Project Whirlwind
Servomechanisms Laboratory
Massachusetts Institute of Technology
Cambridge, Massachusetts

SUBJECT: BI-WEEKLY REPORT, Project 6345, February 2, 1951

To: Jay W. Forrester

From: Project Whirlwind Staff

1.0 SYSTEMS TESTS

1.1 Whirlwind I Systems Test

(S. H.Dodd)

During the last two weeks most of the effort of the Whirlwind Group has been aimed towards improving electrostatic storage reliability. Two approaches to this problem were tried:

1. The electrode voltages of several of the digit columns were changed to provide 0 voltage across the glass separation between the 2nd and 3rd anode dags. This was an effort to prevent glass charging.
2. Tubes which are completely coated with dag on the inside, called 300-series tubes, are being constructed to replace the 100-series tubes, thus preventing glass charging by eliminating all glass surfaces. Five of the 100-series tubes were replaced, during the last two weeks, by all-dag tubes.

An effort was made to reduce the number of electrons reaching the glass opening between the 2nd and 3rd anode by increased bias on the holding gun. This effort was unsuccessful because of non-uniform centering of the holding gun on the target, but most of the glass charging problems seem to have been eliminated by the two expedients mentioned above.

By the end of this bi-weekly period all the tubes in ES Row were either all-dag 300-series tubes or 100-series tubes with A2 and A3 at the same voltage. The resultant increase in reliability has been very gratifying with very much better success in program operation reported by the applications group.

Two of the old 100-series tubes required an increased V_{HG}, thus indicating a tendency toward aging of the target surface.

1.1 Whirlwind I Systems Test (continued)

(T. Leary)

The Start Clock Synchronizer mentioned in the last bi-weekly should be soon in operation in rack C14. Comparison Register #31 has been modified for use as the ES Cycle Alarm panel and will be mounted in rack AX7 as soon as the power wiring for it is installed there. This will make possible the elimination of the rack of test gear now located by EX5.

Marginal Checking - The keeping of records on the marginal checking excursions set-in for Test Program IIE, and the preventive maintenance resulting from inspection of these records, has produced some useful results. The February monthly flip-flop complement tests failed to show up any bad flip-flops. This is presumably because of the closer attention being paid to the daily marginal checking results.

(H. F. Mercer)

Component Failures in WWI

The following failures of electrical components have been reported since January 19, 1951:

Component	No. of Failures	Hours of Operation	Reason for Failure
Crystals			
D-357	1	5510	High Forward Resistance
	2	4467	Low R_b
D-358	14 *	4000-5000	11 - Drift
		4575	1 - Drift
		4765	1 - Drift
		4831	1 - Drift
	* 11 of the 14 D-358 crystal failures were in the S.D.D.		
1N38a	1	1106	Low R_b
Tubes			
7AD7	2	5811	Low I_b
	2	5147	1 - Mechanical 1 - Low I_b
	2	2965	1 - Mechanical 1 - Low I_b
	1	5689	Low I_b
	2	2990	Mechanical

1.1 Whirlwind I Systems Test (continued)

Tubes	No. of Failures	Hours of Operation	Reason for Failure
7AD7	2	4273	1 - Mechanical 1 - Low I_b
7AK7	1	4732	Mechanical
6AG7	1	3848	Low I_b
6SN7	1	5632	Mechanical

1.2 Five Digit Multiplier

(C. N. Paskauskas)

The multiplier has been operating for a period of 55 days without error.

At about 2005 1 February 1951 a momentary power interruption caused the Laboratory -150 V power supply to drop out. When operation was restored both the multiplier and WWI bias supplies were high and had to be brought back to normal.

At 0255 2 February 1951 the line voltage dropped to about 100 V which caused a drop of several volts in multiplier bias voltages. The multiplier made continuous errors until 0807 2 February 1951.

These errors were not due to any malfunction of the multiplier so were not charged against it.

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

1 D-358 clamp crystal
2 7AD7 F.F. Tubes in SC-1 (removed for retest)

2.0 CIRCUITS AND COMPONENTS

2.1 Circuits by System Number

(R. L. Best)

403 In-Out Register

A new flip-flop has been designed for this register, using 7AD7's in place of 6AN5's. The circuit is higher impedance than the previous 6AN5 one, but it will drive a 3 gate-tube load on one side with 0.2 microsecond rise time. The output varies from 0 to -16 volts; the plate swing is 45 volts; the screens are tied to ground, and may be used for marginal checking, and the load on the -150 volt supply is only 27 ma. The plate swing is large enough to drive indicator lights directly. The flip-flop runs satisfactorily at 4mc.

