Digital Computer Laboratory
Massachusetts Institute of Technology
Cambridge 39, Massachusetts

SUBJECT: BI-WEEKLY REPORT, January 18, 1952

To: Jay W. Forrester

From: Laboratory Staff

1.0 SYSTEM OPERATION

1.1 Whirlwind I System

(H. F. Mercer)

Operation

The following is an estimate by the computer operators of the usable percentage of assigned operation time and the errors due to the computer. This covers the period 4 January through 18 January:

Number of assigned hours	70
Number of transient errors	21
Number of steady state errors	7
Number of intermittent errors	9
Percentage of assigned time usable	92
Percentage of assigned time usable since 14 March 1951	86

This section of the bi-weekly was suspended between September 17, 1951 and December 31, 1951 because of Bank B installation. The assigned applications time during that period was 227.5 hours; the percentage of assigned time usable was 91. This percentage is included in the figure of Percentage of assigned time usable since 14 March 1951.

1.1 Whirlwind I System (continued)

(S. H. Dodd)

During the past two weeks, Bank B has been improved in reliability. Bank A deteriorated substantially during the period when Bank B was being installed and tested. However, its reliability has been partially restored toward its former condition.

Addition of the Parity Check System for electrostatic storage is expected to aid materially in trouble shooting storage faults. This Parity System is now operating except for a few minor difficulties which will be cleared up in the next few days. Re-write times for Bank B storage have been changed with an accompanying increase in reliability, and more test work is planned in the future to optimize re-write time in both banks. For several weeks it has been noted that there is a difference in operating margins of the Bank B storage tubes when tested with a test tape and when tested with L-2 (a test program operating from test storage). This difference has been traced to the fact that the tape alternates Spot Interaction and Alternating Array tests during the course of measurement of one margin, while L-2 operates one mode at a time. The reason why storage tubes give different margins under these circumstances has not as yet been determined.

Several troublesome intermittents have been bothering us during the past few weeks. One of these was traced down to a loose pin in the socket of a 7AD7 Buffer Cathode. Another intermittent in the R-F Pulser, which caused blowing of the 500 volt fuse, has also been corrected. New consideration is being given to the possibility of panel vibration for detecting incipient intermittents.

The new 11-digit Plug-in Decoders have been completed and installed in Whirlwind, and are being checked out and tested. As soon as their operating characteristics have been proven, these decoders will be used in place of the old decoders. This changeover will probably occur during the next week.

(N. L. Daggett)

A reduction in the time spent on maintenance of ES has made it possible to accomplish work on the system which had been held up because of higher priority work. Considerable work on ES control is being done by Ziegler.

1.1 Whirlwind I System (continued)

(N. L. Daggett) (continued)

Daily marginal checking is being extended to a number of lines in ES control which were not previously covered.

The scale factor (sf) order has been modified slightly to place the contents of the step counter (i.e., the number of shifts) in the "A" register as well as in the storage register indicated by the address section of the order.

(H. L. Ziegler)

The ES Parity Check has been put into operation and promises to aid materially in detecting faults not being picked up by our present test methods. Timing and mechanics of operation for this check have been worked out satisfactorily and the necessary circuit changes should be completed within the next few days.

Study of ES Control has continued and it now seems possible to eliminate four microseconds from each ES Read operation. An additional microsecond can be eliminated from each ES Write without shortening the actual writing time. These changes will be made on a trial basis in the near future.

Since the preceding bi-weekly report two tubes in Bank B and one tube in Bank A have been replaced. Also, a new tube was placed in service in digit 16B, the Parity Check digit. This brings the WWI ES tube complement up to its planned thirty-four tubes.

(L. O. Leighton)

Component Failures in WWI

The following failures of electrical components have been reported since January 4, 1952:

Component	No. of Failures	Hours of Operation	Reason for Failure
Capacitor			
.001 mfd Mica	1	1210	Mechanical

1.1 Whirlwind I System (continued)

(L. O. Leighton)

Component	No. of Failures	Hours of Operation	Reason for Failure
Tubes			
7AD7	2	8831	1-Mechanical 1-Low I_b
717B	3	1330	Change in characteristics
6SN7	1	3000-4000	Low I_b
	2	6000-7000	1-Low I_b 1-Interface
	2	9000-10000	1-Low I_b 1-Change in characteristics
3E29	1	5256	Change in characteristics
2C51	1	8650	Open

(H. F. Mercer)

Storage Tube Failures in WWI

The following storage tube failures were reported during this bi-weekly period:

RT-235 was rejected after 926 hours of operation because of non-uniform storage.

RT-239 was initially rejected after 942 hours of operation because it would not maintain satisfactory margins. The tube was re-installed on the same day but was again rejected two days later for the same reason; total hours of operation 974.

ST-340 was rejected after 1050 hours of operation because satisfactory margins could not be maintained.

1.1 Whirlwind I System (continued)

(H. F. Mercer)

Storage Tube Complement in WWI

The following is the storage tube complement of both Bank A and Bank B as of this date. One column gives ES clock hours at the time of installation for each tube and another column gives the total hours of operation in the computer for each tube through January 18th.

WWI COMPUTER SCHEDULE

	Bank A			Bank B		
Digit	Tube	Hrs. at Install.	Hrs. of Operation	Tube	Hrs. at Install.	Hrs. of Operation
0	ST337	4049	1769	RT233	4722	1096
1	ST325	2810	3008	RT280	5701	117
2	ST346	4669	1149	RT247	5198	620
3	ST341	5046	772	RT234	4705	1113
4	ST353	4793	1025	RT278	5638	180
5	ST344	5044	774	RT237	4714	1104
6	ST328	2636	3182	RT231	4687	1131
7	ST320-R1	4215	1603	RT241	4737	1081
8	RT287	5703	115	RT243	4726	1092
9	ST305-2	2004	3814	RT244	4726	1092
10	ST329	3094	2724	RT246	4773	1045
11	ST351	5067	751	RT248	4861	957
12	ST350	5134	684	RT258	5207	611
13	ST354	4717	1101	RT282	5417	401
14	ST357	5118	700	RT230-R2	4726	1092
15	ST358	5145	673	RT255	5150	668
16	ST359	5279	539	RT259	5783	35

E.S. Clock hours this date 5818.

