



From: DS, DSB.
Date: 14th November, 1958.
To: Head of M Division,
(attention M.23)



Dear Alan,

INFUSE

It is some months since I last wrote and many months since an overall report has been made on the machine: I must apologise for not writing more often and I can only plead lack of time.

Since my last full report (May) progress has been slow but steady and we were reasonably satisfied that we were ironing out the troubles which were keeping the machine out of operational service. The successful running of JIM (a repeat search programme) was encouraging and Tony Eastway and I agreed that the machine was beginning to look promising: We felt that if CRADLE (a Hagelin programme) could be run reliably we could regard the machine as operational.

In spite of success achieved in setting messages with CRADLE, the performance of the machine cannot be regarded as satisfactory. In the first place results are frequently erratic; on the test message some (known) results may be left out and spurious ones inserted. Half an hour later the test message may run quite successfully. Clearly such marginal operation is not acceptable. Secondly the general reliability of some types of units is not good enough. The main offenders are shift registers and counters. The first type of fault has baffled us completely so far and is obviously serious. The clues, as I see them, are -

- (1) CRADLE uses almost all the machine. The same sort of fault did not occur with GELATINE and JIM.
- (2) Erratic behaviour tends to occur at certain times of the day and rarely at others. The possibility of switching transients on the mains has occurred to us.
- (3) On the +200V and +150V supplies the voltage fluctuations are excessive (10 to 15 volts) when measured over few clock periods. (Better regulation would reduce this but there will be some contribution from inductance and ohmic resistance in the power leads; and in any case the expense involved in ~~in setting~~ precludes experiment.

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- (4) There seems to be a vague correlation of erratic behaviour with main's voltage. All DC voltages are correctly set and heater voltages have been checked in every rack. (I am going to record simultaneously mains voltage, +2, -12 and +200 in the hope that something more definite may show up).

All these observations point to the power supplies. We are therefore fitting +300V +200V and +150V electronically regulated supplies to CLOCK and the drum servo chassis. We have recently received a set of 8 WESTAT type 50V, 5A rectifiers from T Group at Salisbury and we will see whether the transfer of one complete face to these supplies effects any improvement.

The second main trouble (lack of reliability in some units) calls for some form of marginal checking. Perhaps variation of +150V screen supplies to simulate poor emission and variation of -200V to check triggers. I have not yet looked into this thoroughly enough to justify concrete steps at this stage, and I will write to you again. I would be very grateful for your comments on this subject.

Tape to drum

We have had a lot of trouble with this part of the machine. Contributory causes are:-

- (a) Power supplies. Fluctuations of the +200V and +150V supplies reduce the width of clock pulses. We fitted a separate +200V supply to the clock Unit in partial conformity with the recommendation in your M/372/112/4 of 7th Jan. 1958, but this did not remove the trouble and we found that the addition of a separate +150V supply was necessary. As stated earlier, we are fitting electronically regulated supplies for these two voltages on the CLOCK chassis.
- (b) Drum Position and Text Position Counters. There have been occasional intermittent failures in these units. They have recently been fully modified (+2V, 100 ohm cathode follower anode resistors 18 K cathode follower cathode resistors) and there has been no trouble since. In CRADLE arrangements have been made to run them together by throwing a switch so that the operation of the counters' equivalence circuits can be quickly checked; it is hoped to include this facility in future programmes.
- (c) Input Shift Registers. These perform fairly well but occasionally they have been erratic in performance and so far we have not arrived at any single cause of trouble. We hesitated to modify these chassis as this necessitated closing down the machine for some days, but we eventually did this and their subsequent per-

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formance has been satisfactory. There are some indications of interaction between digits in adjacent streams: If this is so a possible cure lies in fitting large bias resistors (say 1.5K) to the triggers. It is also possible that the interaction is caused by coupling through the power supplies.

- (d) Tape Reader: Some months ago we thought the lamp voltage was critical and we fitted an adjustment for it. A more recent study indicates that when bias and location controls are correctly set the lamp voltage can vary over a fairly wide range without malfunction.

Output Shift Registers.

These are satisfactory.

Drum and Associated Circuitry.

There has been very little trouble here. A few DRUM WRITE chassis developed instability in the WWF generators and in each case a cure was effected by fitting type 91A transformers.

