Project Whirlwind
Servomechanisms Laboratory
Massachusetts Institute of Technology
Cambridge, Massachusetts

SUBJECT: BI-WEEKLY REPORT, Project 6345, December 8, 1950

To: Jay W. Forrester

From: Project Whirlwind Staff

1.0 SYSTEMS TESTS

1.1 Whirlwind I System Test

(R. R. Everett, S. H. Dodd, N. H. Taylor, R. Read)

The last bi-weekly period was significant in that for the first time all of Whirlwind including E. S. operated reliably for periods of a few hours. It was possible for many display programs to be shown, and other useful programs to be checked or analysed. The system operated impressively for over an hour last Friday, December 1, for the benefit of a group of visitors.

A few tests were run to improve the storage system row-wise. As a result of interaction encountered on the first program read in from tape, the rewrite times were investigated again and reduced. It has been found helpful in improving reliability to inject about 20 to 50 microseconds of holding time after each ES operation. Although most programs have run with no extra holding time, it provides a useful safety factor. The access time is about 15 microseconds for a read, and about 60 microseconds for a transfer.

The first evidence of aging in the storage tubes was discovered. It occurred only in one tube, and was in the form of a reduction in the positive stability. The trouble was compensated for, but the deterioration not checked by increasing V_{HG} and the signal plate gate amplitudes. A checking program which checks all the circuits and the tubes to a large extent, has been used to measure margins according to maintenance routines that are being organized.

1.1 Whirlwind I System Test (continued)

Two tubes have small areas that are difficult to switch; it is desirable to avoid the area on one of these to avoid program troubles. The three troublesome tubes will probably be replaced soon.

Variation of the Whirlwind power supplies has indicated that reasonable margins exist, although they are not adequate in all cases.

(N. Daggett)

Operation of the system has been plagued by several intermittent troubles lately. One such trouble has been traced to design weakness in flip-flop storage. The difficulties encountered in localizing these troubles suggest that special trouble location problems for particular elements of the computer such as have been proposed in the past might be extremely useful.

The program counter is now cabled in such a manner that digit 8 carries to digit 7 regardless of whether or not the digit 8 carry is used for reset purposes.

(H. F. Mercer)

Component Failures in WWI - The following failures of electrical components have been reported since November 24, 1950:

Component	No. of Failures	Hours of Operation	Reason for Failure
Crystals			
D-357	4	4000 - 5000	1 - Drift 3 - Low back resistance
D-358	2	272	Drift
	2	1194	Low back resistance
	2	2179	Low back resistance
	13	3000-4000	2 - Drift 11 - Low back resistance
	12	4000-5000	8 - Drift 4 - Low back resistance

1.1 Whirlwind I System Test (continued)

Component	No. of Failures	Hours of Operation	Reason for Failure
Tubes			
7AD7	1	613	Mechanical
	1	665	Low I_b
	2	1586	Low I_b
	11	2000-3000	10- Low I_b
			1- Mechanical
	2	3958	Low I_b
	8	4000-5000	4- Low I_b
			3- Mechanical
			1- Gassy

1.2 Five Digit Multiplier

(C. N. Paskauskas)

The multiplier has been in operation for a period of 51 days without making an error - excluding the time out of operation due to city power failure on November 19, 1950.

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

2 clamp crystals
1 holding crystal
1 7AD7
1 6AS6
1 7F8

The "Brown Converter" on the filament regulator was replaced due to sluggish operation of the "variac" voltage control.

One 6AS6 gate tube (check gate) was removed for testing.

2.0 CIRCUITS AND COMPONENTS

2.1 Circuits and Components

(C. W. Watt)

403 In-Out Register

The layout of the new - or "D-C" - In-Out Register is complete, and a prototype will be built during the next few weeks. The layout provides for a 7-1/2" x 26" panel housing a 6AN5 D-C flip-flop, 4 output 7AK7 gate tubes, one 5687 twin cathode follower output, a 7AK7 read in gate and a 6AN5 plate-loaded trigger tube. Multiple mixing inputs, and both slow and fast gate outputs as well as the regular gated pulse outputs are provided.

