1, 1965, which
you requested for use in connection with your work on
multics. While this memorandum is not company private,
it does contain proprietary information. Therefore, I
request that you do not refer to it directly outside of
its use for Bell Telephone Laboratories.

Sincerely,

C. H. Hamann

C. H. HAMANN

MH-13-CHH-gam

Enclosure

SUBJECT: Progress Report, Computer Cost
Distribution Task Force (Replacing
Report Dated June 28, 1965)

DATE: August 1, 1965

FROM: C. H. Hamann

MEMORANDUM FOR FILE

The following is a progress report by the Computer Cost
Distribution Task Force hereinafter called the committee.
This report covers accounting philosophy and distribution
proposals agreed upon by the committee and are presented
here for consideration by the Computer Committee and the
Comptroller.

The proposals presented attempt to be consistent with cur-
rent Laboratories' accounting philosophy; namely that the
primary purpose of the computer pricing structure is the
equitable liquidation of incurred cost over units serviced.
In this connection no attempt was made to broaden the
objective of the pricing structure to make it serve as
an administrative aid.

A cost distribution system based on the above would require
that:

1. units of service be measurable and related to the
   "pools of cost" they are intended to liquidate;

2. units of service can be estimated with some degree
   of accuracy; and

3. pools of cost be significant amounts.

Objectives to strive for in billing for use under this sys-
tem would be to:

1. make charges meaningful to users in printed form;

2. make charges relatively simple to compute (in this
   regard it is assumed that the computer time required
   to prepare the charging data will be insignificant
   compared to the time required to perform the task
   for which the charge is being made); and

3. make charges consistent (identical, if possible)
   for all similar installations.

In addition to normal billing information, statistics related to machine usage or operations could be supplied to individual programmers as a means of calling attention to potential improvements in programming techniques. Eventually desirable techniques suggested from a study of this data could be included in a set of programming standards or "newsletters". Initially, it is expected that the Software Committee, because of a more intimate knowledge of the system, would decide upon the kind of statistics to be generated.

The matter of total company versus location rates for the liquidation of computer expense was reviewed. The committee agreed that the current practice of using "universal" rates should be continued since these rates:

1. permit *But do not require* the transfer of computer work between centers to "even out" work loads without cost penalty or gain thereby providing comparable service for comparable cost;

2. eliminate the possibility of "shopping" by user organizations which would cause uncontrolled shifting of computer work between centers resulting in more exaggerated location rates;

3. tend to be more accurate as variations between estimates and actual costs by segments are less significant in a larger universe;

4. facilitate estimating and auditing as there is no need to determine at which center computer services will be rendered;

5. facilitate charging programs processed at one location with the cost of data stored at another location's computation center; and

6. conform to the normal Laboratories practice of assessing the cost of similar services rendered by one Vice Presidential Area at an average rate for that service.

The feasibility of shift (non-prime time) and preference (or priority) rates was explored. The use of these rates as administrative tools was recognized. However, it was felt that the Laboratories' cost liquidation philosophy of comparable cost for comparable service would be aborted if we were not consistent in this area. As an analogy, at present,

neither time nor preferential treatment for engineering, shop or drafting effort is priced out separately. The fact that work on one project has been postponed in favor of work on another is an administrative decision based upon the relative merits of the two projects rather than their ability to absorb loaded salary charges. Additionally, no work is penalized because of overtime. All work shares in the cost of overtime (premium) differential as part of the loading applied to direct salary dollars. Thus, no change is made in pricing out engineering, shop or drafting effort on the basis of priority or shift worked. Also, the committee felt that the use of preferential and/or shift rates would have a minimal effect as an administrative aid or tool. The use of special rates to accomplish administrative objectives is not only indirect in its application but could be self defeating in case and budget dollar requests for subsequent years and could have other more subtle side effects. Therefore, it was the feeling of the committee that administrative control ought to be divorced from pricing and be on a more direct before-the-fact basis. For the enumerated reasons, the committee recommends that neither shift nor priority computer rates be established.

