Project Whirlwind
Servomechanisms Laboratory
Massachusetts Institute of Technology
Cambridge, Massachusetts

SUBJECT: BI-WEEKLY REPORT, July 7, 1950

To: Jay W. Forrester

From: Project Whirlwind Staff

1.0 SYSTEMS TESTS

1.1 Whirlwind 1 System Test

(N. H. Taylor)

The first program using electrostatic storage with the rest of Whirlwind was run July 7th. One of the simple display problems was used and an error-free run of 1 1/4 hours was made before the program was removed.

There is considerable significance in this achievement, particularly since it was done within two weeks of the time that testing of the overall system was started.

There is, of course, considerable work yet to be done in studying margins of operation of storage tubes and circuits, spot density and spot interaction problems, as well as reliability of the overall system. It is, however, very encouraging to attain this milestone without having to make any major change in the original plans for the Whirlwind System.

(R. Read and G. Sumner)

The past two week period has been mainly devoted to tying in the electrostatic storage tubes with other parts of the WW system. Routine marginal checking has been performed daily, resulting in replacement of three tubes. Operation of WWI with test storage has been satisfactory.

The tie-in of the EST's, although it required about one week, presented no major difficulties. Improper operation of the circuits which interrupt restorer pulses caused some erratic operation and stalling of flip-flops. After adjustment of pulse amplitudes and timing, this has caused no further trouble.

1.1 Whirlwind I System Test (Continued)

A selective clear for the check register has been installed and has proved indespensable in testing EST operation. This clear system permits prevention of alarms from any digit column of ES, thereby allowing marginal checks of other digits.

The first attempt to determine the condition of the storage tubes by using a test program was made on July 5. The program alternated the polarity of each spot of a 14 by 16 array, reading and checking the contents before and after each write cycle. The only notable change in operating conditions required so far has been in write plus time; it is now more nearly equal to that used in the reliability tester. Access time is about 30 μ's for reading or writing.

Margins have been taken using this program, and have indicated a few faulty digits, most of which are being improved. One ST was replaced. Considerable investigation of the row remains before it can be considered reliable. A display problem (powers of x) was successfully performed for 1 1/4 hours on July 7 before being purposely stopped. The problem used ES exclusively during computation. During this long run, no noticeable discrepancies were present and no alarms of any kind were present. The reliability appeared to be dependent on the section of the surface used. The first attempt was made near the center of the target, and only about 4 minute runs were achieved. The long run was achieved on the top line.

(H. F. Mercer)

The following failures of electrical components have been reported since June 23, 1950:

Component	No. of Failures	Hours of Operation	Reason for Failure
Crystals			
D-357	1	341	Drift
	5	2500-2600	Drift
D-358	1	341	Drift
	3	500-1000	Drift
	1	2466	Drift
	1	3410	Drift

Component	No. of Failures	Hours of Operation	Reason for Failure
Delay Line			
0.25 μsec 1350 ohms	1	373	Open
Resistor			
220 ohms 1 watt Carbon	1	3341	Burn-out
Tubes			
6AQ7	1	556	Change in characteristics
7AD7	1	608	Leakage
	1	1478	Change in characteristics
	2	3406	
	2	3663	

1.2 Five-Digit Multiplier

(E. A. Guditz)

The five digit multiplier has made errors only once since the last report. This occurred on Saturday, June 24th at 0635. A power supply fuse blew and was not replaced until the morning of the 26th. The cause of the blown fuse was not determined. Since that time the multiplier has been running without errors for a total of eleven days.

During this period the following components were replaced as a result of marginal checking results:

2 7AD7 flip-flop tubes
3 D-358 Clamp crystals
1 1N34 grid crystal

2.0 CIRCUITS AND COMPONENTS

2.1 Circuits by System Number

810 ES Control

(R. L. Best)

The new amplifier to drive the deflection plates of the TV tube in ES Control is completed, and is awaiting an opportunity to try it out in the system.

