

The Forest Grammar School, Winnersh, Berks.

Background

By 1965, some of the 405 installations were at the ends of their useful lives, bearing in mind the availability of cheaper and more reliable second generation computers. A broker, Alan Hales, had set up business locally, to negotiate the resale of used computers, and it came to his attention, probably through a contact at Elliott Brothers, that the 405 installed in 1959 at Crosse & Blackwell was no longer required. Crosse & Blackwell had been taken over by Nestlé in 1960, so it was Nestlé, who after discussions, agreed to donate their 405 to the school.

The school was in a good, and possibly unique, position to take on the considerable task of operating a large computer, because the then head of Physics, C.W 'Bill' Dally, had already been taking an interest in building small computing equipment at the school. He was very keen to accept the 405, and the school happened to have the space available.

A problem was that Nestlé were not willing to part with their air conditioning equipment, so a search took place for parts to construct the air conditioning, and also to acquire a considerable number of spare parts for the computer itself. Two other users with no longer wanted 405s were found, who were willing to let the school have extensive parts of their machines: Cambridge University and British Insulated Callender's Cables (BICC). The 405 at Cambridge had originally been installed at Siemens in Woolwich, and much of it was moved to the school. Parts, especially air conditioning equipment, were also taken from the BICC installation.

As a result, the school had enough equipment to set up, operate and maintain their Nestlé 405. Some engineering assistance was initially provided by Elliott Brothers to help get the machine up and running.

The school's computer first became operational on 13th November 1966, and was in full use by February 1967.

Archive material

Below are reproduced some photographs and articles relating to the school's computer:

1. An article from a local newspaper, the Times of 23rd December 1965.
2. Extracts from an article from another local paper, the Evening Post of 2nd May 1966.
3. An article from the magazine "Computer Education", June 1969, written by two boys from the school.
4. Four articles copied from "The Forester", the school's magazine, published between 1966 and 1971.

The 1970 Forester article refers to a BBC film made at the school for the Tomorrow's World series of programmes, first broadcast on 5th February 1969. The film can be seen at:

<http://www.bbc.co.uk/archive/tomorrowsworld/8008.shtml>.

FOREST BOYS BRING THEIR COMPUTER HOME



Nestle, made the offer of the Elliott 405 computer to the school, through Mr. Alan Hales, of Kelburne Close, Winnersh, the world's first secondhand computer dealer.

Since the offer was made in October, boys and staff from Forest school have been going to the Nestle building in Soho Square on Saturdays and Sundays. In all, nine staff helped for a total of 255 man-hours, and 28 boys from the 3rd, 4th, 5th and 6th forms put in a total of 532 boy-hours.

They worked hard disconnecting the large grey-painted cabinets into groups so they could be moved easily.

This meant hours of patient work disconnecting and labelling thousands of wires, ready for re-joining at the school.

A school form room was cleared to house the mass of equipment, but there were many willing hands to help with the unloading.

Mr. D. W. Dally, the senior physics master, together with another senior master, Mr. D. Hooker, who have been associated with the project since the beginning were on hand to position the cabinets.

But a selective "memory" disc store had to be dismantled and installed by a specialist from Elliott computers, because of the delicate work involved in the move.

Work will go on in after-school hours until the computer is hooked up ready to go—but this will not be for another six months at least.

Before this the school will be looking around for a ventilating system, because this was not included in the original gift.

Forest Grammar School, Winnersh, decided to "go commercial" and sell time on its new computer. Berkshire County Council Education Committee could earn a small fortune. Experts reckoned time could be sold to firms for around £50 an hour. The computer, which was worth £200,000 when it was

new five years ago, was given to the school for nothing, and it was being installed last Friday. The county council crashed the item through the committees, and made a grant of £500 to cover the cost of dismantling and conveying the computer to the school from London. The London company,



Centre (L to R): C.W.Dally, W.G.Jackson (Head), Alan Hales (Dealer)

A school moves into the Computer Age . . .