For the orderly and equitable liquidation of computer systems expense the committee recommends that three central equipment "pools of cost" be established and that they be as follows:

1. Computing
2. Input/Output Devices
3. Secondary (User Oriented) Storage

It was agreed that the pools of cost be liquidated by measuring usage as follows:

Pool of Cost	Liquidated Over
Computing	CPU Cycle Time (user programs)
Input/Output	Weighted Device Time (user programs)
Secondary Storage	Block-Months Stored (user oriented)

In arriving at the decision to charge out "Computing" on the basis of CPU cycle time, the alternative of charging on the basis of CPU cycle time and the amount of core used was explored. This latter approach was discarded after it was determined that the amount of core alloted to a particular

job could vary depending upon the amount of "memory" that was available when processing took place. A whole series of problems develop from a time-sharing environment over which the user has little or no control. Thus, the same job run at two different times could use different amounts of core memory.

The committee recognized that machine configurations may vary somewhat between locations. However, it is recommended that no attempt be made to price one center separately because of such variations as this would open "Pandora's Box". The variations between computer systems of the same type are usually minor and are based upon local management decisions as to machine configurations required to provide the best service at the least overall cost to the Laboratories. Each center is expected to follow this policy. However, this local autonomy is not carried over to pricing practices since these minor variations do not negate the overall similarities between these machine configurations which permit a total company rate.

The committee briefly discussed the accounting implications which arise from the interim use of a G.E. 635 computer at Whippany while other New Jersey locations will initially receive G.E. 645's. It was agreed that the pricing of the 635 and 645's should be consistent as the differences (mainly the means of allocating storage) were not great enough to warrant any special accounting treatment.

The committee also gave consideration to the matter of whether the Indian Hill Computation Center services should be priced out to users at a total company rate. In this regard the IBM 360 Mod 67 and the G.E. 645 computers are alike in that they are both multiprogramming, multiprocessing, and time-sharing systems with comparable speeds of operation at comparable costs. In addition, services to be furnished by the Indian Hill Computation Center will be similar to those furnished by the other Computation Centers. Therefore, based on accepted accounting practice i.e., the same price for the same kind of service, it is recommended that the IBM 360 Mod 67 be pooled with the G.E. 645 computers for cost liquidation purposes.

In determining the base to be used for the liquidation of the cost of I/O devices and associated control units, it was agreed that there was some degree of comparability between the various devices but that they were varied enough in terms of use to warrant a weighted base rather than a straight clock time base. Accordingly, the committee agreed upon a

weighted base predicated upon the potential full utilization
of each device during a month. The weights so determined
would be applied to estimated device utilization to deter-
mine the weighted base and average device rate. Actual
clocked device time would be weighted by this same factor
before being priced at the prevailing rate to determine the
time charges to using organizations (and cases).

For the liquidation of the I/O cost pool, the total time a
device is assigned should be rated and priced out to the
user. Such a practice will insure the pricing of all "used"
time whether the system allocated time on the device or
whether the user's program dictated the use of the device.
In the latter instance, the user pays for tieing up the de-
vice even though it may be unproductive for a part of the
time.

The committee agreed that user oriented secondary storage be
liquidated over a "block-month" base and that it be measured
in terms of the number of blocks required to store data on
the disc unit and/or data cell. The problem in this area is
not one of measurement but one of frequency of computing
charges for use of data storage facilities. It was agreed
that pricing would be accomplished monthly from the date of
origination for new files and from the first of the month for
those files on hand at the beginning of the month on which
there has been no change in the amount of file space utilized.
All other files would be priced proportionately each time a
change in storage size was made.

The attached Schedule A incorporates the conclusions of the
committee with respect to pooling of costs and the calcula-
tion of rates for the liquidation of these costs. It should
be recognized that costs and their assumed proration between
the various pools are estimates and may vary when measured
against the actual installations and the actual use to which
equipment is placed.

The attached Schedule B indicates the recommended accounting
treatment associated with the initial cost allocation for the
center equipment and associated facilities.