I mentioned in an earlier letter that we had experienced oscillation in some read preamplifiers. We have found that minimum head clearance and adjustment of the associated preamplifier to give an output of 15 to 20 volts peak-to-peak gives satisfactory results. (A miniature potentiometer would be an improvement over the fixed feed-back resistor and we will fit these when we have more time). You may not encounter these difficulties with the improved earthing system you propose.

We find that the drum servo sometimes hunts after the drum has warmed up. Reduction of the amplitude of the input synchronising time wave cures this but operation is sometimes marginal. Could you please send us a copy of the recommended Ferranti circuit for this drum and any other information which may help us in removing this trouble.

We are thinking of fitting a fan to assist in removing the hot air from the preamplifiers, but this can only be regarded as an interim measure.

Some months ago I asked about lubricating the drum; Barry said that Ferranti's insisted no further lubrication is necessary. Surely there is some maximum safe period of operation after which it becomes necessary to repack the bearings: If so could you please supply details. (This drum has not yet completed 2000 hours running).

Logical Units.

Apart from occasional valve and crystal failures all units are reliable and satisfactory. We have not yet had time to fit the +2 volt modification.

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Counters and Shift Registers.

Reference has already been made to these. All modifications (12 pf. cross-over condensers etc.) have been fitted but they maintain their reputation for unreliability. They seldom fail completely. The design of these units is completely orthodox and is, in any case, repeated in many other chassis so I hope we can dismiss that as the cause. We have traced erratic triggering on some counters to open-circuit clamping diodes on the input - C_4 and-gate, so we have included inspection of these in routine maintenance. On the subject of crystal diodes the new Head of T Group (Mr. R.F. Treharne who was formerly Head of the transistor/diode techniques group at W.R.E.) had some very scathing remarks to make about the quality of CV 448's. We have not had much trouble with them since initial failures on installation.

Output.

Extensive modifications have been made to this unit. A separate report will be written; but briefly, for the H/S teletype punch, the reset relay has been replaced by applying a 50 c/s ~~wave~~ wave (at a suitable D.C. level) for this purpose. The synchronous driving motor on the H/S punch has been rotated in its cradle so that punching takes place at the right time. Some additional circuitry (triggers) has been included to clean up the "stop" and "start" pulses and this has been built into a small chassis (on the output table) which is referred to as chassis 30A.

An IBM Input-Output typewriter operating at 9 characters/sec replaces the Letchworth. This required further minor changes, and, of course, the use of the reset relay. These changes are probably not of immediate interest to you so I hope they can wait for the final report.

I think I have already told you that another H/S punch has been ordered and when we receive it we shall abandon use of the Siemens - Halske punch. At present we are retaining this facility purely as a spare. (The circuitry seemed to be quite O.K. although the clutch on the punch had some noisy habits. We used it for punching out [redacted] during the Indonesian crisis).

Modular Adders.

Both units are in use in CPADLE and have operated satisfactorily. Both chassis have been modified so that the subtract instruction is strobed slightly ahead (one hole on the relay line board) of C_4 , so that mistiming pips are not generated in the carry lines. This is not a very elegant solution and I intend to have another look at this when some of the more urgent jobs are out of the way.

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Accumulators.

My letter of 28th July, 1958 and Chester's M/5104/112/1 of 18th Sept. 1958 refer. I intended to make clear in my letter that we had found the cause of this trouble and cleared it. There has been no accumulator failure ~~in~~ *since* GELATINE.

Air Conditioning Plant.

To date this has been completely satisfactory but we have not yet had any really hot days.

+2 Volt Bias Supply.

The current drain on this supply is high (about 1 amp. at present) and it will be a good deal more when all chassis have been modified. On the other hand the -12 volt supply is self charging, and so this leads to complications when both supplies are operated from the same accumulator. We are therefore putting in a separate 2 volt accumulator with separate charging arrangements.

Power Supplies and Power Control.

There have been no failures in any of the units.

The additional regulated supplies will operate through existing controls and have been arranged to operate existing alarm gear. A separate panel using rat-trap fuses is fitted.

Labelling.

I enclose a sample self-adhesive label which we have put on front panels of chassis which have large numbers of inputs e.g. OR, OR-AND and translators. This was done at the request of the programmers and is a satisfactory solution. Cost is about 2/- for each strip.