1.2 Five-Digit Multiplier

(C. N. Paskauskas)

The multiplier has been running satisfactorily since January 7. During the period of this report the following were replaced as a result of marginal checking:

2 7AD7 Flip-Flop tubes - 20,990.3 hrs in service
2 7AD7 Buffer amplifiers - 21,807.5 hrs in service
1 6AS6 Gate tube - 15,599.3 hrs in service

2.0 CIRCUITS AND COMPONENTS

2.2 Vacuum Tubes and Crystals

2.21 Vacuum Tubes

(H. B. Frost)

A lot of 50 tubes, type 25L6GT, have been received and tested. These tubes are being sent in a "round robin" by the ASTM in a study of different methods of measurement of interface resistance. Tests are being made by the General Electric Company, and Evans Signal Laboratory as well as this laboratory.

(H. B. Frost, L. Sutro)

Improvements were made to the two large tube testers in the tube test shop. Each of the tube testers has a power supply variable from 0 to 300 volts used as a plate voltage source. These supplies had shown a regulation from 0 to 200 ma load of more than 3 volts when set for 40 volts output. Installation of one more stage in the feedback loop reduced regulation under load to less than 1/2 volt.

Further refinements have been made in the tube tapper control circuits. The tube tapper no longer "balks" due to the failure of its control thyratrons to extinguish.

2.22 Transistors

(N. T. Jones, J. F. Jacobs)

Engineering Note E-441, "Standardized Transistor Parameter Measurements," has been completed and published. The parameter values have been taken for all transistors using the standard tests. These values have been tabulated and summarized. Disregarding the reverse emitter resistance, variation of parameters between units from either Raytheon or GE are in the order of $\pm$ 20% of the average values.

The record system for transistor characteristics and life histories has been put into operation.

Investigations under way at the present time are:

1. Changes of r_b with I_c and I_e.
2. Alpha versus frequency and alpha cutoff.
3. Negative resistance "N" characteristic circuits.

2.23 Crystal Diodes

(H. B. Frost)

A new and simple dynamic test of the back resistance of crystal diodes has been devised. The test compares the back resistance of a crystal diode immediately after some forward current is drawn with the back resistance under conditions where no forward current is drawn. The data allow the relative importance of holes in the forward current to be found easily. The test method is suitable for routine inspection tests. A short writeup is planned.

2.3 Ferroelectric and Ferromagnetic Cores

(B. Widrowitz)

16 x 16 Metallic Array

New 1N38's were placed in the X crystal matrix to improve the reliability of the X flip-flops.

Some logical equipment was added to the test setup in order that the information which is written into a given core be that read out of the previous core. The net effect is a moving pattern that can be continuously recirculated in the array. This has been done for hours without error.

The array was run at a 40 kc rate, holding a fixed pattern for several hours. It was also possible to have a moving pattern with a PRF of 30 kc. At these frequencies, it was possible to hold patterns while the system was subjected to $\pm$ 5% variations in driver currents. The selection current ratio was 2 to 1.

A skip circuit was included in the address flip-flop triggering circuit. It is now possible to leave a ONE or a ZERO in a given core and recycle the array without rewriting the information in the given core. ZERO's and ONE's have been held for hours with a 2:1 operation at 4 kc.

(K. Olsen, E.A. Guditz)

Ceramic Array and Switch

The possibility of using coil-winding machines in the construction of switch cores has been considered. At this time, the disadvantages of larger cores outweighs the advantages of easier winding. It takes several watts to switch a core and this increases directly with the size of a core.

2.3 Ferroelectric and Ferromagnetic Cores (continued)

(K. Olsen, E.A. Guditz) (continued)

A partial solution to the winding problem is to lessen the number of windings necessary. A scheme is being considered which drives the switch with the selecting winding and thus eliminates the need for the two windings which are now used for driving. This is done at the expense of slightly more complex electronics. It is necessary to have drivers which can be gated off and on by flip-flops. A bread board of a driver that gates half ampere gates with a rise time of about 0.1 μsec. is now being studied.

(D. R. Brown)

New Materials, Testing, and Measurement

The development of ferrite cores suitable for use in a high-speed memory and other computer circuits was discussed with the Vice President and research staff of General Ceramics and Steatite Corporation. Considerable progress has been made in the development of "square-loop" ferrites for use in the memory. The company is interested in the computer field as a potential market for ferrites, and is willing to develop materials for our application. We will set up equipment for making pulse tests on new materials at their laboratory early in February.

A B-H loop tracer is being set up at the Whittemore Building to permit more quantitative measurements.

(D. A. Buck)

Ferroelectrics

Samples of barium titanate obtained from General Ceramics and Steatite are being investigated on the single-condenser checker. These condensers as well as others previously obtained from Glenco show improved signal ratios when cooled below the -5°C transition temperature. No information storage was observed below the -95°C transition temperature. Switching is faster than anticipated; one small condenser switches in 0.4 μsec.

W.W. Coffeen of Metal and Thermit Corporation visited the Laboratory on January 17, 1952 to discuss the properties of ferrous stannate and barium titanate.

Sources of pure ferric oxide for use in firing electrical ceramics are being sought.

2.3 Ferroelectric and Ferromagnetic Cores (continued)

(R. D. Robinson)

Pulse Transformers

A sample pulse transformer was made from a Ferramic H toroidal core with 21 turns and 7 turn windings. The transformer was then fastened to a small phenolic mounting board and 4 heavy leads soldered to the winding at terminals on the board. The whole unit was then plastic embedded by R. Hunt. The finished product resembles a small capacitor of dimension 3/4" x 3/4" x 3/8" with 4 durable connection leads. The unit weighs 7 1/2 grams compared with 28 grams of the standard WWI 3:1 transformer. The performance of the toroid does not appear to be altered by the embeddment procedure.

