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AFSA-351D/27

TRIP REPORT -- Visit to Poughkeepsie to Inspect TPM

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AFSA-351D

26 December 1951
Mr. Samuel S. Snyder
Mr. Leo W. Lathroum
Mr. Douglas L. Hogan

1. INTRODUCTION. On 19 December 1951, the undersigned visited the Computer Laboratories of IBM at Poughkeepsie, N. Y., to inspect the IBM Tape Processing Machine. Also present for AFSA was Mr. Joseph Hyduke of AFSA-221, and, for A3A, Mr. Nathan Disenhaus and Lt. Van Liew. Purpose of our visit was to acquire enough additional technical information about TPM so that AFSA-351 can complete its evaluation, in accordance with the recommendation made at the meeting called by Mr. Friedman on 18 October. Dr. Werner Buchholtz devoted most of the day to an excellent exposition, and was generally most cooperative. Mr. Robert W. Murphy was present, and Messrs. C. J. Bashe and R. P. Crago, IBM engineers, assisted in demonstrating the equipment. Mr. James Greene of IBM'S engineering staff in New York, made arrangements and departed for New York City after we were settled for the technical discussions. Information was obtained at the visit as to logical design, nature of overall operation, description of each machine order, operation of electrostatic storage, tentative plans for use of magnetic tapes, and basic times of execution. The status of construction was observed, and size of each component was estimated. It was not possible, however, to obtain copies of instruction manuals (three volumes are in use, but could not be released to us to take out), official promises of delivery time, rental cost, or copies of representative completed programs. However, a complete order code (inclosure) is available from notes taken during the visit, together with explanatory material about overall functioning. This material is on file in AFSA-351D and will be available to interested personnel.

2. PHYSICAL DESCRIPTION.

a. Size. The TPM at present is in prototype form, and is not complete enough for testing of all the components. However, it will consist of certain pieces of equipment which will be physically the same types of units that were observed in various stages of construction. These units were noted, together with estimates of their dimensions. The following listing of these units represents only actual floor space of the equipment and does not make allowance for suitable operating, storage, and maintenance room normally required for this type of equipment:

EXTRA

Declassified and approved for release by NSA on 01-27-2014 pursuant to E.O. 13526

	Approx. Dimensions, (Feet)	Approx. Area, (Sq. Ft.)
Central Computer	8 x 2	16
Electrostatic Storage (3 cab., total 10,000 characters)	5 x 2	10
Power Supply	6 x 2	12
Magnetic Drum (10,000 characters) (2 drum units, each 5,000 characters)	(2)- 5 x 3	30
Magnetic Tape Drives (4)	(4)- 3 x 2	24
407-type tabulator	5 x 3	15
519-type reproducer	5 x 2	10
TOTAL FLOOR AREA, EQUIPMENT ONLY.....		117 sq. ft.

An estimate was obtained from one of the IBM people that a space of about 25' x 30' = 750 sq. ft. would be required as a minimum operating area. For purposes of comparison, it may be worth noting that ABNER actual floor area of equipment, including input-output punch-card equipment, punched paper tape equipment, 6 magnetic tape drives, two typewriters, and complete conversion unit, totals 150 square feet, and estimated total operating area assigned to ABNER is 18' x 50' = 900 sq. ft. ATLAS I equipment area is about 92 sq. ft., with approximately 900 square feet assigned to actual operation.

b. General Appearance and Status of Construction.

(1) The central computer which contains the control and arithmetic circuits is largely comprised of chassis of the type used in the IBM 604 Calculator. These chassis contain one tube and its associated components all mounted on a miniature tube base. Some of the control circuit chassis are of similar construction elongated and containing half a dozen tubes. In front of the central computer is an indicator and control panel, together with a keyboard for typing in instructions. The wiring of the central computer is similar to that seen in the 604. The central computer contains about 2000 vacuum tubes and 2800 crystal diodes. The central computer is apparently nearly completed with the exception of covers.

(2) The electrostatic storage is contained in a separate unit. One rack contains the main deflection and counting circuits and four other racks will contain the 10,000 7-bit characters of storage with 100 characters (700 bits) stored on a 3KP1 cathode ray tube. The 100-character "accumulator" is contained in an additional one of these tubes. This accumulator performs no arithmetic functions but merely stores sums, partial products, and dividends. On the same rack with the accumulator are 12 chassis, each containing two storage tubes together with reading and writing amplifier circuits. Construction of a prototype set of deflection amplifiers is complete.

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(3) The magnetic drum unit is still under construction. The drum contains fifty tracks, each 700 bits (100 characters) long. The linear packing is 50 to the inch and the peripheral rate is 50 kc. The surface of the drum appears to be CUNIFE wire which has been machined to a cylindrical surface. The drum is about 4½" in diameter and 7½" long. Very little of the reading and writing circuits and not all of the heads appear to have been built.

(4) They have had two magnetic tape units in operation. The tape is ½" wide and uses 7 levels with linear spacing of 100 characters per inch. The present tape speed is 30 inches/sec. but plans are to have four or more tape units containing 12" reels (3000 feet of tape) and running at 75 inches/sec. With regard to the question of tape flaws, two views, both rather vague, were stated by different people. One stated that unflawed tape (source unspecified) would be used. The other stated that the tape might be spliced and the splice could be ignored. Some tape experimentation appeared to be taking place.

