Project Whirlwind
Servomechanisms Laboratory
Massachusetts Institute of Technology
Cambridge, Massachusetts

SUBJECT: BI-WEEKLY REPORT, PART II, MARCH 19, 1948

To: 6345 Engineers

From: Jay W. Forrester

6.0 MATHEMATICS

(P. Franklin)

Work on programs for double length division, iterative procedures for simultaneous linear equations, and curve fitting continues. In curve fitting by expansions in Legendre polynomials, a number of points increasing with the order must be used to give the coefficients of the higher order terms accurately.

(M. Daniloff)

It was found that simulation of aerodynamic coefficients by means of Lagendre polynomials does not give sufficiently accurate results, particularly at both ends of the range of fitting, unless the number of points used is greatly increased in the case of polynomials of orders higher than the second. The reason for this seems to be the haphazard weighing of ordinate caused by Simpson's scheme of evaluating definite integrals. The following schedule is tentatively suggested for securing four-place accuracy. The independent variable t being normalised $(-1 \leq t \leq +1)$, the width of interval δt and number of variates used are:

Order of Legendre Polynomial $P_n(t)$	δt	No. of Variates*
0 - 2 incl.	0,200	11
3	0,100	21
4	0,050	41
5	0,020	101

*This number must be odd.

It now has become certain that simulation of aerodynamic coefficients with an accuracy of 1% or better can be achieved either through the use of the Newton-Cotes interpolation or

6.0 MATHEMATICS (Continued)

or by the use of Legendre's polynomials. However, the procedure to be prescribed for the machine in selecting the proper degree of the approximating polynomial is a matter of some concern since this requires rather subtle scanning.

(E. Reich)

Work on iterative methods for the solution of systems of linear algebraic equations is being continued. The most promising method so far seems to be Seidel's method (P. L. Seidel, "Iteration in Einzelschritten," Munch. Ak., 1874). Seidel's method is as follows:

Let the given system be:

$$\sum_{j=1}^{n} a_{ij} x_j - b_i = 0 \qquad (i = 1, 2, \ldots n)$$

$$a_{ij} = a_{ji}$$

$[a_{ij}]$ positive definite

The components of $x^{(v+1)}$, the $(v+1)^{st}$ approximation vector, with the exception of the Kth component, $x_k^{(v+1)}$, are the same as the components of the vth approximation vector, $x^{(v)}$. The value of $x_k^{(v+1)}$ is obtained from the already computed vector $x^{(v)}$ in such a way that

$$\sum_{\substack{j=1 \\ j \neq K}}^{n} a_{Kj} x_j^{(v)} + a_{KK} x_K^{(v+1)} - b_K = 0$$

K is selected as follows:

For the iteration from $x^{(1)}$ to $x^{(2)}$, K = 1.

If for the iteration from $x^{(v)}$ to $x^{(v+1)}$ we had $K = \kappa$, then in the iteration from $x^{(v+1)}$ to $x^{(v+2)}$

$$K = \begin{cases} \kappa + 1 & \text{if } \kappa \neq n - 1 \\ 1 & \text{if } \kappa = n \end{cases}$$

(C. Adams)

Work on coding various elementary operations, such as double length operations, continues slowly but without any serious delays. A memorandum describing double length operations, promised in the March 5 report should be forthcoming soon. It has been delayed because handling of scale factor in double length division appears to take an excessive number of orders and more thought is being given to the problem.

7.0 INPUT AND OUTPUT

7.3 Binary to Analog Conversion

(E. W. Sard)

A rough draft of a master's thesis proposal has been submitted to my thesis supervisor, Professor Zimmermann, for approval. The title of the thesis is proposed as "Conversion of Binary Pulse Code to Voltage Amplitude." The thesis will investigate how accurately the conversion of a 7-digit parallel binary code is made by a scheme outlined in the proposal. A restriction on the method of conversion is that the voltage amplitude has to be held for a time roughly 5,000 times as long as the time for conversion of the smallest binary number.