Specifications for a die for producing small C-type ferramic cores have been drawn, and when these miniature cores are received we will experiment with coil forms that are more readily adaptable to production manufacture than are the toroids.

(R. Hunt)

Core Winding

The future of very small toroidally wound cores on the project seems to be very great. An investigation has been made into commercially available toroid winders. A very few machines are available, all of which are too large and much too expensive for what they are.

Some experimental work is being done to try and develop a sub-miniature toroid winder. The problem does not seem on the face of it to be too difficult. A suitable bobbin, which would be the heart of the machine, has been designed and if successful I will design a machine around it.

Component Analysis

(B. Paine)

Several batches of defective materials have been investigated and returned. 1400 Jeffers molded iron-core chokes were returned because of improper marking and cracks in the bodies of many units. Eighty-eight 1% Electra resistors out of a batch of 100 were found to have tolerances of 3%. Two 26 volts Berkshire filament transformers from ED rack suffered broken glass bushings during installation. These transformers are in fact not supposed to have glass bushings at all, but screw studs on a bakelite plate. Apparently the transformers were not checked against our specifications when originally received. A report has been written to try to set the Berkshfre Transformer Company straight on the remainder of this

2.6 Component Analysis (continued)

(B. Paine) (continued)

order which is still outstanding.

It is important that any materials ordered according to our specifications or standards be checked carefully on receipt for conformity to these standards, and any discrepancies be reported to the vendor for adjustment. Acceptance test procedures are being devised and evaluated, and soon suitable tests should be ready for use on every component used by the Laboratory.

3.0 STORAGE TUBES

3.1 Construction

(P. Youtz)

Six 400-series storage tubes were processed this past period. All of these tubes had a stannic oxide coating instead of dag. As reported in the test section, the guns of these tubes with stannic oxide coatings suffer poor cathode emission and the beryllium mosaic surfaces had poor secondary emission characteristics. Therefore, we will abandon the practice of using stannic oxide instead of dag for 400-series tubes until we are able to develop new techniques.

However, since the tubes with the stannic oxide coatings processed to a vacuum 10 times better than the dag tubes, experiments with the stannic oxide will continue. In order to get some replacements quickly for Bank B, we will reprocess four tubes early next period. One reprocessed tube was constructed this period.

3.2 Test

(C. L. Corderman, H. J. Platt)

During this period six new tubes were tested, five 400-series prototype and one 300-series. One of the former had sufficiently wide margins at 32 x 32 and is now in Bank B. The other four, plus an additional tube rejected from Whirlwind because of low margins, were checked out at 16 x 16 density. An interference pattern between collector and auxiliary-collector screens gave rise to non-uniform spot size and was responsible for low margins when operating at 1024 spots. Such tubes make excellent replacements

3.2 Test (continued)

(C. L. Corderman, H. J. Platt) (continued)

for Bank A and are supplementing the few 300-series tubes remaining for that bank.

The interference pattern noted above was produced when an attempt was made to use two 70-mesh screens aligned with each other. The situation will be remedied either by using a 70-40 mesh combination or by using a 30° orientation between each mesh and the 70 mesh mosaic surface. RT298 uses the latter approach and gives no trace of a moire effect on spot size distribution over the surface.

Relatively serious troubles have been encountered with the stannic oxide. In tubes using this coating in place of the dag, there have been persistent troubles in getting either or both guns to activate normally and the lower switching voltage has increased from about 65 to 120 volts. Operation may be possible at a V_{HG} of 150 volts if a usable emission can be maintained from both guns.

A reprocessed tube RT253-R1 has been tested. This tube was in Whirlwind for about 400 hours at which time a grid-cathode short developed in the high-velocity gun. After reprocessing, the tube gave anomalous behavior in that the voltage required on the second anode for best focus is about 30 volts instead of the normal 130 volts. Even at this low voltage, the focus is very poor. The gun definitely gives abnormal operation, but sufficient tests have not been completed to be able to pinpoint the trouble.

(T. S. Greenwood, J. Jacobowitz)

The r-f difficulties associated with adding a TV reading system to the RCT have been satisfactorily solved by realigning the r-f pulser, HV gun-end input circuits, and the r-f readout amplifier. In addition, r-f pickup has been decreased by improved bypassing directly at the target element connections.

Testing of RT292, the special tube constructed without a square mica spacer, has begun. The results, however, are not as yet significant because of certain undetected troubles in the P5 video amplifier which resulted in a long-time slow drift in gain and an intermittent momentary failure.

Jack Jacobowitz spent some time during the last bi-weekly period familiarizing himself with the STRT block diagrams.

3.2 Test (continued)

(A. J. Cann)

During this period no pretesting was done. Preliminary observations were made on RT293 and RT296, and further observations were made on tubes previously tested. Attempts were made to find a correlation between non-uniform writing qualities and high lower switching voltage of recent tubes and production changes such as the use of different mica, 70 mesh auxiliary collector and stannic oxide. No conclusions have been reached as yet.

The TV picture has been improved by rerouting some of the r-f cabling; apparently, grounding is far from perfect and location of loops has considerable effect. Drawings of the TVD equipment are almost complete.

Some time was spent learning the details of the system used to keep track of constructions, testing and use of storage tubes.

(A. M. Stein)

The test setup which will be used for the investigation "Current Distribution in the High Velocity Beam in the MIT Electrostatic Storage Tube" is undergoing extensive revision. Television readout has already been incorporated successfully. Other units in the setup are altered to enable the use of a 2^8 step increment generator for a rapid determination of spot size.

4.0 TERMINAL EQUIPMENT

4.1 Typewriter and Tape Punch

(L. H. Norcott)

"FL" Flexowriter #1102 has been modified for tape preparation use and placed in operation. A second "FL" is now being modified for the same purpose and should be ready in a few days.

Commercial Controls Corp. informs us that they are prepared to furnish us with separate "FL" punches or readers on 60 day delivery if desired.