(W. J. Nolan)

835 ES Drivers

As noted in the Bi-Weekly Report of June 9, 1950, work has continued intermittently on a new r-f pulser circuit. Of the two possible tube types mentioned there for use in the feedback circuit, the 715 B was finally chosen. Although 7AK7's appear to stand up under operation with a peak negative grid voltage of 600 volts, the possibility exists that it might be desirable to increase the pulser output by increasing the plate supply voltage from 500 to 1000 volts. This would put 1200 or 1400 volts on the 7AK7 grids which is a little hard on them.

The final circuit decided upon has a maximum output of about 90 volts unregulated. Operation of the regulator reduces the practical maximum to about 75 or 80 volts. Approximately 40% more could be obtained by increasing the plate voltage to 1000 volts. The feedback circuit used for regulation will degenerate changes in tube characteristics by a factor of about 7 over the probable working range. Thus, if the plate current of all tubes in the modulated amplifier and output amplifier were to deteriorate by 10%, the expected 30% decrease in output would be held to about 4 or 5%. A quantitative statement of the advantages of this circuit over the present one is difficult to make due to the dependence of one feature on another. Thus, the desire for equal or better rise time, along with greater output, prevented direct modulation of the 715's in the final. The additional modulation stage, however, greatly increased the

2.1 Circuits and Components (continued)

susceptibility to drift in tube characteristics, making regulation more necessary. The regulator circuits, although not sensitive to drift, greatly increase the number of components (probably by a factor of 2) and thus the possibility of failure. It might be said that in exchange for double the stability and rate of rise of the pulse and 30% more output, the complexity has been increased by perhaps 3 times.

In order to permit evaluation of the circuit in WWI, it is proposed that a breadboard-prototype be constructed. This would be suitable for use in WWI and have the same general structure as the final model but would omit many of the details such as painting, and careful finishing of many parts. At the same time it will eliminate the necessity for breadboards of many of the smaller sections of the circuit.

2.4 Basic Circuits

(R. L. Best)

A d-c flip-flop d-c coupled to its load has been designed using 6AK5 tubes. Its advantages are: (1) it does not use 6AN5's, which are currently in short supply, (2) it takes only 15 m.a. from the -150 volt supply instead of the 43 m.a. required by the 6AN5 flip-flop, and (3) it uses an almost identical circuit to the 6AN5 flip-flop, and can easily be converted to it if desired. Its disadvantages are: (1) slower rise time due to increased output impedance, 0.2μsec. instead of 0.1 μsec., (2) it can only drive a single gate tube or buffer amplifier on each side, and (3) it needs a separate tube to drive indicator lights. It is recommended for immediate register panel needs where the standard equipment is not available. It is drawn up on SA-36322.

2.5 Tubes and Components

(H. B. Frost)

A group of scope photographs of plate current waveform of 6AG7 tubes from life tests have been analysed. Two different types of pictures were taken -- single shot pictures of long pulses and pictures showing the continuous variation of cathode surface potential before, during, and after a 4.5 microsecond plate current pulse. The long single pulses illustrate that there is no apparent decay in the plate current of 6AG7 tubes with passive alloy cathodes even though the average plate current on d-c test is low. The pictures showing the variation

2.5 Tubes and Components (continued)

in cathode potential indicate that the change is very nearly what had been postulated from the pulse current decay.

The supply of 6AN5 tubes has now been augmented by the arrival of 36 tubes to replace those previously rejected. Thus the 6AN5 situation is no longer critical, although more tubes are needed for a comfortable supply.

The work load in the vacuum tube shop is very heavy at present. Routine retesting of a large number of tubes in various WWI power supplies, WWI retests for marginal reasons, and test equipment reconditioning, all add up to a very considerable amount of work.