835 ES Drivers

(W. J. Nolan)

R-F Pulser - As mentioned in a previous bi-weekly report, work is continuing on an amplitude control system for the r-f pulser. The circuit now being worked on has operated satisfactorily over a limited range of outputs but is still unstable in the region where it is probably most needed. The breadboard on which the circuit was built has suffered many modifications in its four months of existence and the trouble was partly blamed on poor tube arrangement. To correct this, a new breadboard has been laid out and is under construction.

2.5 Vacuum Tube Studies

(H. B. Frost)

During this last period tube shop records, which had been accumulating since the first of June, were cleaned up in large part by part-time help. It is expected that the arrival of a new secretary the third week in July will find the records in reasonably good shape.

At the present time multiplier tube records are being analyzed to determine new tube life data. The analysis will be the same type as was performed in January. From this data multiplier tube life will be determined.

An accelerated life test of SR 1407 tubes is now in progress. In addition, a life test of 5687 tubes is being performed to determine the effect of bulb temperature on normally-off sections operating in the same envelope with a normally-on section. These tubes are being cooled by air-blast.

2.0 Circuits and Components (continued)

2.7 A Coincident-Current Magnetic Memory Unit

(W. N. Papian)

A progress report (M-1061) has been issued.

The draft of Chapter I of the thesis has been written. Chapter II, on core response times, is being written. Some time was spent developing an approximate method for predicting the rate of growth of flux in a thin magnetic ribbon when saturation is taken into account. The results bear some qualitative resemblance to experimental results.

3.0 STORAGE TUBES

(R. R. Everett)

A revised mode of storage tube operation is now under study. This mode consists of several parts, any or all of which may prove their worth. The study is aimed first at providing greater reliability and possibly greater speed or storage density for the 100-series tubes now in WW. Secondly, it is expected that any improvements thus obtained in the use of present tubes will bring us closer to new tubes of 32 x 32 density.

The proposals are in several parts:

1. Selective Writing: Prior to each writing operation the existing contents of the register will be ascertained by reading. Writing will be carried out only in those tubes whose contents are to be changed. A spot of either polarity will thus be written once and once only and spot growth effects will be minimized.

   This change can be made readily in the computer. It has not been possible to use this mode in ES Row when operated separately. Since it can apparently do no harm and will probably do good, the necessary computer revisions will probably be made in the next few weeks.

2. Omission of Rewriting: The present holding beam is probably adequate to restore the charge removed from positive spots by the reading operation. It is not adequate to restore charge lost from negative spots due to the differences in positive and negative charging and holding stability. J. W. Forrester has suggested using a reading gate large enough to lift negative areas to less than first crossover voltage of collector, say within 10 volts. The reading beam could not then charge negative areas above first crossover and they should remain stable although read indefinitely. It would no longer be possible to guarantee a negative readout for checking. This mode, if successful, would have several advantages:

   a. Omission of spot interaction due to rewriting.

   b. Omission of rewriting time. It has long been recognized that the only convenient way to attain WW specified access time (6 μs) is to omit rewrite.

   c. Increased stability of the negative background.

3.0 STORAGE TUBES (Continued)

Essentially no computer modification would be necessary to provide this change.

3. Different HV Gate Amplitudes for W+ and W-: At present the necessary difference between W+ and W- is attained by different gate length. The gate amplitudes and presumably the beam diameters are the same. Since the tubes are preferably operated with negative backgrounds the beam for writing minus (essentially erasing) should be larger than that for writing plus which should in turn be larger than the reading beam. Especially in long-throw tubes the beam diameter varies with beam current and therefore with video drive.

This change could be made fairly easily in WW by using the HV gun driver provided in each column for the second bank of tubes. Bank selection can be accomplished in other ways.

A thorough study of all these proposals will be made in the storage tube laboratory in the next few weeks. No changes, except possibly selective writing, will be put into WW until thoroughly proven.

3.1 Construction

(P. Youtz)

The storage tube construction group continued its accelerated construction program to get a complete complement of acceptable storage tubes so that all of the 16 storage tubes in ES Row could be replaced.