7.4 Magnetic Recording

(Edwin S. Rich)

A circuit that will convert the double-swing pulses from the playback head of the magnetic recording equipment into single pulses of the proper polarity has been built and partially tested. The results obtained thus far indicate that the circuit will be satisfactory when properly adjusted. Further information on resolution of recorded signals can be obtained as soon as this adjustment is completed.

The second model of a static reading head has been completed, a bridge circuit for use with this head has been built. Initial tests indicate that a strongly magnetized spot on the tape will produce an output voltage from the bridge that is about 30 db. above that at balance. However, it was found that variations in the level of the 1,000 cps. signal applied to the bridge caused by line voltage fluctuations produced marked variations in the output voltage from the bridge. An attempt will be made to improve the stability of the circuit in this respect.

7.6 Output Printers

(Frederic A. Foss)

The problems associated with the synchronization of the teletype printer operation with the digit switching operation have been further considered.

A breadboard register circuit, used to energize the relays in the relay selector circuit, has been built and tested. Its performance was satisfactory and the construction of this register and associated relay circuits will now commence.

8.0 STORAGE TUBES

8.1 Tube Construction and Testing

8.11 Tube Construction and Processing

(J.H.McCusker, T.F.Clough and P. Youtz)

A research tube to study the characteristics of a new type of holding gun was processed satisfactorily and tested. This type of holding gun will be used in the first five-inch storage tube. Two new-type research tubes to study SE characteristics of surfaces were processed and tested to show feasibility of this type of tube. A third tube to study SE characteristics of Beryllium was processed.

Considerable experimentation with components and techniques for five-inch tubes was performed during this period.

It will be necessary to use dry nitrogen to flood the five-inch tubes during certain phases of the tube construction.

W.E.Pickett, a glassblower, has joined the vacuum tube laboratory. N.Zimbel, a physics major at M.I.T., is working part-time and assisting with tube processing. I.Paulsen, an instrument-maker, joined us and will be making tube components and building jigs.

(F.H.Caswell)

Experimentation with precipitated Calcium Tungstate on the large signal plates has been successful. The signal plate for the first large storage tube can now be precipitated and final assembly begun. The first of the large storage tubes has been designated ST25.

Exploded views of ST25 have been photographed for our files.

Machined parts for the second large storage tube have been received from the machine shop. Complete components for the storage structure of this tube are now on hand.

Elements were fabricated and assembled for four research tubes during the past two weeks.

With the addition of another technician to the tube component construction group we intend to make jigs to facilitate component assembly and to machine the greater part of storage tube components.

(R.Shaw)

Memorandum No. M-273 describes creep tests of aluminum signal plate.

Parts for two signal plate assemblies are in the storage tube laboratory. Two sets of parts of a modified design are being made and will be completed during the first week of April. Sketches are being prepared of further modifications. In addition to changes of design, changes of assembly technique are being considered in order to improve the flatness of the screen.

Dies for nonex stem vertical sealing equipment have been completed and are considered satisfactory.

8.12 Tube Testing

(S.H.Dodd)

Mod. 18 characteristics were measured to act as reference data for other calcium tungstate storage tubes. Holding gun potential for optimum performance is quite critical (-295 ± 5 volts). Repetition rates of 500 cps with 40 μs pulses can be used for one minute for writing plus or minus without affecting adjacent spots. Storage must be with a negative background. Even with single shot operation, the tube cannot be used with a positive background.

Preliminary tests have been made on Mod 18B but as yet no definite data is available.

(M.I.Florencourt)

The fourth in a series of holding gun research tubes, RT12A, was tested. This tube is a duplicate of RT12 and was made to check the results obtained on RT12. Total current for 1000 volts initial accelerating potential was 400 μa. Fairly satisfactory uniformity and area of covering were obtained. A duplicate of this holding-gun will be used in the first five-inch-diameter storage tube. More information on this tube and the first three holding-gun research tubes is contained in Memorandum M-290.

8.13 Storage Tube Demonstration

(W.J.Nolan)

Circuits necessary for the operation of the EST Demonstrator have been tried out. A few days will be required to permit building some of the indicated changes into the equipment.

(J.S.Rochefort)

Checked out High Voltage Power Supply (Model 11) and Holding Gun Power Supply. The High Voltage Power Supply meets all specifications, and the Holding Gun Supply falls within expected performance.