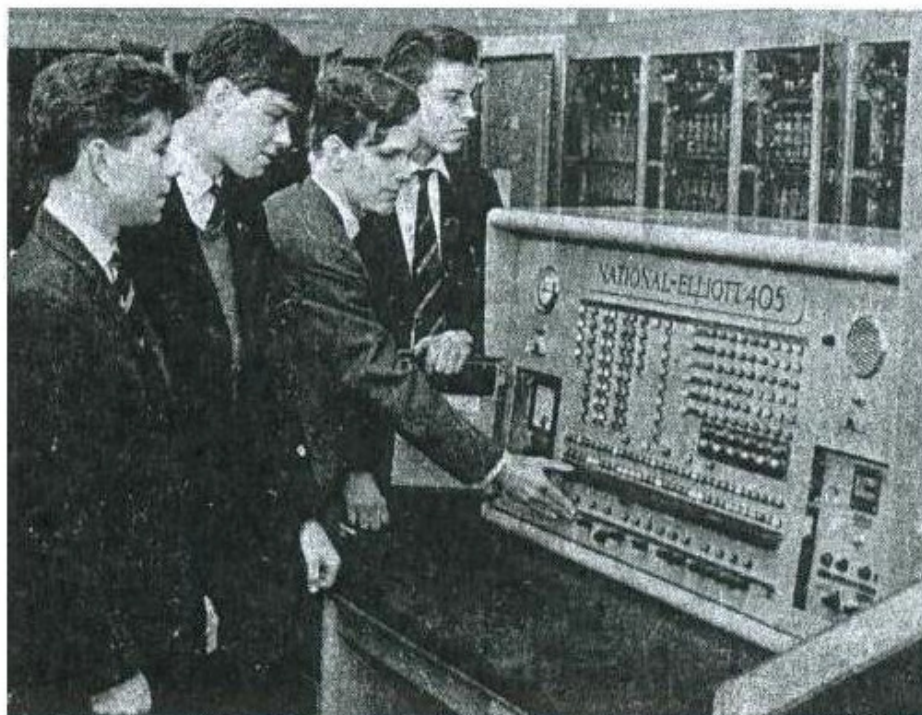
**Michael Braham presents another profile of a local
school . . . Forest Grammar School, Winnersh**

FOREST Grammar School at Winnersh is a young school with an old name. It comes from the ancient forest of Windsor which once covered the area. The school started after the last war as Woodley Hill Grammar School under its present headmaster Mr. W. G. Jackson.

Since the end of last year the school has had a full-size industrial computer of its own. It occupies a whole classroom and is now being installed by a team of sixth-formers.

Working on this long job in their spare time they've already done over 2,000 solder joints — and learned a great deal about how a computer works. Other boys have helped with the foundations for the computer's alternator.

Before it acquired the computer the school built "Damsel" — an electric calculating machine — to bring modern maths to the classroom. And three of the maths staff have written a textbook called "Numasets" designed to bring school maths up to date.



**The school's large computer . . . and sixth
formers (l to r) John Hardwick, John Wilkins,
Martin Cooper, Peter Cooper.**

Damsel, Jim & Nellie

A report by Fred S and Fred B, two pupils at The Forest School, Winnersh, on the installation of their first-generation computer. This was recently featured in the television programme 'Tomorrow's World'.

The school's senior physics master had organised work on electronics with a bias toward computer logic for a number of years. This culminated in building Damsel - a computer teaching aid which used patchcords to interconnect the various parts. This was completed in 1963 and it was able to add, subtract, multiply and divide two six bit numbers.

In 1965 the building of a full scale general purpose computer was begun, incorporating a core store with 256 words of 16 bits and an order code of 16 functions. This project had the name Jim and full scale production of 80 bistables was about to start when in the summer of 1965 a well known manufacturer offered the school a computer - a National Elliott 405 (later nicknamed Nellie) - which was about to be broken up for scrap.

For twelve weekends parties of volunteers went to London and descended on Nellie armed with soldering irons, wire cutters, spanners, crowbars and sticky tape. Each of the 21 cabinets contained 80 plug-in logic modules, and the 140 interconnections between cabinets needed to be labelled, first of all with tie-on tags and then using 4in coloured sticky tape and the resistor colour code to number each wire to be unsoldered.

The console was connected to the main cabinets by flexible trunking containing 150 wires. In all, 2000 wires were unsoldered, which had to be put back in the correct place when the computer was reassembled.

The main part of the computer was split into 13 sections; axles and 4in wheels were made in the school workshop and tests were made to see if the cabinets would go through doors, etc., the floor and passage ways being covered with hardboard. The motor-alternator set (used to steady the mains voltage for the computer) proved to be the most difficult part to move. It was in a basement and was finally pulled up a flight of 30 stairs by the school Rugby XV using ropes borrowed from the school gym and the Weston differential pulley from the physics laboratory. Finally, after four hours of lifting, shoving, pushing and heaving, nearly six tons of computer, spare parts, punching equipment, test equipment and ducting were loaded into two special vans.