The second work week of this period was cut short by the two holidays. We processed this past bi-weekly period 6 evaporation tubes to produce beryllium mosaics, and 3 storage tubes with 40 mesh mosaic for use in WWI (ST172, ST173, ST174).

Two research tubes were constructed this period. One research tube, RT155, had a plain mica target. This tube is to be used by C. L. Corderman to observe the holding-beam restoring-current curve for mica. The second research tube, RT154, has a very thin mica target which is .0015" thick. This research tube is for the stability studies of H. B. Frost.

(R. Shaw)

Measuring rods, for checking deflection plate spacing, were received from Van Keuren Company, 6 July 1950. These are being used

3.1 Construction (Continued)

to inspect the latest shipment of 5U guns; however, at the time of writing, no reportable results have been obtained.

A special gauge has been received from the shop. Its purpose is to check the alignment of apertures and deflection plates of 5U guns as received from RCA. Its essential part is a mandrel which will pass freely between the deflection plates and through the G_2, A_1 and A_2 apertures of a gun in which misalignment does not exceed our tentative tolerance. Some reworking is required before this gauge can be used, because the space between the first pair of deflection plates is running consistently smaller than earlier measurements had indicated.

The reconditioned inclinable chuck has been tried out and is considered satisfactory. The first envelope made in it had an error of about 1/16 in the spacing of the gun arms, but this is believed to be due to misalignment of the straight, three-jawed chucks on the lathe. This matter will be investigated more fully and corrected insofar as possible after the equipment has been moved to the basement 1 August 1950. A recheck will be required at that time in any event.

A layout is in process of a self-jigging electron gun having an optical system equivalent to that of the 5U.

3.2 Test

(M. I. Florencourt)

Seven storage tubes were given standard tests; they were ST168 through ST174. Of these, ST169 was rejected for a spot on the surface devoid of beryllium mosaic.

Seven storage tubes were given static acceptance tests: ST161 through ST166, and ST168. All these tubes were accepted; (ST167 and ST169 had been rejected at standard tests.)

(C. L. Corderman)

Restoring current data was obtained on ST169 for five different V_{HG}'s as a function of the third anode voltage. The restoring current curves exhibit pronounced minima when A_3 is 25-50 volts below the collector indicating the effect of secondary electrons from the A_3 aquadag. An attempt is being made to correlate these curves with test results on the STRT, using a read signal plate gate approximately equal to V_{HG}.

3.2 Test (Continued)

(H. B. Frost)

Some brief tests have been performed to explore the possibility of using a read gate amplitude such that the negative spot being read will remain below first crossover. The advantage of this procedure lies in the fact that positive restoring action is much faster than negative restoring action; moreover the positive areas must receive a much greater charge to be written negative than a negative area must receive to be written positive. These tests were made at the suggestion of Mr. Forrester. Sufficient data was obtained to indicate that this type of operation is feasible, and that it is not necessary to rewrite a spot after being read provided a limited amount of holding gun time is available. This mode of operation will be investigated much more thoroughly in the next period.

A study of correlations between spot size and other factors has been started. The spot size refers to the spot size obtained by long writing times. A suspected correlation between spot size and vacuum quality has not been found, although this cannot be definite until better data on gas pressure is available. Information on gas scattering is scarce, but available information indicates that gas scattering is improbable. However, a tentative correlation between spot size and surface-collector spacing was found. More data is needed.

The writing time necessary to obtain a given spot diameter is an exponential function of the diameter for write times over a wide range (two orders of magnitude) of writing times greater than 10 microseconds.

(A. R. Tanguay)

An engineering note is being written which will present measurements and calculations of mosaic target capacitance. This report will include a summary of the information obtained from various research tubes as it applies to and substantiates the conclusions reached. It will also attempt to point out some related characteristics which affect such factors as stability, maximum operation V_{HG}, and spot size.