8.2 Storage Tube Research

8.21 Surface Material Characteristics

(H.L.Heydt and J.H.McCusker)

It is planned to make all future secondary emission measurements in a new type of tube containing merely (1) an electron gun with deflection plates removed and with separate external connection to the second grid, and (2) a storage surface and signal plate. Since the second anode potential in such a tube chiefly determines the primary electron velocity, it is hoped that good beam current and focus may be obtained for all values of second anode potential by proper control of the second grid and first anode potentials. To investigate this matter, research tubes RT11 and RT13, similar in nature to the type tube just outlined, were studied.

RT11 provided visual indication of beam intensity, position and focus, while RT13 provided additionally for electrical measurement of beam current. Results seem to indicate that if the second grid and first anode potentials are fixed at particular values, then beam focus, positioning and current will be adequate for all values of second anode potential. At low second anode potentials, however, the fluorescence of willemite is slight and visual observations of focus and positioning cannot be completely relied upon. Consequently, another special research tube is to be prepared to electrically check the focus as observed in RT13. In the meantime it will be assumed that the new type of research tube is satisfactory for making secondary emission measurements.

One of the new type research tubes containing a storage surface of beryllium on Al_2O_3 has been prepared and soon will be subjected to secondary emission tests. Plans for revising the secondary emission test set-up and life rack to accommodate the new type research tubes are also under way.

(W.J.Nolan)

Preliminary designs have been made for a set-up to conduct life tests on the emitting surfaces of the 931-A phototube.

8.23 Output System Circuits

(C.H.R.Campling)

Breadboards for all but one of the proposed output-circuits have been completed and await testing. The three experimental pulse-transformers which were ordered from the New England Transformer Corporation have been delivered.

Power from the laboratory common supply has become available at the test benches in Room 219, and two modified Western Electric power supplies have been installed to provide a regulated 500-volt supply.

Tests on the gate amplifier which is to be used for signal-plate switching have shown that operation with the non-regulated supply causes voltage jitter at the output from the power tube. At present a PI power supply is being used. The output gate has a rise-time of about 1/4 microsecond and a fall-time of about 3/4 microsecond. The desired amplitude of about 200 volts is easily obtainable, but there has been some difficulty in securing good amplitude control.

A low-power gate-amplifier for clamp-circuit switching has also been constructed and tested. It appears to be satisfactory.

8.3 Unclassified

(M.I.Florencourt)

Memorandum M-303 containing an index to the photographs taken of the storage tube program has been issued. Prints of all the photographs taken may be seen in Room 220.

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Test Equipment Replacement Tubes

(S.H.Dodd)

The stock room is only keeping minimum quantities of those tubes specified as standard in Section 6.20 of the Standards Book. Some of the tubes used in test equipment have not been included in this list. A survey of test equipment in the Storage Tube Laboratory was made and additions and changes in the standard list were recommended to S. Abbott. This survey did not include commercial test equipment.

Visitors

(S.H.Dodd)

Dr. Edward W. Sampson, Mr. Horst Feistel, Mr. Edmund S. Staples, and Mr. John V. Harrington of Cambridge Field Station visited us for a discussion of storage tubes. The operation of our tube was discussed and a demonstration given.

8.4 Deflection Circuits

(J.O.Ely)

Circuit schematics of a 32-position deflection-voltage generator for demonstration use have been completed in sketch form. Subpanel assembly-layout sketches for the three types of subpanel required have been completed. One subpanel, containing one complete increment-switching circuit, has been wired and mounted on an aluminum panel so that tests can be started. Work of laying out the aluminum panel for the complete deflection-voltage generator is underway. Construction of subpanel assemblies is progressing satisfactorily in the electronics shop. Scheduled date of completion of this unit may not be met, since almost one week was consumed in constructing the first increment-switch. Tests performed on the single subpanel will be of such a nature, however, that the overall schedule will not be materially affected.

A report describing the design of this unit and giving results of tests to date has been begun and will be released, probably, within the next two-week period.

Tests of the increment-switch panel are being held up by lack of suitable test equipment. Units needed are trigger mixers, delayed-pulse generators, and push-button pulse generators.