2.7 Three-Dimensional Magnetic Storage

(W. Papian)

Operation of the 2x2x1 array has been confined, during the past few weeks, to the cycling of information around all four cores. A more advanced test is now beginning which stores a given pattern in two cores, cycles another pattern around the remaining two cores a large number of times, and then returns to read and re-write on the original two. Preliminary observations indicate that information deterioration in the first two cores is, as expected, limited and reasonable. Output pulse shapes will be recorded and signal and info-retention ratios calculated.

Two of the Harvard type Static Magnetic Memory Units have been ordered from Alden Products Co. for testing here.

3.0 STORAGE TUBES

3.1 Construction

(P. Youtz)

Three research tubes were processed successfully this period. The first tube RT-191-1 was designed to minimize the drift of the high-velocity beam resulting from charged glass surfaces. All of the glass was dagged except for a quarter inch window between the A_2 and A_3 dag. There is a metal shield over the separation between A_2 and A_3 to prevent the glass window from charging. The holding gun has a 1-1/2 inch diameter metal A_2' cylinder.

RT193 was also designed to minimize the drift of the high velocity beam resulting from charged glass surfaces, and, in addition, to determine the effect of the dag in the holding gun neck on the holding beam focus. All of the glass was dagged continuous to the high velocity gun neck and body, except for an annular window in the end of the tube which separated the dag of the holding gun neck, designated A_3', from the dag of the body. The holding gun had a 1-1/2 inch diameter metal A_2' cylinder.

The third research tube RT194 was similar to RT193 except the target snubbers were inverted and insulated from the dag with insalute.

These tubes were turned over to the test group for evaluation. This concludes a series of tubes designed and constructed to minimize the glass charging phenomena. We will use the results of the test group to freeze the design of a series of tubes to be constructed as replacement tubes for any storage tube that might fail in the computer.

Wire mesh of 200 mesh size and .0013 wire have been received. This will be used as an experimental collector screen. Powdered 707 glass has been received from Corning Glass Works. We will attempt to settle a uniform layer of this powdered 707 glass on a metal backing plate and sinter it to the backing plate. Then we will evaporate a beryllium mosaic on the sintered surface. This is another approach to the problem of finding a suitable thin dielectric surface with as low a dielectric constant as possible.

(R. Shaw)

Some attention has been given to the holding gun having a metal A_2' cylinder. This gun is used in storage tubes in which the dag is made continuous to avoid glass charging.

3.1 Construction (continued)

Some changes have been made to the gun with the object of increasing structural rigidity. If possible, the use of insalute cement will be eliminated.

Some heavy steatite tubing (6 mm. o.d.) has been obtained and used in the construction of a dummy anode assembly. This withstood the thermal stresses incident to the bake-out process with no apparent damage.

3.2 Test

(A. R. Tanguay)

The pulse voltmeter mentioned in the last bi-weekly, has been assembled in a compact unit and has proved entirely satisfactory. The circuit will be drawn up by the drafting room shortly.

Several tubes were tested for restoring currents. These are RT150, RT156, RT187, RT188, RT190, RT191-1, RT193, ST152, ST194, ST195, ST196, ST197.

It was observed that all standard tubes have about the same restoring current curves.

RT150, a research tube, with a screen in front of the collector, has the highest maximum positive restoring current, while RT193, with a separate A_3' dag over the A_2' metal cylinder has the largest maximum negative restoring current. RT194, a tube similar to RT193, will be tested to determine whether the surface or the A_3' dag is responsible for the large maximum negative restoring current.

(M. F. Mann)

A complete correlation of all techniques of processing has been made on four tubes to determine, if possible, why for two tubes (ST152 and ST176) the V_{HG} for holding has increased with the usage of the tube, while for the other two tubes (ST103-R1 and ST142) it has not. No conclusions are obvious as yet.

The correlation summary sheets have been brought up to date and the November Research and Storage Tube Summary has been released.