3.4 Unclassified

(W. J. Nolan)

While waiting for the r-f pulser breadboard, some work was done on clearing up troubles in the new deflection system for the ST demonstrator. Although originally proposed as a complete electronic deflection system on a single chassis, attempts to include

3.4 Unclassified (Continued)

more points in the array, additional flexibility of control, and greater deflection voltages have considerably expanded the system. It now consists of 3 units: a decoder and increment generator, a deflection amplifier and sweep adapter, and a control unit. These replace the stepping relays, sweep adapter, and switching unit of the present system.

The deflection amplifier is a slow, low power analog of the WWI deflection amplifier. Included on the same chassis is an electronic switch which performs the functions of the present sweep adapter in cutting off the TV sweep and setting up deflection voltages for a single point. The output voltage of 250 volts for a single plate plus 100 volts of positioning voltage should be sufficient to eliminate the difficulties found when using the present sweep adapter with short throw tubes. This unit is now believed to be complete and in operating condition.

4.0 INPUT-OUTPUT EQUIPMENT

4.1 Eastman Kodak

(J. A. O'Brien, D. Hageman)

As mentioned in the previous bi-weekly, reading tests performed under computer control indicated that the scanning beam was not properly synchronized with reference marks on the film. In particular, an error was consistently made upon reading the first word of a block. This occurred despite the fact that the film drive had been allowed to attain full speed; thereby eliminating the effect of irregularities in film motion which apparently accompany starting.

The problem of obtaining better synchronization has been engaged for quite some time. Lack of a satisfactory solution is due largely to the fact that the signal from the reference marker phototube is relatively noisy and the waveform thereof not uniform. The circuitry must also accommodate two film speeds, line-by-line and normal. An additional difficulty resides in the fact that a positive check upon the adequacy of synchronization can be obtained only by actually reading into the In-Output Element, where upon other sources of error may be introduced.

Certain changes in the reference marker channel have been made in accordance with the aforementioned results. No positive check upon their effectiveness has been made to date.

The cathode-ray-tube of the RR was replaced after it had been observed that an effective change in beam deflection occurred when intensified following cut-off periods of a minute or so. This difficulty has not been observed since replacement.

Several different methods of obtaining the signal from "digit" phototubes have been tried with the intention of improving both signal amplitude and signal-to-noise ratio. The most promising involves utilization of the signal from the last dynode rather than from the anode. The advantage of so doing is that a positive (rather than negative) pulse is obtained which can be used to drive a normally-off stage.

4.3 Typewriter and Tape-Punching Equipment

(R. E. Hunt)

Tape Preparation Unit - The last bi-weekly period has been spent in the further development of this unit. We now have the unit to a point of being very reliable, although some questions on ease of operation and detecting errors remain to be discovered when the unit is put into actual operation.

The circuitry has been modified to provide a "too fast" alarm and counter which should prevent an operator from becoming lost in a manuscript. Further spark suppression has been added. Timing has been improved, by making some relays slow releasing, to eliminate random errors.

At present the haywire is being cleaned up and the unit will be incorporated into its special table.

Work will commence immediately on the tape output unit.

(C. W. Watt)

Input Tape Reader - Construction of the input tape reader should begin next week.

(J. S. Hanson)

Flexowriter Output Equipment - The circuit schematic of the Flexowriter output equipment has been completed and a breadboard of the gas tube register and associated circuitry is being made up in the shops. Rack test setup has been assembled in order to determine the most optimum conditions for driving the gas tube register from the computer storage register.

5.2 Power Supplies and Control

(J. J. Gano)

Regulator for Plate Supply Alternator - The breadboard regulator with its protective circuit is ready to connect to the system. Design of the permanent form should get underway during the next week.

D. C. Power Supplies - In order to have more time to conduct tests on these supplies it is intended to work Saturdays during the summer. The object of these tests will be

(1) To improve transient behavior, especially of the 90 volt supply.

(2) To determine and eliminate the cause of frequent thyratron failures on the + 250 volt supply.

(C. W. Watt)

Video Cabling - An extension of the wireway above row F has been started that will permit cabling to be carried into the future operation room of WWI. This involves two new pieces of wireway and the making of a hole in the brick wall of the computer room. It is expected this work will be completed by August 1.