8.4 Deflection Circuits (cont'd)

Drawings relating to the work so far are:

SR-39607-1 (3 sheets)
SD-31719-2
SD-31722

(Louis J. Nardone)

Tests on the output amplifier for the deflection voltage generator were completed. Results showed a voltage swing of 106 volts. A curve of voltage output vs. binary number was very nearly linear. There was a 12.5% difference between the slope at N=1 and N=31.

Preliminary design tests on the eights increment of the deflection voltage generator are in progress. The unit is functioning properly. Voltage and time measurements will be made.

9.0 SERVOS AND SIMULATION

9.1 Cockpit

9.11 Cockpit Structure

(H.R.Boyd)

Part of a B-24 fuselage is now being shipped to Special Devices at Port Washington. When it arrives, we will look it over and remove items that we would like to use in our breadb and cockpit and have them shipped here.

(E.S.Prohaska)

Design of the hydraulic pistons for control force loading is nearly completed.

Baldwin-Southwork, Type C-14, resistance strain gages have been selected for control-force measurement, and methods of mounting and shielding the gages are being studied.

9.13 Control Force Loading

(C.G.Eaton)

Dynamic tests of the differential-pressure regulator have been made, and an analysis of the test results has been started. It appears at present that the regulator performs very well in the steady-state but the dynamics of the system need further investigation.

9.2 Sampling Servo Stability Study

(W.K.Linvill)

Thus far no simplified analysis used yielded more familiar transfer functions than those obtained by Hurewicz. Since

$$\frac{\theta_o}{\theta_i}(s) = \frac{KG}{1+KG}$$

the KG functions obtained by Hurewicz yield $\frac{\theta_o}{\theta_i}(s)$ functions which are hard to interpret in terms of overall system response. Rather than to attempt further simplification of the analysis, an attempt will be made to approximate the Hurewicz functions by functions easier to interpret.

10.0 TRAINING

10.1 Seminar Series

(R.P.Mayer)

The present seminar series is being recorded and will eventually be issued.

The past lectures are in various stages of preparation. It is hoped that time will be found during the next two-week period to prepare and issue a few of the earlier lectures.

(R.R.Everett)

The WW seminar continues to meet in the basement lecture room at 3:10 PM Mondays and Wednesdays. Preliminary considerations, binary arithmetic, and the WWI code have been covered thus far. A consideration of the actual computer block diagrams will start next week.

Because of lack of editing time, the notes for previous seminars are still in rough draft form. Rollin Mayer has taken over the job of editing.

11.0 FACILITIES AND CENTRAL SERVICE

11.1 Publications

(J. N. Ulman, Jr.) The following material has been received in the Library, Room 217, and is available to 6345 Personnel.

6345 Reports
Summary Report No. 3

E-103	Ion Current Measurements in 7AK7 Tubes	M. Hayes
E-104	Basic Circuits	J. A. O'Brien
E-105	Power Requirements for WWI	H. S. Lee
E-106	IN38 Germanium Crystal Diode Rating Tests	R. L. Ellis
M-225	Theory of Secondary Electron Emission from Metals (Translation)	M. Florencourt
M-259	Lock-In Tube Sockets	J. W. Forrester
M-260	Communications Between the Servo Laboratory and Sylvania	J. W. Forrester
M-261	WWI Flip-Flop Storage Layout Authorization	H. Fahnestock
M-262	Power Supplies and Distribution Conference	J. W. Forrester
M-263	WWI Specification Distribution	H. Fahnestock
M-264	Eastman Conference, March 2, 1948	H. R. Boyd
M-265	Visit to Sylvania on Feb. 24, 1948	C. W. Watt
M-266	Accumulator Prototype Construction Authorization	H. Fahnestock
M-267	Bi-Weekly Report, Part I, Mar. 5, 1948	J. W. Forrester
M-268	Bi-Weekly Report, Part II, Mar. 5, 1948	J. W. Forrester
M-269	Design Data Needed By Sylvania to Complete Rack Design	C. W. Watt
M-270	Thesis Proposals and Progress Reports	J. W. Forrester
M-271	Progress Report: High Speed Pulse Recording on Magnetic Tape	E. S. Rich
M-272	Use of Termination Notices in the Barta Building	H. R. Boyd
M-273	Creep Test of 5" Anodized Storage Surface	R. Shaw
M-274	Crystal-Rectifier Requirements	D. R. Brown
M-275	Meeting of Electronics Group, Feb. 20 and 26, 1948	N. H. Taylor
M-276	Tube Construction and Test Program of the Storage Tube Group	(S. H. Dodd (W. J. Nolan (P. Youtz
M-277	Layout of Program Counter	H. Fahnestock
M-278	Proposal-Multiplier Cabling	H. Fahnestock
M-279	Layout of Program Register	H. Fahnestock