4.2 Magnetic Tape

(J. A. O'Brien)

The circuit schematics of three of the four flip-flops of magnetic tape control have been completed. These circuits will be made from extra in-out register panels, and work is now being done on the modifications required on the assemblies.

Some very promising improvements to the magnetic tape head switching circuits have been made and are being investigated by J.W. Forgie. He hopes to be able to increase the usable play back signal and reduce the switching time.

(J. W. Forgie)

Tests with the computer indicated satisfactory operation of the redesigned reading amplifier but revealed excessive noise originating from the read-record switch panels. This noise had not previously caused trouble, but since the new amplifier had considerably more sensitivity than those already in use, extra pulses were picked up by the magnetic tape test program. Since these extra pulses cannot be tolerated, an investigation of the switch panel has been undertaken. The result of this investigation has been a major modification of the switch panel which yields a considerably larger output signal on reading, elimination of the previous noise sources (crystals), and a considerably reduced transient on mode switching. A new amplifier design is under way which will take advantage of these changes in the switch panel. Tests with the computer will continue as time permits.

(K. McVicar, S. Ginsburg)

Present work on the interim magnetic tape system is still directed towards increasing reliability. Since Al Roberts from the systems group has been working with us on weekends, our effective operating time has increased considerably.

4.2 Magnetic Tape (continued)

(K. McVicar, S. Ginsburg)

Several circuits in the system have been improved upon and others are presently being constructed.

(E. P. Farnsworth)

Occasional mal functioning of the decoder thyratron register in the magnetic tape printing-out system has been traced to extraneous "start tape" pulses originating in the Flexowriter feedout cam contacts. The "start tape" control circuit is being revised so as to instantaneously energize and subsequently fire a thyratron pulse generator once per Flexowriter clutch revolution.

4.4 Magnetic Drums

(E. S. Rich)

At a meeting of interested parties on January 10, the methods proposed for operating magnetic drums as a part of WWI terminal equipment were discussed. The discussion was mainly concerned with the advisability of changing the design of IO control and of the rc and rd orders so that these orders would act as an sp order if an in-out operation were called for before a previous one had been completed. During the meeting some technical difficulties were brought out which would prevent the above from being accomplished as easily as was at first thought. In view of these difficulties and the fact that programmers at present see no great advantage in the proposed scheme, the change will not be made. However, it seemed quite desirable to make provision for adding this facility in the future. In anticipation of this, the in-out system will be installed so that the rc and rd orders will cause transfers between IOR and AC rather than IOR and ES.

5.0 INSTALLATION AND POWER

5.1 Power Cabling and Installation

(C. W. Watt)

It has been decided, after consultation with interested parties, to add two more P row type racks in the maintenance room next to racks P0 and P15. These will be used for relay equipment for relay panels associated with terminal equipment, as well as for additional power distribution panels.

This extra rack space can be obtained with a minimum of upset to the existing arrangement in the maintenance room, as only one end of the existing maintenance stock room must be sacrificed. These racks will be installed during the next few months.

5.2 Power Supplies and Control

(R. Jahn)

a) 48-Volt Supply

An "emergency manual control" has been added to the 48-volt supply. A temporary overvoltage relay has also been installed.

b) Emergency Filament Voltage Supply

A study is being made of a new emergency filament voltage supply which will bring up the filament voltage in three increments to minimize thermal shock.

(J. J. Gano)

D-C Supplies

The life of the thyratrons in the +?50 supply has increased considerably since the new cushioning circuits were installed a year and a half ago. Three tubes have failed, one at 2000 hours and the other at 5000 hours.

A representative of the tube manufacturer advised that we should get 10,000 hours. Since we have reached a limit in the reduction of R and C, we will try to improve the cushioning circuit by introducing inductance.

5.2 Power Supplies and Control (continued)

(G. A. Kerby)

D-C Supplies

Four interim power supplies have been installed in Whittemore. Regulation characteristics are being taken.

The 600 volt, 5 amp rectifier has been completed and will be used to test the 10 amp regulator at partial load.

6.0 BLOCK DIAGRAMS

(B. Morriss)

During the past period a meeting was held with representatives from the Applications, Systems, and In-Out groups to discuss the operation of in-out orders. Of principal concern was the question of whether IOR should communicate with AC or storage in single word transfers. It had been suggested by Walquist that if the rc and rd orders transferred information between IOR and AC, the address section of the orders could contain an address to which control would be transferred instead of stopping the computer if the in-out element had not completed a previously ordered transfer. This would allow a programmer to do a better job of optimum programming where time is of great value. It was originally thought that if the programmer did not want to take advantage of this time but wanted to stop and wait, the order could transfer control to the register containing the rd ar rc order. It was pointed out that this dynamic stop is not possible because the continual reading and rewriting of the same register tends to destroy the information in the surrounding ES registers.

It was felt that without being able to use the dynamic stop, such an arrangement would complicate programming of the average problem, but that some such provisions must be incorporated when additional terminal equipment is added which has long and variable time responses. Therefore the decision was made that IOR would communicate with AC, and that the address sections of the rd and rc orders would serve no purpose until such time as the change of control mode is needed. At this time it would be incorporated, probably by the addition of a flip-flop in IOS so that all terminal units can operate either the stop or change control modes depending upon the insertion of a one in the additional digit column.

The addition of the buffer drum with which the length of transfers is not known in advance indicates that the form of the in-out orders may have to be changed. The block transfer orders are being designed to keep track of the amount of information transferred and to stop when no more information or buffer storage space is available. This coupled with some form of change of control on the single word trans-

6.0 BLOCK DIAGRAMS (continued)

(B. Morriss) (continued)

fers may be sufficient to handle the transfers to and from the buffer drum fields which serve as buffer storage for other terminal equipment in an efficient manner.

(R. P. Mayer)

Note E-440, "WWI Operating Speed", has been typed and is ready to be issued.

Note E-429, "Proposed New Order cl (qc), Cycle Left," is to be modified and re-issued showing the temporary from ql (instead of qc), and indicating that special add memory will not be cleared.