(T. Leary)

Video Cabling - The design of a group of 31 cables involving the resets of one of the Flip-Flop Storage Registers has been undertaken. This involves also the construction of a Video Connection Panel for connecting some of these cables to equipment in room 138.

6.0 BLOCK DIAGRAMS

(R. P. Mayer)

A sketch, SD-35873, has been drawn showing "Integrated Traffic Schedules, PR replaced by AR, Including 'q' Orders". On this drawing similar operations are shown as one, with balloons indicating differences between operations. This sketch is being used in the present investigations of methods of operating Electrostatic Storage (ES).

Methods are now being worked out for operating the ES Tubes so that the "Write" operation writes on only those spots that need to be changed. The decision to write in a particular column is determined by the Check Register, which compares the previous spot conditions with the desired spot conditions. With this method of operation repeated charging of a spot in one direction does not occur, preventing the accumulation and spread of excessive charges.

7.0 CHECKING METHODS

7.1 Test Problems

(G. Cooper)

Several programs for possible use in testing electrostatic storage have been written. An engineering note describing these programs and discussing the manner in which they may be used to isolate weaknesses in the storage system is being written.

Some more data have been obtained on the failure symptoms observed with Test Sequence VI. In a few cases, these data point to a need for some supplementary test sequence to achieve a sufficient degree of automatic trouble location. Time has not been available to devise such a sequence.

8.0 MATHEMATICS AND PROGRAMMING

(C. W. Adams)

By the time that the interim tape input unit is ready to operate, in about a month, it will be desirable to have written and punched on tape an input program, several test programs and one or two different kinds of more-or-less practiced display programs. The input, or initial, program will be used to convert Flexowriter-coded information into pure binary form. Since the initial program will probably occupy about 100 registers or more even in its simplest form, and since the initial capacity of the computer will be 256 registers, any program which is to be converted by the initial program will be somewhat restricted in length. As soon as output tape-punching equipment is available, however, it will be possible to use the initial program to convert the desired program and to record it in binary form on tape. Then the desired program can be read into storage again with no space being needed for the initial program. Plans are being made to complete the writing and punching of the various necessary programs by sometime early in August.

9.0 FACILITIES AND CENTRAL SERVICES

9.1 Publications

(J. N. Ulman, Jr.)

The following material has been received in the library, Room 217, and is available to 6345 personnel.

6345 Reports

No.	Title	No. of Pages	Date	Author
M-1055	Meeting of the Mathematical Computing Advisory Panel, June 8, 1950	5	6-15-50	C. W. Adams
M-1057	Bi-Weekly Report, June 23, 1950	25	6-23-50	
M-1058	Staff Indoctrination Program	5	7-5-50	J. C. Proctor
M-1060	Whirlwind I Marginal Checking - Summary and Recommendations	2	6-30-50	R. A. Nelson
M-1061	Progress Report: A Co-Incident Current Magnetic Memory Unit	2	5-19-50 to 7-5-50	W. N. Papian
M-1062	Electronic Computer Division Personnel	3	7-1-50	
M-1063	Master's Thesis Proposal: Scheduling Games for the Whirlwind Computer	5	7-7-50	H. D. Bennington
A-110	Division Personnel	1	6-30-50	J. W. Forrester

Library Files

	Members of a Symposium on Large-Scale Digital Calculating Machinery, Sept. 13-16, 1949	Harvard U.
.004	European Scientific Notes: 15 May, 1950	ONR, London
47	Technical Information Pilot: June 13, June 20, June 22, 1950	ONR, Library of Congress
180	Document Office Bulletin: June 9, June 23, 1950	RLE, MIT
271	Machine Solution of Problems for the Office of Air Research: Progress Report No. 9	Computation Lab., Harvard Univ.
559	Technical News Bulletin: June, 1950	National Bureau of Standards
597	MIT Reports on Research: June, 1950	M. I. T.
622	The Aerovox Research Worker: May, June, 1950	Aerovox Corp.
743	Proceedings of the Institute of Radio Engineers: August, 1937	I. R. E.