3.2 Test (continued)

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

Two more tubes have been checked out and passed in the STRT. They are ST141 and RT170. The former tube was returned to T. Clough for regluing of the bakelite signal plate base before being sent to WW. A word of caution is in order for anyone engaged in removing the r-f or power plugs to the signal plate assembly chassis.

ST183, which had been rejected from WW for reading-out errors when there were none present by TV readout was placed in the STRT under static read condition with a positive array on a negative background. After some time many errors (indication of negative readout) occurred. Viewing the surface with TV showed that the entire array was intact. Upon repetition of the experiment it was found that rewriting the array after errors appeared cleared up the errors for a while. It was also found, upon switching the STRT from static read to TV scan, that the TV picture jumped momentarily as if the beam had suddenly shifted. This was followed by the investigation of possible charging of the glass wall in the tube between A_2 and A_2' as a source of the afore-mentioned errors.

The technique of applying heat to a small area of glass to increase its conductivity was used by J. O. Ely to measure the potential of the glass in and around the gap between A_2 and A_2'. An electrostatic voltmeter was connected in series with a variable power supply and used to measure the potential above ground of a spot in the A_2-A_2' gap. The mode of operation was static read of a positive array on a negative background. The power supply voltage was raised until a null was obtained with the voltmeter thus obtaining the potential of the glass. A single error, occurring before the null was obtained, disappeared when the null point was reached.

When the temperature of the spot under investigation was raised, the potential of the spot increased and resulted in the single error recurring in a slow and erratic manner.

Under TV scan, switching the surface completely positive or negative had no measurable effect on the potential of the glass in the area of the spot. Returning the mode of operation to static read of a positive array, no immediate errors occurred and no change in potential was observed.

3.2 Test (continued)

Lowering and then raising the temperature of the spot resulted in a new single intermittent error. The heating supply was removed and the tube allowed to return to normal operating temperatures. After two hours no additional errors were observed. Re-application of heat to the spot resulted in the same potential as that previous to removing the heat. A few errors began occurring intermittently, but no change was evident in the voltmeter indication.

No conclusions were reached at this time.

During the last period a new voltmeter was built for the HG Restoring Current set-up replacing the one built in the previous period and utilizing a circuit which gave better measurements.

(C. L. Corderman)

It has long been realized that areas of the Be mosaic undergo changes in secondary emission when subjected to bombardment by either of the electron beams. In general, a lower SE results; however, increases have also been observed. An exact quantitative description of these changes is complicated by the many variables present of which a few of the more important might be the degree of Be oxidation, the type and amount of residual gas in the tube, and the current density and velocity of bombarding electrons. As a matter of observation, the SE changes taking place in a normal tube operating under computer conditions do not render the tube unsatisfactory for at least 700 hours, which is the average time of operation for 6 of the older tubes now in ES Row. At least one tube, ST142, has had 1400 hours of use and continues to operate in a normal fashion.

Occasionally, however, a tube comes along which, after only several hundred hours of operation, will not hold a positive array of spots at a normal V_{HG} of 100 volts. We are presently engaged in an investigation of the tubes which have failed, both to improve the quality of tubes under construction and to better understand the phenomena taking place in the lower switching process.

As a first step, complete summary sheets have been made by M. Mann for four tubes. They are ST152-1, which failed in positive holding after 570 hours; ST176, which failed after 480 hours; and ST103-1 and ST142 both of which were operating normally after 850 and 1400 hours respectively. As yet, no definite correlation has been established; however, the data tabulated will furnish

3.2 Test (continued)

a ready reference for checking upon tubes which may fail in the future.

We are now planning to combine a TV readout system with the restoring current tester. By using a negative sawtooth on the signal plate, the restoring current to positive areas will be traced out in reverse, while negative areas will be taken below holding-gun cathode potential and will not contribute to the net output current. In this manner, the restoring current either to the array of spots which has been bombarded during normal operation or the background area may be determined separately. The results of these tests should establish whether the failure to hold positive spots is primarily caused by a reduction in secondary emission or by a change in some other property of the mosaic.