M-280	Bus Driver Panels	H. Fahnestock
M-281	Layout of Check Register	H. Fahnestock
M-282	Power Supply Change	H. Kenosian
M-283	B-Register Prototype Drawing Authorization	H. Fahnestock
M-284	Power Fusing	C. W. Watt
M-285	Power Supply Proposal No. I	H. R. Boyd
M-286	Handling of Sylvania Drawings	C. W. Watt
M-287-1	Project Whirlwind Seminar Schedule March 10 - April 14	R. R. Everett
M-288	Crystal Tester Construction	H. Fahnestock
M-289	Progress Report: A Storage Tube Output System	C. Campling
M-290	Holding-Gun Research Tubes	M. Florencourt
M-291	Modification of Program Counter	H. Fahnestock
M-292	Requirements for Voltage Variation Panels	C. W. Watt
M-294	Proposed Panel-Selection Circuit	E. S. Rich
M-295	Investigation of 7AK7 Processing, Emporium, Pa. Mar. 2, 1948	D. R. Brown
M-296	Arithmetic Control, Design and Construction	H. Fahnestock
M-297	Designation of Video Jacks on Circuit Schematics	C. W. Watt
M-298	Pulse Transformer Delivery	H. Fahnestock
M-299	Whirlwind I Heater Grounds	H. Fahnestock
M-300	Flip-Flop Storage Register Prototype Drawing Authorization	H. Fahnestock
M-301	Approval of Components for WWI	C. W. Watt
M-302	Quantity of Aluminum Channel Required for WWI Installation	C. W. Watt
M-303	Photographs of Storage Tube Program	M. Florencourt
M-304	Whirlwind I Standards: Construction of Test Equipment	H. Fahnestock

Library Files

52	Progress Report for Electronic Digital Computer for Period February 13 to February 27, 1948	Sylvania
.004	European Scientific Notes (Formerly London Newsletter) Feb. 1, 1948	
.004	European Scientific Notes, Feb. 1, 1948	
Book	Servomechanism Fundamentals	Lauer, Lesnick, and Matson

11.2 Standards Committee

(S. Abbott)

The following specification (M.I.T.) has been approved and will be distributed:

Class P6.19 Transformers

An inventory of non-standard transformers in stock is being prepared.

(C. W. Watt)

Several discussions have been held during the past two weeks with representatives of the Waltham Horological Company about power connectors for the WWI panels. Two or three designs have been submitted by them. A decision has not yet been made as to which kind to use.

(Hugh R. Boyd)

A new Standards Committee consisting of C. W. Watt, Chairman, H. B. Morley, and R. S. Fallows of Sylvania, has recently been formed. This committee will make decisions on components for use in WWI. This committee will not only approve all components to be used in WWI but will have the added responsibility of trying to anticipate needs insofar as possible and will investigate suitable components for all applications. They can make a good contribution only if all persons concerned with the program give them as much cooperation and advance information on component problems as possible.

(C. W. Watt)

The WWI Standards Committee, composed of Watt and Morley of M.I.T. and Fallows of Sylvania, has begun the consideration of components for WWI. The expected activities of this committee are listed in Memorandum M-301 entitled "Approval of Components for WWI". It is requested that everyone read this memo and submit to Watt, specifications, samples, or descriptions of all components that will be required which are not already covered in the 7.0 Series of specifications in laboratory standards book. The following WWI specifications were acted upon and are now ready for approval by Tahnestock & Stevens:

S7.077	Fastners, Quick Acting (Airlock)
P7.082	Insulating Materials, Linen Base Bakelite
P7.082	Insulating Materials, Extruded Vinylite Tubing
P7.074	Elastic Stop Nuts
P7.185	Turret Lugs
P7.185	Stand Off Spacers-Rivet Type

Particular attention will be paid to components by those

members of the laboratory attending the IRE during the coming week. Certain components such as sockets, power connectors, and wiring material will be especially noted with the hope that improvements in the present standards can be made.