(W. J. Nolan)

835 BS Drivers

Work on the new r-f pulser is now progressing satisfactorily. Both the r-f section chassis and the video section panel have been constructed and are now being wired. The only major remaining pieces of sheet metal work are the enclosure and covers for the r-f section, and several small brackets.

All of the major parts of the new pulser have now been breadboarded and found to work. Some of the accessory parts, such as the alarm for incorrect pulse amplitude can not be checked until the unit is built in its final form and shielded more thoroughly than is possible with a breadboard.

2.5 Tubes and Components

(H. B. Frost)

An E-note describing the Vacuum Tube Pulse Current Tester has been written. It is expected that this report will be issued as soon as the necessary drawings are completed.

Tests have recently been made in WWI to produce flip-flop failure by reducing heater voltage. These runs have been

2.5 Tubes and Components (continued)

compared with the margins in the usual flip-flop complement test. There was no correlation in the four cases which were compared.

The short and leakage testers in the vacuum tube test shop have been modified. As defined by JAN specs, a leak must have a resistance of 10 megohms or lower. Thus, the short and leakage testers have been modified so that leaks of this resistance or lower will register as shorts using the thyratron section. Leaks of higher resistance will still be shown as before on the neon bulb directly. This modification will make determination of which tubes should be returned to the manufacturers somewhat easier.

A breakdown was prepared of 6AN5 failures in d-c register panels. In a total of 76 sockets, 23 tubes have failed. Seventeen of these failures were shorts and tap shorts. Although the total number of failures is not excessive for the period of time involved (about 5000 hours), the number of failures from tap shorts and shorts is somewhat greater than desirable.

2.7 Three-Dimensional Magnetic Storage

(W. N. Papian)

Messrs. D. J. Epstein and B.A. Calhoun of the Insulation Lab (MIT) visited us to discuss the development program in the magnetic ferrites. Mr. Epstein wants to find a doctoral thesis in an investigation into the high-frequency and short-time phenomena associated with the responses of these materials. The discussion centered around the eddy-current shielding problem. It looks as though this very important effect has been overlooked in many of the high-frequency studies on the ferrites to date, with resultant data that makes it appear as though the true permeability of these materials starts drooping at lower frequencies.

Further thought will be given to this aspect of the problem. They are quite interested in the fact that we are trying to solve the non-linear eddy-current shielding equation on Whirlwind, and believe the results will be of value in the investigation.

3.0 STORAGE TUBES

3.1 Construction

(P. Youtz)

Seven storage tubes, ST-313, ST-314-1, ST-315-2, ST-316, ST-317-1, ST-318 and ST-319, designed to minimize the drift of the high velocity beam resulting from charged glass surfaces, were constructed for use in the Whirlwind computer. In these tubes, the glass was completely dagged and the holding gun had a 1-1/2 inch diameter metal A_2 cylinder. These tubes will replace the tubes in ES row which have undagged glass. Since the all-dag tubes are operating satisfactorily in ES row, we will continue to construct a series of these tubes.

3.2 Test

(A. Stein)

Pretests were conducted on the television demonstrator unit. The following tubes were pretested and passed:

ST-313
ST-314-1
RT-199

ST-312 was passed marginally due to poor storage surface leakage.

The following tubes were disposal-tested:

ST-142
ST-184
ST-166

The second half of this bi-weekly period was spent on vacation.

(H. J. Platt)

The following tubes were passed for use in WWI: ST-310, ST-312, ST-313, and ST-314-1.

A much needed change in the STRT was made. A filament power panel was moved about twelve feet closer to the rack it was supplying, thereby eliminating marginal

3.2 Test (continued)

operation of several gate and delay units caused by low filament voltage.

Several units were built for the new spot potential setup. Among them was a phase shifter for use in the deflection circuits, a gate-mixer inverter, and a signal plate gate amplifier.