Before adding the TV system, however, the restoring current tester is being used by A. Tanguay to determine the effect of the A_1 and A_2 potentials upon restoring current amplitudes and the crossover points, i.e., zero net restoring current. Also A. Stein is checking several tubes in the TV demonstrator to note the effect of these electrode potentials upon the lower stability point for an array of positive spots. Further restoring current tests as a function of V_{HG} will be necessary to have the complete data for a correlation between the lower switching process and the observed restoring current curves.

Restoring current tests have also been completed on a number of RT's and standard ST's to find the most suitable A_2' electrode structure and dag configuration for future storage tubes.

(A. Stein)

One research tube, RT191-1 was pretested and passed.

Special tests were performed on RT143, which has a movable target assembly. The effects of varying the angle of incidence of the holding beam on the target surface were studied.

The demonstrator panel of the TVD was rewired and simplified by the elimination of several gate and delay units.

4.0 INPUT-OUTPUT EQUIPMENT

4.2 Display

(R. E. Hunt)

Work continues on the display unit. A satisfactory method of red light illumination for the dials has been worked out, and incorporated into the design.

A preliminary but complete layout of the cathode ray tube amplifier panel has been made and will go to the drafting room shortly.

The mock up of the proposed display unit is now in room 225, for display and comment.

4.3 Typewriter and Tape Punching Equipment

(J. S. Hanson)

Approximately ninety oscillograph charts have been classified and indexed, and a considerable amount of timing data measured and tabulated. Excessive delay has been found in some of the circuits involving reader translator relays and tape punch selector magnets, and further relay cycling tests will be made in an effort to minimize this delay. A motor driven contactor was built during the past week for this purpose.

4.4 Input-Output Planning

(E. S. Rich)

Some decisions which have yet to be made in the planning of the terminal equipment system are the design of the input-output orders and routing of information between the computer and the I-O register. A memo is being prepared showing our present thinking and outlining alternatives so the possibilities can be examined by the various coding groups and the best ones selected. Work on the I-O system block diagram, however, is not held up. A detailed block diagram of the system containing only those units of terminal equipment which probably will be ready in the next year is being worked out.

5.0 INSTALLATION AND POWER

5.2 Power Supplies and Control

(J. J. Gano)

D-C Plate Supply Alternator: All panels have been installed and cabled. A minor change in the protective circuit and final adjustments and testing of the system should be completed on Saturday.

(R. E. Hunt)

The final draft of a 49 page E note on the WWI Marginal Checking System has been made. This report will be issued to the systems group very shortly. It contains a complete analysis of the system, complete with figures, photographs, reductions of all associated drawings and a trouble location chart.

It is expected that this report will be of considerable aid to the systems group in understanding and maintaining the marginal checking system.

5.3 Video Cabling

(T. Leary)

A steady succession of cable changes (mostly deletions) has necessitated rewiring quite a number of cables and panel schedules. There are about six new cables to be built at the moment.

6.0 BLOCK DIAGRAMS

(J. M. Salzer)

Work is continuing on the in-out orders and in the manner in which they fit in with the present plans on in-out equipment. A memo will be prepared to discuss the various possible forms of in-out orders for consideration by those interested in coding, checking, and input-output. Comments and suggestions will be invited and the final design of these orders decided on that basis.

(R. P. Mayer)

The program Register is now cleared, on TP 8, only on orders that read into storage. Thus a transfer check alarm on TP 8 leaves PR holding the information being transferred.

"Check Register Check" now occurs only on orders cp and sp.

Two proposals for a method of ES Bank Selection have now been sketched for S. H. Dodd.

Block Diagrams (not including control Matrix and Timing Diagrams) have been marked up and turned over to the drafting room.