(5) A modified 519 reproducer is being constructed to serve as an input and output unit. This will not necessarily be the final design for this purpose. A 407 tabulator is being modified for use as an output printer. Both of these equipments will operate in conjunction with revolver storage on the drum to resolve the asynchrony. Neither appear to be very far along. As an interim device an electric typewriter is being used as an output printer.

(6) Commercial power supply units are being used with an IBM-built distributor panel. The room air is air-conditioned and the units of the TPM have individual blower systems to utilize the room air for cooling.

(7) When pressed for an answer as to when production of the TPM might be expected, none of the engineers wanted to give an answer. A figure that the time was of at least the order of magnitude of two years, was volunteered by Mr. Crago. To the engineers the present equipment is not even a production prototype but strictly a development project at this time.

3. EVALUATION FOR AGENCY USE.

a. Speed. General purpose computers (of which TPM is an example) usually are not directly adaptable to the type problems that exist in quantity at this Agency. However, the speed of these machines and

their flexible commands have in several cases made it possible for them to solve many problems of our type in a reasonable time. As more specialized orders are added to some of these machines their usefulness has increased. The TPM lacks not only the speed but in many cases the flexibility of its order code that are necessary to make it a suitable device for this Agency's work. For example, the simple addition of one three-digit number to another will take over a millisecond; other operations are also comparably slow. As the number of digits increase, so does the time for the operation (the increase is at the rate of 128 microseconds per digit). Due to the nature of the machine, this time is fixed and can not be improved, as would be the case with most machines with drum or other circulating memory. All computers connected with the Agency at this time can operate faster than TPM. The TPM is compared with these other computers since in complexity and physical size it falls in their class.

b. Programming. Programming for the TPM is like programming for any computer. Although programming for minimum access time is not necessary, or indeed possible, other machine characteristics add to the complexity of programming. For example, the varying length of a unit of information (a good feature from the point of view of flexibility) makes programming much more difficult than handling a standard word length. The order code, which lacks much to make it desirable, will make the programming of relatively simple tasks, such as alphabetic frequency distributions, false addition or false subtraction, much more difficult than in the Agency's existing and contemplated digital machines.

c. Input-Output. The use of the unput and output equipment, particularly tape, is not as flexible as one would desire (or expect) in a machine designed to process tape. For example, the requirement to rewind a tape to change the function from read to write (and write to read) is very restricting.

4. CONCLUDING REMARKS.

a. It is recommended that the Agency reject the proposal to rent one or more models of the Tape Processing Machine, for the following reasons:

(1) The TPM is not small in size, will not be soon available, is not easy to program, and in general is not suited to Agency use.

(2) Based upon experience in programming for several different computers, and acquaintance with many types of machines in different parts of this country and England, it is safe to say that TPM would show up unfavorably, in comparison with equipment of comparable size and complexity, for solution of most Agency jobs that have been considered for general-purpose computers.

(3) The Agency already has in operation one of the most reliable electronic computers (ATLAS I), has completed and almost put into operation a second machine with many specialized cryptanalytic features (ABNER), and is committed to ATLAS II and NOMAD, which represent definite forward steps in carrying out a far-reaching develop-

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ment program on analytic equipment. Furthermore, construction of an additional model of both ATLAS I and ABNER has been recommended by the Cryptanalytic Aids Panel. Operation of such an impressive computer installation represents a tremendous investment both financially and in training of technical personnel. To consider addition of still more computer equipment which in itself represents a backward step technically and which has not been completed even in prototype form, would be unwise, regardless of whether the acquisition is by purchase or by rental from a commercial concern.

b. It is suggested that any eventual reconsideration of the question of obtaining the TPM satisfy the following requirements:

(1) That programs for typical Agency problems be written and time estimates calculated, and compared with programs for other equipment, so as to demonstrate any cases where it would be to the Agency's benefit to have the TPM;

(2) It is understood that many characteristics of the TPM prototype are subject to radical changes; therefore the Agency would be wise to wait until the features have been finally determined and a production model observed in operation, before attempting a complete evaluation.

c. It is considered that from the point of view of the IBM Corporation, we would be rendering IBM a disservice to indicate too great an interest in TPM. Requests for IBM to expedite production at this time, before Agency opinion on the machine has had time to be made firm, would place an obligation on the Agency to follow through with some measure of support. Should the unfavorable recommendation expressed above become Agency policy, we might have caused IBM to make uneconomical deviations in their own production schedule to respond to such an unwarranted enthusiasm.

Inclosure:
TPM List Of Instructions

SAMUEL S. SNYDER, 351-D

DOUGLAS L. HOGAN, 351-B

LEO W. LATHROUM, 351-D

Copies Furnished:
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TPM -- LIST OF INSTRUCTIONS

Reset Add
Reset Subtract
Add
Subtract
Reset-Add-Reset
Add to Memory
Store
Store--Alter Field Marks
Store--No Field Marks
Store--Between Field Marks
Store--Positive Sign
Store--Negative Sign
Lengthen
Shorten
Set Field Marks
Round
Transfer
Transfer on Positive Sign
Compare
No Operation
Stop
Multiply
Divide
Blank
Insert Decimal Point
Asterisk
Select Tape
Write
Read
Rewind
Transfer Except End of File
Drum