(C. L. Corderman)

Another all-dag 300-series tube, ST-316, has been pretested and passed as satisfactory for mount installation. It will go into the mount now containing RT-188, a marginal all-dag research tube with a holding gun which is different from that in 300-series tubes.

Some time has been spent in the design and checkout of special equipment, and also in assembling standard test units, for a new spot potential measurement set-up. This equipment will make use of a circular-scanning low-current reading beam, which in conjunction with a variable amplitude read signal-plate gate will give a rapid measurement of the potential distribution around a written spot. In the initial mode of operation, the potential around a positive spot, immediately after writing or after a variable holding gun on period, will be determined.

It is hoped that this equipment will give useful information concerning the various factors which determine positive and negative spot size and aid in the development of the high velocity gun and target structure for a 32 x 32 tube.

(A. R. Tanguay)

Tests on the Restoring Current Tester to explain the operating characteristics of all-dag tubes as compared with standard tubes have begun. A serious question is: why does an extra screen produce higher restoring current when used in a standard 100-series tube than when used in an all-dag tube? This is yet to be explained.

The second week of the last bi-weekly period was spent on vacation.

(H. Jacobowitz, B. Turner)

We joined the Storage Tube group Monday, January 29, 1951. Since then reading has been done in the field of Electrostatic Storage Tubes and their related circuits.

4.0 INPUT-OUTPUT EQUIPMENT

4.2 Special Display

(R. R. Gould)

It was discovered that the Special Display Vertical Decoder contained wiring errors whose correction has materially improved the operation of the decoder. Modifications of the circuit are planned that should give further improvement.

Of the 12 D-358 crystal diodes used to gate the current increments in the Special Display Horizontal Decoder 11 were found to be bad and were replaced with 1N38A's. After recalibration the output of this decoder should be much more stable.

4.3 Typewriter and Tape Punching Equipment

(J. S. Hanson)

Premature appearance of a "Completion" signal in the Tape Output Equipment during "Blank" signal presetting of the relay counter used in the "Word-Complement" mode of tape punching and printing has now been avoided by rerouting the "Completion" signal through a spare set of relay contacts. This has necessitated major revision of the associated relay timing diagram.

Timing diagrams are nearly complete, and an investigation of relay contact life under various load conditions as found in the tape output system is under way.

(R. E. Hunt)

The majority of my time during the last bi-weekly report period has been spent locating intermittent and random failures in the tape preparation unit. All efforts to locate a trouble failed.

Finally the relative timing of each relay was measured using the Brush Oscillograph and a timing diagram for the whole unit was plotted. It was found that the unit deviated quite widely from the theoretical timing diagram made during the design of the unit. Three cases of marginal timing became obvious from the evaluation of this diagram and measures were taken to correct each one. The unit operated correctly following these changes.

4.3 Typewriter and Tape Punching Equipment (continued)

(R. E. Hunt) (continued)

The tape preparation auxiliary control was installed and operated correctly after one minor change. This controls tape insertions, tape reproductions, and printing alternate lines.

4.4 Input-Output Planning

(E. S. Rich)

Discussion by the in-out committee on the subject of magnetic-tape-unit control brought out sufficient points in favor of an all electronic system of switching heads and controlling the clutches that it was decided to undertake such a design. Only simple manual controls will be necessary for some time while experiments and tests on the units are being performed.

Some thought has been given to problems that might arise in integrating magnetic drums with the terminal equipment system. It appears that it should be a relatively straightforward matter to arrange a system for high-speed block transfers between a drum and ES storage. However, the use of a drum as terminal equipment buffer storage for asynchronous inputs and outputs is not well enough defined at the present time for one to determine whether our presently planned I-O system is optimum for such buffer storage.

Magnetic Tape

(D. Hageman)

A thesis proposal (M-1151) entitled, "A Head for Static Reading of Magnetic Recordings," has been written. The thesis concerns an investigation into the suitability of two saturable-core devices for reading pulse signals off a slowly-moving or stationary tape, and is a continuation of work begun by E. S. Rich some time ago.

(J. A. O'Brien)

A Thesis proposal is being written on electronic control of the magnetic tape units.