11.3 Purchasing - Stock

(Hugh R. Boyd)

Mr. Morley has recently placed an order for a complete stock of 5% tolerance mica capacitors and 1 and 2 watt composition resistors. Where these high tolerance units are desirable, quantities of equipment are being made and it is desired to maintain as much uniformity as possible. For most laboratory applications, it is agreed that 10% tolerance capacitors and resistors are satisfactory. Because of the high cost of 5% tolerance components, it is desirable that 10% components be used as much as possible for experimental applications but this should not be followed to the extent of increasing engineering or testing time.

(H. B. Morley)

A complete stock of mica capacitors and resistors (1 and 2 watt), 5% tolerance, will be requisitioned for addition to the present stock.

A recent shipment of RF chokes from C.T.C. has been treated with a special impregnating compound. It is believed this will be satisfactory as a standard treatment for all sizes and types of RF chokes, and may possibly be of value for impregnating pulse transformers and other components.

Quantity orders have been placed for material for the Test Equipment program, such as 6-wire cable, Jones plugs and sockets, hardware, etc.

It is becoming increasingly important that engineers anticipate material requirements for construction programs, and advise this section so that adequate stock can be ordered.

11.4 Electronic Construction

(Robert H. Murch)

The following jobs and units are in the Electronics Laboratory for construction.

1. 10 DC Bench Outlet Boxes.
   6 of these have been completed. The other 4 are being held until a relay is available so that a control for +500 volts can be added to them.

2. Modifications to Single Pulse Synchronizers.
This job is being held until it is approved by Test Equipment Committee.

3. Modifications to a P-5 Synchroscope to to make a two-gun scope.

4. Clock and Restorer Pulse Source.
This unit has been completed and is ready for test with a temporary installation of internal coax cables. A permanent installation will be made when the coax cable terminators D-97B become available.

5. 25 Adapter Sockets.
13 of these have been completed. The balance will be completed when Amphenol Shells are received.

6. Layout and Design of Rack Power Control Unit (Mod. 2).
Layouts for this Unit will be completed today and submitted to Test Equipment Committee for approval of Proto-Type Construction.

7. 10 AC Circuit Breaker Boxes.
These have been completed except for installation of Pilot light sockets which are out of stock.

8. 2 Flip-Flop Register Breadboards.
These breadboards are under construction.

9. Experimental Binary Counter 2:1 and 4:1.
This unit is under construction and will be completed about March 25, if IN34 crystals and 3/4 inch C.T.C. Mounting posts come in by March 22.

10. Deflection-Voltage Generator.
This unit is under construction and will be completed in about 2 weeks.

11. Accumulator Prototype.
Construction drawing being incomplete, should start Monday, March 22.

12. Restorer and Push-Button Pulse Generator.
This is part of Time Pulse Distributor.
IN34 Crystals are needed for this job.

13. Line Driver Breadboard.
This will be completed March 20.

11.4 Electronic Construction (Continued)

14. Flip-Flop Breadboard.
IN34 crystals are needed.

15. 3 Whiffletree Electronic Switches.
These will be started soon.

There is about 2 1/2 weeks work in the Electronic Lab. This does not include the machine work on the panels for jobs number 10 and 11, which will be done in the Mechanical Shop. The following is a list of parts that are out of stock and needed for jobs in the Lab.

Coax Cable Terminators D-97B
Amphenol Shells
Drake 60N Pilot light sockets
3/4 inch C.T.C. mounting posts
IN34 crystals
1 inch octol sockets
1 μs Delay Lines

(F. H. Caswell)

Air and gas pipe installation has been completed on the new glass working bench.