(G. Cooper)

The major portion of this past period was spent in checking the revisions of the WWI Block Diagrams made by R. P. Mayer. This work has been completed.

7.0 CHECKING METHODS

7.1 Test Problems

(G. Cooper)

A new Test Sequence, TSQ VII, Multiplication Check, has been written and is available as SA-36344. This problem gives a complete check of the equipment required to function in multiplication and, in addition, gives a fairly complete check of addition, subtraction, and shifting, and a partial check of division. It is hoped that an additional Test Sequence will serve to complete the check of the Arithmetic Element, though a third one may be required. Of course, the resulting Sequences can be combined into one larger program and be used with ES instead of TS.

8.0 MATHEMATICS

(C. W. Adams)

A number of programs have been prepared by part-time members of the math group for exploratory and display purposes. One such program plots a polynomial, up to x^7, on a set of decimally-calibrated axes (range -1 to +1), obtains the roots of the polynomial within the range and plots these decimally on the second display scope. Another program enables the computer to play a perfect game of Nim using general rules (each of two players may remove at most m markers from each of at most n piles of markers, and must at least remove one marker from each one pile in each move, object being to remove the last marker). Others permit various kinds of outputs(decimal, sexadecimal, and 6-6-4), which can be used with a conversion program to prepare sexadecimal tapes or 6-6-4 tapes from standard-form tapes. They can also be used to print decimal results, such as a table of trig functions to check the trig function subroutine. Other standard subroutines are being worked on.

These and several other programs are now ready to be tried whenever computer time becomes available.

(J. M. Frankovich)

A simplified version of the Runge-Kutta program for finding eigenvalues of the Schrodinger equation, using double length operations, has been prepared. Insufficient storage is left for maintaining the minimum error possible with this method; however, a tape will be prepared using a potential function tabulated at 66 points.

(J. Porter and F. Helwig)

During the past report period we were able to run off on the computer a solution of the magnetic tape problem suggested by W. Papian, c.f. M-1071. The results of these runs suggested certain modifications in the program which have been incorporated into a new tape.

(1) Intermediate results will be printed. This change will enable us to study the actual solution provided by our method and to compare these with results to be expected.

8.0 MATHEMATICS (continued)

(2) The mesh values employed have been reassessed in order to assure convergence to the solution of the partial differential equation. The desired criterion is still under study but a tentative one has been selected on the basis of results presented in a paper by L. Thomas.

Another method of calculation has been programmed and will also be run. A comparison of results from the two methods should provide useful information for future work.

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-1128	A Proposal for Power and Video Cabling in the New Control Room	4	11-15-50	C. W. Watt
M-1131	Bi-Weekly Report, Project 6345, November 27, 1950	19	11-27-50	
M-1133	Electronic Computer Division Personnel	3	12-1-50	
M-1134	November 1950 Research and Storage Tube Summary	4	12-4-50	M. F. Mann
A-111	Staff Organization	1	12-11-50	J. W. Forrester

Library Files

.004	European Scientific Notes: 1 September, 1950	ONR/London
47	Technical Information Pilot: July 31, October 10, November 3, November 8, 1950	ONR/ Library of Congress
178	Mathematical Tables and Other Aids to Computation: Vol. IV, No. 32, October, 1950	National Research Council
180	Document Office Bulletin: December 1, 1950	RLE/MIT
622	Aerovox Research Worker: October, November, 1950	Aerovox Corp.
884	Progress Report Number 13, Project 6694: December 1, 1950	Servo Lab./MIT
1039	Dynamic Electrostatic Storage Using Williams' Technique. National Bureau of Standards 13.3-4R: October, 1950	W. W. Davis, R. J. Slutz, S. N. Alexander
1040	Acid Pickling of Steel and Effect of Inhibitors. Technical Report No. 66, Redstone Arsenal	K. Hager, M. Rosenthal
1041	Investigation of a Flow-Valve Operating from a Constant-Volume Hydraulic Supply. Engineering Report No. 25, Project 6506: November 15, 1950	E. S. Prohaska, Servo Lab./MIT
1042	Investigation of Reversing Propeller Pitch on a Multi-Engine Aircraft In-Flight. Preprint of a paper presented at the SAE National Aeronautic Meeting, New York, April 17-20, 1950	H. O. Fisher, Curtiss Wright Corp.
1043	Transient Loading of Wide Delta Airfoils at Supersonic Speeds. NAVORD Report 1235, NOTS 295: 13 June, 1950	J. W. Miles