The Nike Computing Department is expected to partition off
one of the Whippany Computation Center's G.E. 635 computers
during specified times of the day and operate it with their
own personnel. This is a management decision based in part
upon cost and security considerations. When not required by
the Nike organization, it is anticipated that the computer
would be "returned" to the Whippany Computation Center for

their use.   The allocation of cost between the two organizations may be a problem.   Due to the lack of complete information at this time no charging recommendation is offered.   This matter is included for the purpose of documenting the problem .

C. H. HAMANN
For Computer Cost Distribution
Task Force

NY-8713-CHH-ER

(Dual Processors)

Portion (10%)   300
Cost Time   30
                       10   40

                       260
ive Hours per Month   x 3
ive Hours per Year (x 12)   780
                           9360

ed Clock Time(1) of Devices

	Reader	Printer	Microfilm Plotter	Mag. Tape
	$\dfrac{\$650.00}{200 \text{ hrs.}} = \$3.25$	$\dfrac{\$1400.00}{200 \text{ hrs.}} = \$7.00$	$\dfrac{\$7,500}{200 \text{ hrs.}} = \$37.50$	$\dfrac{\$922.50}{200 \text{ hrs.}} = \$4.61$
	46%	100%	535%	66%

4.75

	Hours Per Month	Est. Clocked Hours	Factor	Weighted Est. Hours
k	400	260	.59	153
pe	200	40	.68	27
	600	300	.46	138
	400	280	.59	165
	800	720	1.00	720
Tape (2)(3)	1200	550	.66	362
m Plotter	600	100	5.35	535
location				2,100
l locations (x 4)				8,400
)				100,800

expected usage (Printer).

Charging Bases

Secondary Storage

Block Months - Measured on Estimated
Disc and Data Cell Capacities

	Disc Unit	Data Cell	Total
6 Bit Characters of Storage Capacity	23.6×10^6	418.0×10^6	
Number of Units	$\times 2$	$\times 2$	
Total Storage	47.2×10^6	836.0×10^6	
Allocable to Secondary Storage	80%	80%	
Potential Secondary Storage Capacity	37.8×10^6	668.8×10^6	
Percent of Utilization	75%	50%	
Secondary Storage Utilization (6 bit characters)	28.3×10^6	334.4×10^6	362.7×10^6
Computer Words (6 character)			60.5×10^6
Blocks (1024 Words) per Month			59.1×10^3
Locations			$\times 4$
Monthly			236.4×10^3
Annual Equivalent (x12)			2.8×10^6

Initial Cost Allocation of the
Time Sharing Computer Systems and Associated Facilities

	Overhead of Using Org'n.	Overhead of Compution Centers	Case and Department	Rate as Separate System	Telephone (Instruments)
Central Equipment (Computing, Input-Output, Secondary Storage)					
Typewriters and Lines	X	X			X(See Note 1)
Typewriter Switching					
a) Centrex		X			X
b) Data Switching (See Note 2)	X	X			
Data Transmission Lines and Associated Terminal Equipment					
a) Between Main Locations (Incl. Indian Hill)		X			
b) Branch Locations (See Note 3)		X			
General Computer Center Costs (Salaries, Rent, etc. Excluding Machine Rentals		X			
Systems Programming Effort and Counseling Services		X			
Independent Computers					
a) One Case &/or Dept. Using			X		
b) Many Cases &/or Depts. Using				X	
General Use Peripheral Equipment					
a) In Centers		X			
b) In Using Organization	X				

Notes:

1. When normal telephone circuits are used for data transmission the cost of transmission lines and associated telephone instruments should become part of the Communication Service Organization expense and distributed on the basis of telephone instruments.

2. $\dfrac{\text{Total Cost of Switching Unit}}{\text{Potential No. of Users}}$ = Unit Cost; Unrecovered cost will become part of the Computation Center overhead.

3. Terminal equipment to be used would require the approval of the Computer Committee but in no instant should it exceed the cost of a GE 115 computer or equivalent.