9.1 Publications (continued)

Library Files (continued)

No.	Title	Author
744	On Integral Equations - Their Solution by Iteration and Analytic Continuation (Ph. D. Thesis)	A. J. Perlis
745	Telephone Terminal Sets TC-21-A and TC-21-B (Carrier) and Repeater Set TC-23-A (Carrier): Technical Manual TM 11-341, October, 1945	War Department
746	The BARK, A Swedish General Purpose Relay Calculator. Swedish Telegraph Administration	H. Freese G. Neovius
747	Research Activities of the Institute for Numerical Analysis: Quarterly Progress Reports. July-Sept., Oct.-Dec., 1948; April-June, July-Sept., Oct.-Dec., 1949; Jan.-Mar., 1950	J. H. Curtiss, Ntl. Applied Math. Labs. Ntl. Bureau of Standards
748	Projects and Publications of the National Applied Mathematics Laboratories: Quarterly Reports: Jan.-Mar., July-Sept., Oct.-Dec., 1948; April-June, July-Sept., Oct.-Dec., 1949; Jan.-Mar., 1950	Ntl. Applied Math Labs., Ntl. Bureau of Standards
749	Recommendations for Safe Control of Expanding Air Traffic. Part I, February, 1947	Air Transport Assn. of America
750	Bibliography of Unclassified Moore School Reports on Electronic Digital Computers	G. W. Patterson
751	An Electronic Simulator for Nonlinear Servomechanisms. AIEE Paper 50-47. Preprint AIEE Transactions Vol. 68, 1949	C. M. Edwards E. C. Johnson
752	A Generalized Analogue Computer for Flight Simulation: Preprint AIEE Transactions, Vol. 69, 1950	A. C. Hall
753	Report on Tenth Annual Conference on Physical Electronics: March 30, 31, April 1, 1950	Dept. Physics, RLE, MIT
754	Progress Report: Laboratory for Nuclear Science and Engineering. January 1, 1950	M. I. T.
755	Permanent Magnets. August 10, 1944	R. L. Sanford Ntl. Bur. Standards
756	A New Low Power Pulse Transformer for High Duty Cycle Operation. Engineering Research Report, June, 1950	W. L. Martin U. of California
757	Writing Superior Reports: A Powerful Career Aid. In The Bridge of Eta Kappa Nu, March, 1950	R. Beach Eta Kappa Nu
758	Provisional Specifications for the Development of a Numerically Controlled Milling Machine. Engineering Report No. 2, D. I. C. 6694, June 30, 1950	J. O. McDonough A. K. Susskind J. H. Brown R. H. Marsh

9.2 Standards, Purchasing and Stock

Attention of all lab personnel is again directed to the fact that a fairly comprehensive list of standard WWI and laboratory stock has been compiled and is included in the Class 6 and 7 Standards Books. Every reasonable effort should be made to adhere to this list in the design of any lab equipment in order to avoid the possibility of non-standard components becoming a part of WWI equipment. Any deficiencies in the standards list should be referred to the Standards Committee for consideration.

PROCUREMENT AND STOCK:

Reorganization of the stockroom, receiving and shipping, and transportation has been completed, and is set up with Pugliese in charge under general supervision from Morley and Hodgdon. Cowie will supervise details of receiving, shipping and transportation, and all stockroom personnel will be expected to perform stock clerk and inspection duties as required.

Delivery on many items is becoming increasingly indefinite of late, due primarily to heavy demands from TV manufacturers, and in part to summer vacation schedules and unsettled international conditions. Personnel are requested to take cognizance of this in ordering material, and allow more time for deliveries, particularly on critical items such as tubes, JAN spec. resistors and capacitors, etc.

The number of orders processed in June was slightly above the average for the previous five months. This represents a much heavier workload, however, since we are now processing complete orders instead of requisitions only as before.