5.0 INSTALLATION AND POWER

5.2 Power Supplies and Control

D.C. Plate Supply Alternator: The regulator has been put back into operation using auxiliary power supplies instead of its own power supplies. The major cause of instability was a combination of interchange of component values in a compensating circuit plus a variety of parasitic loops formed through the regulator power supplies. Disturbances of the building service passed through the plus and minus 150 volt V. R. tube supplies of our panel whether fed from 120-208 volts regulated or unregulated power. When laboratory power was substituted, these same disturbances passed through the plus and minus 150 volt laboratory supplies because of their slow regulating action. Using highly regulated P-1 and P-3 supplies cured the trouble. It now remains to determine how much regulation is necessary for our regulator power supplies.

120-208 Regulated Laboratory Power: Relay power has been transferred from regulated voltage to unregulated voltage in order to afford protection for sudden voltage drops which prevented relays from operating and thus dropping the 120 regulated voltage throughout the building.

5.3 Video Cabling

(T. Leary)

There is a considerable accumulation of cables needed to replace changes made in a temporary fashion which must be dealt with.

All CPO units now have either permanent or temporary labels giving their correct uses.

6.0 BLOCK DIAGRAMS

(R. P. Mayer)

Most Block Diagrams (excluding matrix and timing diagrams) have now been distributed. Most of the matrix and timing diagrams are now in the drafting room being revised.

Drawing SB-36564 (Block Sketch, Marginal Checking Circuit) shows the wiring of the marginal checking circuit layed out in more-or-less logical blocks. A further drawing will show a simplified block diagram of the system.

Drawing SB-36580 (Preliminary Suggestions for Control of Marginal Checking by the Program) shows the extent of the work completed (including a program, wiring of WWI and the Marginal Checking equipment, and the sequences involved) toward making the program control marginal checking.

Memo M-1156, Special Add Memory Clearing on Certain Orders, says that order sf is "illegal" after an sa order. This is not strictly true, and consequently it is likely that the crystal connecting sf to the "AC Carry Clear" line will be removed in the near future. As long as this crystal remains connected, however, sf must be considered "illegal" as defined in M-1156

(B. E. Morriss)

During the past period the Control Matrix and Timing Diagrams were revised together with the drawing of new Timing Diagrams for presently installed temporary orders. These drawings have been sent to the drawing room.

Under the direction of J. M. Salzer work is continuing on proposed in-out orders and procedures.

8.0 MATHEMATICS

(C. W. Adams)

Considerable attention has been given to the development of a satisfactory initial input program. By assuming that tapes are prepared in a special binary form called 5-5-6 (in which a 16-digit word is split into groups of 5, 5 and 6 digits from right to left) with special conventions at the beginning and end, a very convenient form of input can be used. No special resets are presupposed and the main program starts as soon as the input is complete. The conversion to 5-5-6 form, including the special conventions, is performed by the computer, converting from a standard decimal (or octal) Flexowriter-coded tape.

The week January 29-February 2 was spent with J. Porter at the Carter Oil Research Lab in Tulsa in connection with Project 6752. Among other things the discussions and plans which arose there re-emphasized the need for convenient ways to handle floating-point and extra-precision computations.

(F. Helwig)

Tapes T53 and T59, which are the tapes for the linear and non-linear magnetic tape problems respectively, were run for short periods on Whirlwind. In both cases the approximate solution exhibits oscillations which do not appear to be present in the exact solution. Since this is probably due to the method being used the following steps have been taken:

(a) A program is being written which replaces the partial differential equation involved by a system of ordinary differential equation and then solves these using the Runge Kutta method having accuracy h^4.

(b) Two tapes, T95 and T96, have been written in which the linear and non-linear cases are handled by the original method, but in which the original discontinuous boundary condition is replaced by

$$H(0,t) = H(d,t) = \lambda t \qquad 0 \leq t \leq H_e/\lambda$$
$$H(0,t) = H(d,t) = H_e \qquad H_e/\lambda \leq t$$

Since these boundary conditions are continuous it is expected that the spurious oscillations will not occur.

8.0 MATHEMATICS (continued)

(J. M. Frankovich)

The first production problem program (T57) was run in the computer again last week and worked satisfactorily. The results indicated that less sensitivity to parameter changes was necessary to allow closer investigation of the solutions. Suitable revisions were made in the program and it was run again this week. However, difficulty with the computer was encountered and no further results were obtained.