Strobe Pulse Generators.

Type 106 transformers have been fitted to maintain correct pulse width.

Clock.

We find that it is impossible to increase the width of the clock pulse so that mark and space are equal. This is not of any consequence at present and will be attended to in due course; some circuit changes will be necessary.

Extension Counters.

Earlier remarks on counters apply. I note that you have modified the inhibit arrangements on the input. We, too, found this necessary and I am sorry I omitted to mention it.

Coaxial Cables.

These are a fairly constant source of trouble. I think they are frequently damaged when chassis are withdrawn to clear or search for common faults.

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Plugboard

I referred to our proposals briefly in para. 2 of my 0209502 in July. As stated there we ran BORONIA III using open-wire connections to the IBM plugboard with complete success, and we took measurements of cross-talk under all conceivable "worst" conditions. Results of both efforts were encouraging and we are currently wiring up a unit of 3 racks in final form as a prototype for the rest of the machine. We will run the same program as a test, and if completely successful we will extend it to all racks. I feel that the advantages of the open-wire system justify the effort we are putting into it. Removal of plugged-up chassis is difficult and time-consuming and also, I suspect, causes some failures on coaxial cables; an open wire system in which connections are made to the back plate not only facilitates easy access to the chassis but leaves the ordinary sockets free for easy monitoring and fault-finding by the programmers.

We have found a fairly easy solution to the plug and socket problem although it is something of a compromise. We are going to use Cannon 50-way sub-miniature (D Series) connectors (Type D₁-50) which, in single chassis can be fixed in the hand slot with a minimum of workshop effort. In double chassis a hole will have to be cut for the second connector. On OR chassis and OR-AND chassis it is necessary to fit two connectors, and that means provisions of two connectors in each rack position or a restriction of the positions in which these chassis can be placed. We decided on the latter solution; the rack adjacent to each plugboard will be fitted to accommodate these chassis. The programmers say they can see no objection to this. In the case of OR chassis it is only possible to accommodate 14 of the total of 15 gates provided because there are only 100 connections available against the 106 required; if the remaining one is essential it can be plugged in the normal way.

Wiring is to be carried out using PVC covered 7/.0076, which is carried across each of the 7 chassis positions in fanning boards with the holes drilled in centres 3/16" apart. When not in use the connectors and leads are clipped in the same way as the power leads. (The clips for these have been brought closer to the front of the racks; a more convenient position anyway !).

I hope we will have the prototype ready by the end of January but progress is slow because we must of course put our main effort into clearing the machine faults.

Thank you for your W65/8306/2233 of 28th March, 1958 on operational requirements for the COLONOB plugboards which has been very useful.

Staff.

From looking through previous correspondence I see that you can have very little idea of our staffing situation.

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The position is as follows:-

INFUSE TECHNICAL MAINTENANCE.

- Bailey : - Engineer responsible to the Senior Engineer for maintenance of electronic equipment i.e. INFUSE and the high-speed checker. He has been here for 4½ months and spends about 90% of his time on INFUSE.
- Singleton :- Supervising Technician Gr. V, (Acting).
- Robson :- Supervising Technician Gr. II, (Acting).

Until recently we have had one other technician, and we hope to have him back at a future date. At this stage we could usefully employ two additional technicians. Apart from minor workshop assistance (say 3 hours per week) all wiring and construction work is done by INFUSE staff. We have also been fortunate in having the services of Philip Grouse for long periods; he has done most of the work on the output and the fitting of the IBM typewriter.

INFUSE PROGRAMMING STAFF.

Eastway (DX)
Grouse
Miss Hills
Miss Beeson.

And part-time assistance of a typist in preparing tapes.

It is intended that I should return to Salisbury at the conclusion of the Supply Department's responsibilities for INFUSE. No date has been fixed for my return and although there is no formal agreement, I hope that the following will be completed before I go.

1. Machine de-bugged and brought to a level of reliability acceptable to DSB.
2. Satisfactory operation of plugboard prototype.
3. Completion of logical and electronic design of a suitable core store. (I shall be writing to you about this).
4. Preparation of a maintenance routine. (This will probably turn out to be your own maintenance routine suitably modified for our somewhat different machine and staff).

With kind regards,

L. J. Quinlan

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