General organization and operation of the Standards, Stock and Procurement facilities was outlined by Morley on this date to a group of new laboratory personnel. Further assistance on problems relating to these functions can be obtained by applying at this office.

9.3 Construction

(R. A. Osborne)

Production Report - The following items have been completed and inspected since June 23, 1950:

9.3 Construction (Continued)

133 Terminators
1 Breadboard
2 D.C. Register Panels

Modification of Tape Preparation Relay Panel

Modification of Deflection Amplifier for TV Set in ES Control.

(L. Prentice)

Machine Shop - The work load has been extremely heavy. This is due to vacation schedules and to large orders for storage tube parts. Peak load will continue for the next two weeks; we should be able to catch up somewhat during the first part of August when the storage tube group is on vacation.

Sheet Metal - All the time available here has been used to supplement the work in the machine shop.

9.4 Drafting

(A. M. Falcione)

1. MemorDistribution System: At the present time there are 28 different distribution lists for the various memos, reports, and other miscellaneous data for project 6345 and 6673. The possibilities of combining and reducing the list is now under consideration. It is hoped to establish definite distribution lists such as A, B, C, etc. This will eliminate the typing of individual names on memos etc. and standardize the distribution system.

2. Drafting Load: Due to the tie-in of E Row to the computer, many changes on E Row panels have been found necessary which has increased our work load considerably. Approximately 70% of all the installation drawings have been completed and graded. Terminal Schedule drawings for F Row, C Row, and A Row are now completed and will be sent out for B-Reductions during the next week.

3. Termination: Allan Greaves, 1 July 1950.

9.7 Administration and Service Organization

(H. Fahnestock)

An administration and service organization chart has been drawn up and is available from the print room to those desiring copies. The drawing number is D-35882 (B-reduction).

10.0 GENERAL

(J. C. Proctor)

New Staff

Dudley A. Buck received his B.S. in Electrical Engineering from the University of Washington. He has been an Ensign in the Navy stationed at the Naval Communications Station in Washington for the last two years. His home is Santa Barbara, California.

John M. Dodd received his B.S. in Electrical Engineering from Stanford University. His home is in San Francisco.

Frank C. Helwig received his B.S. in Mathematics from Purdue. He is now working on his Doctorate in the Mathematics Department at M.I.T. He spent four years in the Air Force as Electronics Officer. His home is in Gary, Indiana.

Frederic E. Irish received his B.S. in Electrical Engineering from the University of Maine. He served with the Air Force during the war. His home is in South Portland, Maine.

Benham E. Morriss received his B.S. degree in Electrical Engineering from Virginia Military Institute. He is now working for an M.S. in Business Administration. His home is in Norfolk, Virginia.

Herbert J. Platt received his B.S. in Electrical Engineering from Pratt Institute. He was in the Army during the war. His home is in New York City.

Theodore L. Roess received his B.S. degree in Electrical Engineering from Northwestern. He served with the Navy as electronic technicians mate on radar and G.C.A. equipment. He has done cooperative work with Allis Chalmers. His home is in Skokie, Illinois.

Edward J. Samario received his B.S. degree in Electrical Engineering from Notre Dame. He served with the Air Corps during the War. His home is in Los Angeles.

10.0 General (continued)

(J. C. Proctor)

New Non-Staff

Miss Dorothy Lenihan of Boston is a new mathematical secretary assigned to tape preparation. She received an A.B. in mathematics from Emmanuel College and has had clerical experience.

Staff Terminations

Harrison Rowe
Kenneth McVicar
Alexander Orden

Non-Staff Terminations

Allan Greaves
Francis Hannon
Sylvia Todd

Radio Interference - For the past two weeks severe radio interference on 161.43 megacycles has been traced to the corner of Massachusetts Avenue and Windsor Street. It is sometimes continuous for long periods including Sundays and nights and has been noted as an on-off cycle with a period of 11-15 seconds. It is not General Radio or Sanborn. Fahnestock would welcome suggestions as to what equipment in this building might be a possible cause.