The second production problem program (T94) has been completed and will be tried next week. This program will compare the computed production of an industry with empirical production data. The computation is made by extrapolation from a set of initial conditions on the industry with continual reference to another set of data representing consumption of the industry's products. This reference is made in a manner intended to simulate management decisions of "how much to produce when we have this much in stock."

(J. T. Gilmore)

I have been concerned with the use of WWI to perform conversion from decimal to binary form. Two conversion programs have been written and used successfully. One converts Flexowriter decimal standard tape to either sexadecimal or 6-6-4 tape. The other converts Flexowriter decimal standard tape to a special 5-5-6 tape.

I have just written a program which will convert either a Flexowriter octal or decimal standard to the special 5-5-6 form. (Two tapes have been made of this program. One will treat an unchecked standard and the other a checked standard.) There is also the problem of converting some of the old sexadecimal tapes into 5-5-6 form. I am preparing a conversion program which should do this. I plan to make a standard octal tape of this program and see if it will be successfully converted by my "decimal or octal to 5-5-6" program. To complete the test, I will try converting a short sexadecimal tape into 5-5-6. By reading the 5-5-6 tape of this program into the computer and running the program, we can see whether it behaves as it did in the past, when it was read in via sexadecimal tape.

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
R-194	Experience with Receiving-Type Vacuum Tubes on the Whirlwind Computer (Talk given at Conference on Electron Tubes for Computers December 11 & 12, 1950)	11	12-12-50	E. S. Rich
M-1151	A Head for Static Reading of Magnetic Recordings. M. S. Thesis Proposal	12	1-19-51	D. Hageman
M-1153	Bi-Weekly Report, Project 6345, January 19, 1951	21	1-19-51	
M-1154	Progress Report: A Study of the Holding Beam in the M. I. T. Storage Tube	2	(12-28-50 to (1-22-51	J. O. Ely
M-1156	Special Add Memory Clearing on Certain Orders	2	1-25-51	R. P. Mayer
M-1157	Electronic Computer Division Personnel	3	2-1-51	
A-113	Staff Organization	1	1-26-51	J. W. Forrester

Library Files

	Electronics: December, 1950	McGraw-Hill
47	Technical Information Pilot: January 4, 1951	ONR/L. of C.
180	Document Office Bulletin: January 26, 1951	R.L.E./M.I.T.
181	Pegasus: December 1950	Fairchild Corp.
600	Quarterly Progress Report: January 15, 1951	R.L.E./M.I.T.
698	Physics Abstracts: December, 1950	I. E. E.
1125	Mathematical Theory of Multidimensional Servo Systems. PRF No. 496. October, 1950	(M. Golomb (E. Usdin (Purdue Rsch.Found.
1126	On the Composition of Programs for Automatic Computing. NOLM 9805. 25 January, 1949	(H. B. Curry (Nav. Ord. Lab.
1127	Check Problems for Automatic Failure Detection in an Electronic Digital Computer. S. M. Thesis, M.I.T., 1951	R. H. Gould
1128	Magnetic Amplifiers. Report UA-514-P-1. 23 August, 1949	(H. J. Smith (Cornell Aero.Lab.
1129	Tests on a Regenerative Pulse Modulation Scheme for Use with an Acoustic Memory. Report No. 12.3-5R. January 2, 1951	(R. P. Witt (Ntl. Bur. Stds.

9.1 Publications (Continued)

Library Files (Continued)

No.	Title	Author
1130	Magnetic Cores as Elements of Digital Computing Schemes. August 28, 1950	M. K. Haynes, U. of Illinois
1131	Computer Components Fellowship No. 347. Quarterly Report No. 1: October 11, 1950 to January 11, 1951. AF Cambridge Research Labs. Contract CLNAF 19/122/-376	Mellon Institute of Industrial Research, J. R. Bowman, F. A. Schwertz, R. T. Steinback, B. O. Marshall, Jr.
1132	Production Engineering and Reservoir Mechanics (Oil, Condensate, and Natural Gas)	Oil & Gas Journal, P. Jones
1133	Advanced Reservoir Engineering (Up-to-Date Treatment of Fundamentals). Part 1: Units 300 - 345. Part 2: Units 346 - 384.	Oil and Gas Journal
1136	Theory of Nonlinear Transducers. Technical Report No. 160. August 12, 1950	R.L.E./M.I.T., H. E. Singleton

Books

Barlow's Tables of Squares, Cubes, Square Roots, Cube Roots, and Reciprocals. Fourth Edition	L. J. Comrie, ed.
Seven-Place Values of Trigonometric Functions	J. Peters, comp.
Tables of Sines and Cosines for Radian Arguments	Fed. Wks. Agency, W. P. A., for National Bureau of Standards

9.2 Standards, Purchasing and Stock

(H. B. Morley)

Standards

No new standards issued this period.