A relatively simple method of getting B-box operation is nearly worked out.

(J. H. Hughes)

I have been checking the Programmed Marginal Checking diagrams and making a revised block sketch of the PMC relay circuits.

7.0 CHECKING METHODS

7.1 Test Programs

(D. A. Kemper)

All the trouble-location programs now work satisfactorily. It was discovered last week that the Add Check program did not test anything in AC Carry so a new program was written to take care of this. The new program appears rather powerful and easy to interpret. During the past two weeks several trouble-location sessions were scheduled on the computer. System technicians would disconnect cables in the computer without the knowledge of the author while the latter would attempt to determine by means of the programs which cable was disconnected. These sessions were somewhat more successful than the one reported several weeks ago. Over a dozen such cable disconnections were performed, all of which were located by the program. Often the author could report the location of the trouble as soon as the technician who disconnected the cable arrived back in Test Control.

Work is progressing on the memorandum describing these programs.

7.1 Test Programs (continued)

(M. F. Mann)

Detailed study of the WWI System and logic is being started in preparation for a continuation of the work done up to the present on trouble-location programs.

7.4 Marginal Checking

(R. Hunt)

A new unit has been constructed as a prototype and tested. It functioned very well except that the cycle speed was judged to be too fast. It was about 1.4 seconds per cycle. The old unit was replaced and remeasured. It turned out to have a cycle speed of 2.9 seconds per cycle. This was judged to be about the most desirable speed.

The AC motor on the prototype unit was replaced by a D-C Shunt motor with a variably controlled field. The unit will now be replaced and will offer a range of cycle speeds from 1.2 seconds per cycle to 5 seconds.

The Variac control for the cycle speed will be in rack P5 with the control pot voltage Variacs. This prototype unit will now be tested for several months before the final design is made.

8.0 MATHEMATICS, CODING, AND APPLICATIONS

8.1 Operation

(J. T. Gilmore)

During the past bi-weekly period the Mathematics group used 24 hours and 10 minutes of computer time. Four hours and 36 minutes were used to convert Flexowriter standard tape to 5-5-6 binary tape. Four hours were used in converting the old Flexowriter standard tapes of the library of subroutines to the new Flexowriter code. The remaining 15 hours and 44 minutes were used to operate 67 programs.

8.2 Procedures

(J. T. Gilmore)

The new Flexowriter equipment is now ready to be used in the tape preparation room. The Bank B conversion program has been modified to take care of this change in the code and the 5-5-6 conversion program is in the process of being changed.

Because interpretive subroutines need preset parameters which should not be available to regular subroutines another set of preset parameters is being incorporated into the conversion program's vocabulary. It is to be used only by interpretive or control subroutines. The exact nomenclature will be announced as soon as the conversion program has been successfully modified.

The photoelectric reader to magnetic tape to electrostatic storage conversion program is still being programmed. It is hoped that tests can be made by the end of the bi-weekly period.

A storage print-out post-mortem program has been written which will print words in any one of the four conventional forms and will also include their storage locations. The range and type print-out desired will be indicated in the flip-flop registers. Later, however, it will be possible to use the conversion program to read in standard tape which will indicate the range and kind of print out. The complete process will only require the last 320 registers of Bank B.

(J. W. Carr, III)

The small hand tape punch has come back from the outside heat-treatment, and is now to be ground down before being ready for use. It is hoped that this will be available within the next bi-weekly period for use in correcting and modifying tapes.

8.2 Procedures (continued)

(J. W. Carr, III)

Subroutines for the following operations are now under test:

1. Matrix multiplication (24, 6, 0)
2. Arbitrary k-th derivative of arbitrary n-th order polynomial
3. Print decimal integers, zero suppression, final zero printed.
4. Arbitrary insert Flexowriter tape read and print.

8.3 Problems

(J. W. Carr, III)

The Boolean matrix problem has now been corrected to reset all variables, so that it is hoped future tests will give all correct answers independent of initial conditions. No random number tape is as yet available.

Mr. Tsai of Sloan Laboratory (mechanical engineering) is now coding the first portions of a partial differential equation connected with the exhaust from a reciprocating engine, using (24, 6, 0) number storage.

Several problem inquiries were received during the week, including Prof. Ashley (matric inversion and eigenvalues), Dr. Lanning (ordinary non-linear differential equations), and Messrs. Apt and Ross (interpolation in a table.) Coding may be begun by these people or in their behalf soon.

(D. G. Aronson)

Work on problem #45 (Crystal Structure) has been continued. A number of conferences have been held with Drs. Abrahams and Shoemaker, the originators of this problem. A program for computing $\rho(x,y)$ in the general 2-dimensional case was written by Shoemaker. A revised version of this program is being prepared for test on the machine early in the forthcoming bi-weekly period.

8.3 Problems (continued)

(D. G. Aronson) (continued)

Some time has been spent in examining the validity of the method of solution used in the initial attempts at integrating the Unwin Equation (Problem #42). No definite conclusions have been reached. Further studies will be carried out.

(F. Helwig)

A conversion program that will convert decimal coded numbers to the form used by (30, 0, 0) interpretive subroutines has been written and is being tested. The conversion procedure is the same as that described for (24, 6, 0) numbers in Section 8.3 of the previous bi-weekly (M-1364).

8.4 Subroutines

(D. E. Lenihan)

The following subroutines were received in the Library:

OT 2.2t - Print C(AC) as Decimal Fraction, Sign and Magnitude, Point, Single Column Layout

PA 8.1t - Operations on Real (15, 0, c) Fixed-Point Single Register numbers (Interpretive)

TF 1.1t - Form Cosine $\frac{\pi}{2}$ y from y Stored in AC, and Leave Result in AC(15, 0, 0)

TF 7.1t - Form Sine $\frac{\pi}{2}$ x from x Stored in AC, and/or Form Cosine $\frac{\pi}{2}$ y from y Stored in AC, Leave Result in AC (15, 0, 0)

These subroutines have been approved but they have not been typed yet. They will be typed on ditto and distributed next week.