9.2 Standards, Purchasing, and Stock

(H. B. Morley)

Standards

Recent MIL (JAN) Standards issued:

JAN-C-91 - Capacitors, Paper-Dielectric, Fixed (Nonmetallic Cases)

JAN-1-6 - Instruments, Electrical Measuring, Indicating, Basic, Voltmeters and Ammeters

MIL-C-16B- Crystal Unit, Quartz

Procurement and Stock

All items of standard stock are being reviewed and stock replenishment orders being placed to bring stocks up to levels consistent with present delivery schedules.

Samples of Alden Static Magnetic Memory Units manufactured by Alden Products Co. have been ordered for experimental use.

Arrangements are being completed to dispose of some items at Ft. Heath which have been declared surplus to the requirements of this project.

9.3 Construction

(R. A. Osborne)

Production Report

The following items have been completed and inspected since November 24, 1950:

1 Sweep & Unblanking Circuits for 16" Display Scope (Breadboard)

1 Oscillator Circuit for type 420 Power Supply (Breadboard)

1 H.V. Protective Circuit

1 Regulator Panel for D-C Plate Alternator

9.3 Construction (continued)

50 Video Cables for S.T. Reliability

Modifications to 26 video cables

Modification and cleanup of one 6AK5 DCDC FF & GT breadboard

9.4 Drafting

(A. M. Falcione)

1. New Drawings: 420 Input-Output Switch

a) Bus Driver - All drawings are now complete.

b) Switch Panel - Circuit Schematic is complete. Assembly drawing is partially completed.

c) 8-position Matrix - Circuit Schematic is complete. Assembly and Al. Panel now being done. Both to be completed next week.

d) Flexowriter Matrix - Circuit Schematic is partially completed. Assembly drawing to follow.

2. D-C Input-Output Register (403) Circuit Schematic and preliminary Assembly drawings are complete.

3. An aid to making Slide drawings is now complete. Drawing C36333 which is self explanatory specifies the exact proportions and lettering sizes to be used for all future drawings to be made for slide reproduction. This guide should eliminate any future discrepancies on slide drawings.

4. The drafting load is heavy and is expected to remain at this level for some time.

10.0 GENERAL

(J. C. Proctor)

New Non-Staff

Mr. Robert H. Squarebrigs is a new junior technician in the Whirlwind Systems Group. He is a graduate of the Massachusetts Radio and Telegraph School and Massachusetts Trades Shops and Schools of Boston where he received radio and television instruction.

(J. W. Forrester)

The development of the computer and the objectives of the project have reached a point where some re-assignment of responsibilities among our senior engineers seems desirable. These changes are effective immediately.

S. H. Dodd, reporting to the Project Supervisor, will have full charge of the operation of the Whirlwind computer. This includes scheduling of computer time between maintenance, testing of new equipment, and use of the machine by the applications groups. Dodd will give final engineering approval for all computer modifications, and will be responsible for drawings and records. Fahnestock, as before, will countersign modifications as they may affect shop load and procurement. Watt's group will assist Dodd in Whirlwind power maintenance and installation.

N. H. Taylor, reporting to the Project Supervisor, will have charge of new engineering design. As before, this will include the work in Rich's group on terminal equipment. He will also consider major computer modifications, long range planning for redesign, and the engineering aspects of the application and integration of the computer to other systems. In the near future he will be making a study of other existing or proposed computers.