Procurement and Stock

Every effort should be made to conserve stainless steel hardware such as nuts, screws, washers, etc. as availability becomes increasingly difficult and prices are constantly rising. No greater quantities than are actually needed should be withdrawn from the stockroom as small items of this type are easily lost.

Procurement of plastic film capacitors becomes even more critical as we have been notified that the factory was destroyed in the late Chicago fire. However, we have been advised that they expect to get back into production in about four months. No alternate supplier has been found.

It is again requested that all personnel using instruments or equipment notify the stockroom at once of any damage or needed calibration of this material. Also any equipment not needed should be returned promptly to the instrument room.

It should be noted that any effort made by laboratory personnel to obtain library material or other MIT services often results in a billing through the D.I.C. office of which we have no record. Therefore, please coordinate these requests with the Procurement Department.

New Items

Sub-miniature microswitch and double-throw standard microswitch. Literature is available in this office.

9.3 Construction

(R. A. Osborne)

Production Report

The following units have been completed since January 19, 1951:

1	In-Out Switch Bus Driver
17	3' D-C Patch Cords
6	8' D-C Patch Cords

9.3 Construction (continued)

The following units are under construction:

1 In-Out Switch Register Driver
1 In-Out Switch Switch Panel
1 Power Supply and Connector Panel Prototype
1 In-Out Switch, 8 Position Matrix
16 D-C Filter Panels

9.4 Drafting

(A. M. Falcione)

Timing Diagrams:

All timing diagrams are now undergoing revisions, some of which will require new drawings due to the extensive changes being made in the arrangement.

WWI Master drawing list is now being revised and brought up to date. It is hoped that new sets will be issued before the next Bi-Weekly Report.

10.0 GENERAL

(H. F. Fahnestock)

Bi-Weekly Decimal Classification

Please read Administrative Memo A-42-3. Radically different section headings are to be used beginning with the next bi-weekly.

(J. C. Proctor)

New Staff

Walter S. Attridge, Jr. will work with Mr. Welchman's group. He received a B.S. in Physics in June, 1950 and a B.S. in Electrical Engineering in January from MIT and was an Electronic Technician's Mate in the Navy.

John T. Gilmore, Jr. who has been working as a student mathematician has transferred to a staff position with Charles Adam's group.

Frank E. Heart has joined Mr. Welchman's group as a research assistant. He received a B.S. in Electrical Engineering from MIT in February.

Herman Jacobowitz is a new research assistant in the storage tube laboratory. He is a graduate of City College of New York in Electrical Engineering.

Basil R. Remis, also a graduate of City College of New York in Electrical Engineering, is a research assistant working with William Nolan.

Rembert B. Turner will work as a research assistant in the storage tube group as well as teaching in the Electrical Engineering Department. He is a graduate in Electrical Engineering from the University of South Carolina.

New Non-Staff

Miss Barbara R. Glazier, a new detailer in the drafting department, will replace Joe C. Wilson, Jr.

Mrs. Carol G. Miller of Cleveland, Ohio will assist Mrs. Ryan in the Library. Mrs. Miller has several years clerical experience. Her husband is a student in the Harvard Law School.

Miss Dorothea M. Cohen is a new laboratory assistant in the storage tube laboratory.

10.0 GENERAL (continued)

New student mathematicians include Oliver G. Aberth and Orlien N. Becker.

The new Northeastern cooperative students working in the storage tube laboratory are Daniel C. Lynch, Jr., Hyman M. Shumrak, and Edward J. Skrzypinski.

Terminated Non-Staff

Donald J. Eberly has left the laboratory for induction into military service.

Joe C. Wilson, Jr. has transferred to the Supersonic Wind Tunnel.