The new leatherette notebooks have been distributed to full-time programmers in the Applications Group. These notebooks are to be used exclusively for the subroutine Library and each person will be responsible for his individual copy.

In the future as the subroutines are used more and there seem to be no more improvements or amendments to them, new masters will be made for them on the multilith indicating a more permanent status. Subroutines that are in the temporary category will still be typed on ditto masters.

8.4 Subroutines (continued)

(F. Helwig)

Work is continuing on various fixed point interpretive subroutines and the corresponding output typing routines. The following subroutines have been prepared and are being tested.

PA3.5t - Operations on (30, 0, 0) fixed-point numbers. (This routine gives 30-digit accuracy for mr and contains a sign agreement routine.

PA3.10t - Operations on (30, 0, 0) fixed-point numbers. (This routine gives 28-digit accuracy for mr and does not contain a sign agreement routine)

OT103.1t - Output typing for (30, 0, 0) interpretive subroutines which contain a sign agreement routine.

OT103.10t - Output typing for (30, 0, 0) interpretive subroutines which do not contain a sign agreement routine.

(M. Demurjian)

Subroutine OT2.2t PRINT C(AC) as decimal fraction, sign and magnitude, point, single column layout has been submitted to the library.

The subroutines being tested at present have been standardized as to preset parameters. In the forthcoming week these subroutines will be checked and submitted to the library. The preset parameters are being used in the following manner:

V1 Type of qp output desired, ie., P0 to print and suppress the punch, or P 64 to punch and suppress the printer, or P 128 to punch and print simultaneously.

V2 Digit length.

V3 Address of first register of a block of registers in storage to be printed.

V4 Address of last register of the block in storage to be printed.

V5 Zero suppression.

8.4 Subroutines (continued)

(D. M. Neeb)

During the past bi-weekly period two subroutines were submitted to the library. One computes the cosine $(\pi/2)_y$ and the other computes either the sine $(\pi/2)_x$ or the cosine $(\pi/2)_y$ depending on where the subroutine is entered. Both of these subroutines give answers with a maximum error of approximately $\pm$ 0.00005 and an average error of $\pm$ 0.00002.

(J. Frankovich)

Two subroutines have been written and are being tested:

OT 101.1t will print the contents of the multiple register accumulation of a (15,15,0) interpretive subroutine when entered from a program being interpreted. The number is first converted from binary to decimal form so that the printed result,

$$\pm .\ X\ 1 + Y,$$

says that the number in the m.r.a. is equal to

$$\pm .\ X \cdot 10^{\pm Y}.$$

NR 202.1 t will find the square root of the number in the m.r.a. of a (24,6,0) interpreted subroutine when entered as in the above case. The result will be left in the m.r.a. and its accuracy can be specified by means of a preset parameter.

(D. G. Aronson)

The following routines have been written for use with the (15,15,0) and (24,6,0) PA routines

(i) sin or cos of any angle (in radians) within the range of the PA routine

(ii) all trigonometric functions for any angle (in radians) within the range of the PA routine

8.4 Subroutines (continued)

(D. G. Aronson) (continued)

Both routines are based on a 9^{th} degree polynomial approximation to sin $\pi/2$ θ, -1 ≤ θ ≤ 1. These routines must, of course, be used with caution since within the allowable precision of the PA routines the evaluation of, say, sin $x \cdot 2^n$, $n > 15$ is completely meaningless. These routines, and variations on them, will be tested and submitted to the library as soon as the input and output methods for the PA routines have been settled. Better methods of obtaining multiple length trigonometric functions are being investigated.

(E. Kopley, M. Mackay)

Modification of subroutines for displaying decimal and octal fractions and octal instructions have been written and are awaiting testing. Recent minor changes have been incorporated in these programs since they were last tested ostensibly successfully. Until the developed film is received, the accuracy of the displays remain unknown. It is considered that greater flexibility is lent to the subroutines if the addresses of the first and last register of a bank of registers to be displayed are referred to as program parameters instead of preset parameters.

Suppression of initial zeros, display of decimal integers and decimal instructions, (24, 6, 0) display and round-off are being considered.

A subroutine has been written for displaying the x-y axes-calibrated, as well as for each of the four quadrants, calibrated. Some of these have been tested with success. Combinations of the first and second quadrants and the first and fourth quadrants have been written and are awaiting testing. A subroutine for tabulating on the scope the argument and dependent variable is under consideration.

9.0 FACILITIES AND CENTRAL SERVICES

9.1 Publications

(Anola Ryan)

The Engineering II drawing file, containing a complete set of Whirlwind drawings, which was formerly kept in Room 112 has been transferred to the Library. Anyone interested in borrowing drawings from this file should contact the librarian.

The following material has been received in the Library Room 217, and is available for laboratory personnel.

LABORATORY REPORTS

No.	Title	No. of Pages	Date	Author
E-441	Standardized Transistor Parameter Measurements	8	1-3-52	J. F. Jacobs N. T. Jones
M-1369	Trip to General Ceramics, January 9, 1952	3	1-10-52	D. R. Brown
M-1371	Magnetic Core Activity	5	1-15-52	W. N. Papian
M-1372	Acceptance of WWI Panels	1	1-16-52	S. H. Dodd
M-1373	Availability and Safety of Technicians	2	1-21-52	H. F. Mercer
M-1376	Progress Report No. 1, M. S. Thesis: An Investigation of Ferroelectrics for Digital Information Storage	2	11-23-51 to 1-15-52	D. A. Buck