Oxygen manifolds, under construction in the machine shop, will be installed on this bench when completed.

The full time of one technician was utilized in work on glass working bench and the full time of another in electronic construction.

(A.J. Taylor)

Fifty vacuum tube life test panels are under construction. So far this is absorbing 30% of available man-hours. Completion of the units is scheduled for May 5.

11.5 Drafting

(Hugh R. Boyd)

A-34 on drafting procedures is being revised as follows:

Drawings may now be sent out of the building without being graded if attached to a memorandum. No registering or change notice follow-up will be made on copies of graded drawings which are part of memorandums. This revision is being made to reduce the red tape and relieve the confusion caused by the statement in A-34 which required all drawings sent out of the Barta Building to be graded and registration records kept.

11.5 Drafting (Continued)

(A. M. Falcione)

1. With reference to comments in bi-weekly report dated February 6, 1948, regarding Albanene paper which was believed to be defective, it is advised that a report from B. L. Makepeace indicates the following.

a. Tests show that our "D" size paper is below standard in color and transparency.

b. Irregularity exists from standard in the pencil erasing qualities. To produce the best results, the best type of eraser to use on Albanene is the A. W. Faber Pink Pearl.

c. Arrangements are being made to return this defective paper to B. L. Makepeace for replacement.

d. Samples of our "A" and "B" size paper will also be submitted for laboratory tests.

2. In regard to prints of Sylvania drawings coming to M.I.T., there has been no central point to which prints are delivered, which, as the tempo increases, will cause much confusion and delay. Arrangements are being made with Sylvania to send all sepias to the Print Room, Attention of Mrs. K. Richardson. These sepias will be handled in the same manner as our graded d awings. A memorandum is being written on this subject for information purposes.

11.6 Unclassified

(A. J. Taylor)

The machine shop is applying 75% of the available time to the manufacture of storage tube parts.

The rest of the time is being used for general machine work on special parts for electronic equipment.

12.0 GENERAL

(J. C. Proctor)

New Staff Personnel:

Walter S. Rogers, DIC staff member, to work on the WWI installation program. Mr. Rogers studied engineering at Princeton. He worked with United Shoe Machinery before the war, and served with the Navy from 1941-1947 in DF stations in this country and as radio materiel officer in the Pacific, leaving the service with the rank of Commander. He has been active in amateur radio since 1911.

Robert H. Gould, DIC staff member, to work on video circuits. Mr. Gould is a graduate of MIT, February 1948, S.B. Electrical Engineering. He served with the Navy 1944-1946.

(H. R. Boyd)

New Non-Staff Personnel:

Christinakos, M. M. - Janitor, transferred from Building 32 to Barta Building.

Haynes, Lyndon B. - Sheet Metal Worker working in machine shop. Mr. Haynes'early years were spent in New Hampshire, and he worked at a U.S. Naval Torpedo Station during the war.

Ladner, Mrs. Elizabeth S. - Engineering Secretary for the Storage Tube Group. Mrs. Ladner attended Wheaton College and Radcliffe College. She is a graduate of the Fisher School of Boston.

Paulsen, Ingvar - Sr. Mech. Tech. Mr. Paulsen's early years were spent in Norway. He attended Mass. Univ. Extension and Franklin Union. He worked at the Harvard University,Radiation Laboratory, and had his own radio business for 25 years.

Pickett, William E. - Glass Blower. Mr. Pickett hails from New York and is working with Pat Youtz and his group. He attended Syracuse University nights for two years. He formerly worked for the Utica Tube Works.

Zimbel, Norman S. - Technician for Vacuum Tube Group. Mr. Zimbel is a present a student at MIT and will be working part time until July 1st. He expects to complete his course at MIT in June of this year.

12.0 GENERAL (Continued)

(H. R. Boyd)

The following terminations have taken place during the past two weeks:

D. Grundberg
Aileen Harvey (Transferred to Main Building)
Peter Darvarris (Transferred to Building 20)
Martin Navison
Anne Narota
Mark Flomenhoft
Daphne Murray (Transferred to Main Building)

(H. Fahnestock)

Add to Bi-Weekly Report Decimal Classifications: Section 1.25 Time Schedules.