LIBRARY FILES

Technical Reports

No.	Identifying Information	Source
.004	European Scientific Notes: November 15, December 1, 1951	ONR/London
47	Technical Information Pilot: October 24, November 1, November 6, 1951	ONR/Library of Congress
51	Tracerlog: January 1952	Tracerlab, Inc.
180	Document Office Bulletin: January 18, 1952	RLE/MIT
271	Machine Solution of Problems for the Office of Air Research. Progress Report No. 20, covering period 1 March - 1 November, 1951	Computation Lab. Harvard University
280	Digital Computer Newsletter: January 1952	ONR/Washington
372	Notes on Numerical Analysis: Material covered in the two term course (6.531 and 6.532)	Z. Kopal, professor J. Salzer, ed.
559	Technical News Bulletin: January 1952	Ntl. Bur. Stds.
600	Quarterly Progress Report No. 24. January 15, 1952	RLE/MIT
884	Progress Report No. 26, D. I. C. Project 6873. January 4, 1952	
1284	Discontinuous Automatic Control of Missiles: Technical Report No. 14 (Part 3, Chapters 9-10) December, 1951	Stanford University I. Flugge-Lotz

9.1 Publications (Continued)

LIBRARY FILES (Continued)

Technical Reports (Continued)

No.	Identifying Information	Source
1325	Quarterly Progress Report: January 15, 1952	Solid State and Molecular Theory Group/MIT
1477	Notes on Numerical Methods: Additions as of October 22, 1951	Oak Ridge Ntl. Labs A. S. Householder
1648	Methods Developed at the Naval Ordnance Test Station for Rapid Calculation of Air Density. Navord Report 1910, Nots 437. August 28, 1951	Naval Ordnance Test Station N. R. Williams K. C. Coulson
1649	Defects in Magnetic Tape: Report on Investigations. Engineering Report No. 11, October 1, 1951	Raytheon Mfg. Co.
1650	Journal of the Royal Society of Arts: December 14, 1951. Including: "Automatic Calculating Machines"	M. V. Wilkes
1651	Unpublished Research Reports: A Problem in Bibliographical Control. Occasional Papers No. 17. December 1950	U. of Illinois Library School E. B. Jackson
1652	Applicability of Newer Electronic Techniques to Information Searching. January 2, 1952	P. R. Bagley J. W. Perry
1653	On the Numerical Solution of the Fredholm Integral Equation of the Second Kind with Particular Reference to Legendre's Function in Integral Form Using a High Speed Digital Computer. B. S. Thesis, MIT, 1952	M. Rotenberg
1654	A Vital Point of View (Concerning Design of Military Electronic Equipment for Maximum Reliability)	Panel on Electron Tubes Research and Development Board
1655	Interference Filtering. Technical Report No. 185. March 1, 1951	RLE/MIT J. Costas
1656	Prediction and Filtering in the Presence of Gaussian Interference (Preliminary). Report R-27. October 1951	Instrumentation Lab./MIT J. H. Laning
1657	Pacific Journal of Mathematics, December, 1951. Includes articles by R. H. Bruck, P. R. Garabedian, M. R. Hestenes, and S. T. Hu	University of California Press
1658	Wind Variability (Report of Progress): SIGEL - RMB - 4, Project 172-A-1. September 5, 1951	A. Arnold/Signal Corps Eng. Labs./Meteorological Branch
1659	On Lineal Entire Functions of n Complex Variables. NBS Report No. 136. October 4, 1951. Prepublication copy.	Ntl. Bur. Stds. T. S. Motzkin I. J. Schoenberg
1660	A One-Particle Model for Nucleon-Nuclei Scattering. NBS Report 1322. November 20, 1951. Prepublication copy.	Ntl. Bur. Stds. R. E. Le Levier D. S. Saxon
1661	Sufficient Conditions for the Convergence of Newton's Method in Complex Banach Spaces. NBS Report No. 1306. November 1, 1951. Prepublication copy.	Ntl. Bur. Stds. M. L. Stein
1662	Solution of Systems of Linear Equations by Minimized Iterations. NAML Report 52.13. July 30, 1951	Ntl. Bur. Stds. C. Lanczos

9.1 Publications (Continued)

LIBRARY FILES (Continued)

Technical Reports (Continued)

No.	Identifying Information	Source
1663	Metric Methods in Integral and Differential Geometry NBS Report 1339. November 2, 1951	(Ntl. Bur. Stds. (J. W. Gaddum
1664	Modes of Vibration of a Suspended Chain. NAML Report 51-3. 1951. Prepublication Copy	(Ntl. Bur. Stds. (D. S. Saxon (A. S. Cahn

Journals

Identifying Information
Electrical Communication: December, 1951
Journal of Mathematics and Physics: January, 1952
Machine Design: January, 1952
Oil and Gas Journal: January 7, January 14, 1952
Proceedings of the I. R. E.: January, 1952
RCA Review: December, 1951

Books

Identifying Information	Author
Electrical Engineer's Handbook, 4th edition: Electric Power, John Wiley and Sons, 1949	(H. Pender (W. A. Del Mar, eds.
Stainless Steel Handbook, Allegheny Ludlum Steel Corp., 1951	
Contributions to the Theory of Games, Annals of Mathematics Series No. 24, Princeton University Press, 1950	(H. W. Kuhn (A. W. Tucker, eds.
A Student Guide for Aeronautics, Aero Publishers, 1950	M. E. Tower
Aviation Dictionary, 3rd edition, Aero Publishers, 1951	(E. S. Gentle (C. E. Chapel, eds.
New Books Received at Eastman Library, MIT, October 1 - December 1, 1951 (Accessions List)	Eastman Library/MIT

9.2 Standards, Purchasing, and Stock

(H. B. Morley)

Attention is called to Asministrative Memo A-121 which outlines a method of handling assigned materials more efficiently -- particularly part 2 wherein the use of the CR (Construction Requisition) number is outlined. This number should be given on work sheet if additional material is ordered for the work under construction. It would be advisable to have better coordination of requests for material. Many times similar requests from different persons are presented to this department.

In the past we have cautioned Laboratory Personnel against making any commitments (or statements) that would be interpreted by the vendor as a definite order (or intent) to purchase. It is recognized that engineers can often get technical information expeditiously by writing direct to the manufacturer (or by interviews with Sales Engineers) but all business transactions must be handled by the Purchasing Department. Copies of all such letters should be sent to this department.

Many statements and promises from suppliers are becoming progressively inaccurate. We are plagued with incorrect shipments, defective materials, late (or no) deliveries, incorrect billing, etc. All this adds greatly to the work load of this department.

Component tests and evaluations of B. Paine in connection with the Standards Committee Program are commendable. We now have a definite procedure of testing new items that are submitted to this department by vendors for consideration. These tests have brought to light certain defects of materials already in use and in others proposed for use. Arrangements have been made to return these materials to vendors for adjustment.

New items given to Standards Committee for evaluation:

CTS JAN Type Carbon and Wire Wound Potentiometers
IRC JAN Type Composition Resistors

(H. W. Hodgdon)

Laboratory standards for five types of relays were prepared in rough draft form this period, and are ready for final typing and issue. The section on pulse transformers is being issued in essentially the same form as before, with some minor corrections and

9.2 Standards, Purchasing, and Stock (continued)

(H. W. Hodgdon) (continued)

additions. During the next period work will continue on relays, fuses, and resistors.

In order to build up a general file of information on standards, publications will be obtained from Armed Services Electro Standards Agency, the American Standards Association and other organizations. Contacts are being established with a view to visiting General Radio Co., ASESA, and possibly others, for the puspose of discussing standards programs being carried on by commercial and government organizations.

Any and all Laboratory personnel having interest or concern in any matters relating to standards are urged to consult with the Standards Committee. Weekly mestings are held on Tuesdays at 10:30 A.M. in Room 250, and comments or suggestions will be welcome. Analysis of criticisms and suggestions made by engineers and technicians using components will be our best method of selecting the most suitable items for our use and of improving existing standards.

9.3 Construction

(R. A. Osborne)

Production Report

The following units have been completed since January 4, 1952:

2	16" Scope Units final assembly
71	Misc. Coils & Transformers
10	D-C In-Out Registers

The following units are under construction:

80	Video Cables
2	5 amp. Regulator Panels
2	5 amp Rectifier Panels
6	Delay Line Amplifier Panels
1	Storage Tube Monitor
2	ESD Output Panels
1	Display Decoder Repair
1	LV Floating Power Supply
6	Delay Line Amplifiers

9.4 Drafting

(A. M. Falcione)

1. New Drawings:

A. Power Equipment Co. Power Supplies -48 Volts, -15 Volts, -30 Volts require additional drafting time because of late engineering changes. We are expediting the drawings for the -48 Volt supply so as to get the drawings into the shop as soon as possible. The two others will follow.

B. 420, In-Out Switch Display Matrix. The Circuit Schematic for this unit, D-50720, is complete and graded. The Assembly and Parts Lists, together with the aluminum panel drawing, are now in process of completion.

C. Magnetic Tape Drive Control. The Circuit Schematic for this unit is complete. The Parts List and Assembly are being held up pending further instructions from J. A. O'Brien.

D. 412, IOC Reset Control. The Circuit Schematic, D-50442, and its its Assembly, E-50551, have undergone considerable changes, which are now complete, and will be released within the next few days.

E. 820, ESD Termination Panel. The present drawings which now exist for this unit in the drawing files will remain as is, although the unit will be known as Mod. 1. These drawings will become obsolete when Mod. 2 has been constructed and installed. The Circuit Schematic for Mod. 2 is complete and graded, #C-50750. The Assembly and Parts List for Mod. 2 will follow. Drawing numbers have already been assigned as follows: Assembly and Parts List, D-50751; Aluminum Panel, D-50752.

2. The attention of all engineers is called to the new location of engineering file No. 2 which includes all drawings for WWI. This file is now located in the library at the Barta Building, and is available to all engineers for reference purposes. Engineers who desire to change graded drawings will accomplish a change notice form, #DL-127, and attach it to the engineer file #2 blue print which has been marked in red with the proposed changes. Both the change notice and the marked print should be forwarded to Hal Mercer at the Barta Bldg., for clearance and necessary WWI modification notice, if required. This procedure does not apply to the Storage Tube Group, or to the Block Diagram group. The cooperation of all engineers would be greatly appreciated in following the above procedure, as it facilitates matters at both ends.

9.4 Drafting (continued)

(A. M. Falcione) (continued)

3. Our new Multilith Photo Offset Printer has been received at the Whittemore Bldg. As soon as the necessary typewriter ribbons and other incidental supplies are received, each secretary will be given a multilith master to type a test sample, so that prints may be run off to ascertain if the proper procedure is being followed by the secretary in the typing of the new type masters. This will enable the secretaries to try the new masters and become acquainted with them prior to actual operation.

10.0 GENERAL

(J. C. Proctor)

New Staff

John W. Craig, Jr. is a new staff member working with the air defense group. He received his M.S. and B.S. in EgE. from MIT, and has had various cooperative assignments with Bell Telephone, A.T&T and AFCRL.

John Newitt is a new staff member also working with Bob Wieser. He has his B.S. in E.E. from Johns Hopkins University and has had several years' experience in engineering with RCA , Vectron Inc., and Cetral Records, among others.

Warner Ogden is a new staff member working with Norm Taylor. He has his B.S. in Physics from Carleton College and has been with ERA for several years.

Robert Horn is a new staff member who will work with Bob Nelson on recruiting. He has a B.S. in E.E. and an M.S. in Business Adm. from MIT. He has been an engineer with General Electric and with Eastman Kodak for a number of years.

New Non-Staff

William H. Ferguson is a new part-time student technician from MIT working with the storage tube group.

Robert R. Ford is a new lab helper working under Bill Wiercinski.

Paul F. Marino is a part-time student technician working with Dave Brown.

10.0 GENERAL (continued)

(J. C. Proctor) (continued)

Charles L. Riley is a new part-time student technician working with Dave Brown. For several years he has been an engineer with the New Bedford Gas & Edison Light Co.

Robert C. Sullivan is a new Stock Clerk.

Robert W. Sittler is a thesis student working with Bill Linvill.

Terminated Non-Staff

H. Elizabeth Cooke

Bernard Leslie

Hyman Shumrak