Then the real work started - to unpack it at school, put it in a classroom and get it working again. Half the tie-on labels had fallen off and the other half were badly blackened by the London soot that was everywhere inside the cabinets. An old vacuum cleaner was used by second form 'volunteers' to clean as much off the inside and outside as possible. The second method of labelling using colour coding was still recognisable and after the 13 sections had been rejoined, resoldering began. Only ten errors in labelling and resoldering were made, but these were only found later when the full commissioning started.

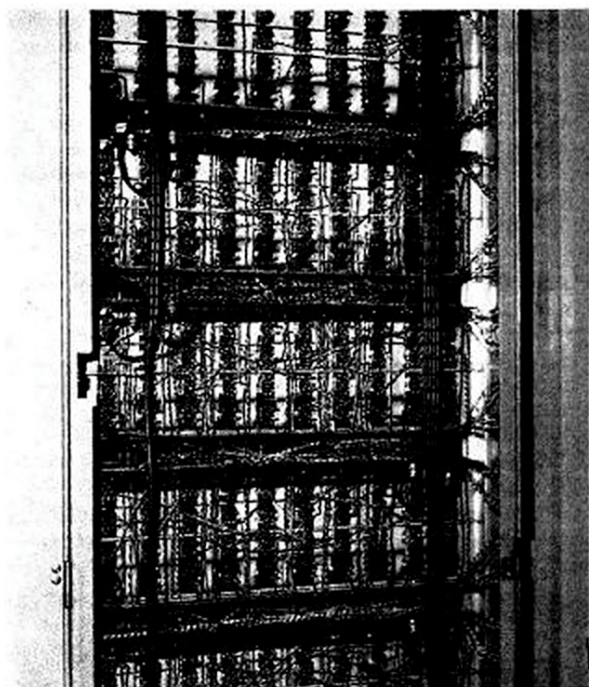
The fourth form boys and staff built a brick housing, 12ft x 12ft x 12ft with cavity walls and flat roof, for the 25kVA motor alternator set near the swimming pool, and after some delay owing to lack of money the Southern Electricity Board installed the power wiring between the alternator house and the computer.

At last the great day came, our physics master pressed the start button and plunged the whole school

into darkness because the 100 amp fuses of two of the three phases in the school supply blew. After learning about star and delta windings on the motor, the fault was discovered and put right. There were other teething troubles - the computer in London had had its own refrigeration plant to supply cool air - this was not included in the gift so the fans from two other similar computers which were being broken up were recovered. (So expert had the school become at taking this type of computer to pieces that they descended on the second of these 405's being scrapped and in four hours had the cabinets taken apart, transported by lift from the fourth to the ground floor and loaded into two vans ready to be moved to the school for spares.)

When the fans were installed, we switched on again to find the computers' own fuses had blown - but at least the school was not in darkness! When this was repaired it was found that the fans were turning backwards - pumping air in instead of drawing it out.

With the power and ventilation systems working we started to test and repair the logic. This was not easy due to our lack of knowledge and the unreliability of the machine. Eventually in December 1966 we were able to run simple programs using a device called a 'pseudo' disc designed by a lower sixth form boy - S.A. Gilbey. The manufacturers of the computer sent two engineers to install the main backing store, a 16K magnetic disc, which they set up mechanically, but were unable to trace a fault in the wiring in the time available. After much more testing, pondering over the pages and pages of logic diagrams, the fault was found and put right by boys in the lower sixth.



The wiring of one cabinet in detail.

Maintenance

Maintaining the computer is one of the more time-consuming aspects. This is partly due to the fact that the computer was almost in its death throes! Considering that it had almost 3000 valves and about 13 000 plugs and sockets it is fairly remarkable that 'Nellie' works for such long intervals without fault. The theoretical mean time between failures was worked out at about 12 hours. We have found this to be about right in practice. This time would be increased if the computer was switched on for longer periods. It is switched on two or three times daily and diodes especially object to this, sometimes with disastrous results such as blowing fuses.

Diagnosing faults is occasionally difficult and often tedious as we still do not fully understand how every instruction is decoded and obeyed. This is especially true of input and output functions which are complex in themselves. The magnetic disc is also prone to faults, since its speed has to be accurate to 1 part in 10 000. This requires very accurate control and is very difficult to correct when it becomes faulty. There is a means of altering certain supply levels to test the computer. At the time of writing the disc speed control and therefore the whole computer, will only function when all the voltage levels are correct.

Despite this, the computer has been functioning correctly for quite some time now and the only problems have been in connection with peripheral equipment.

Mr Pomeroy, a maths master, has been in charge of maintaining off-line paper tape equipment including punches, verifiers and a paper tape controlled typewriter. He has coped extremely well considering the amount of hard use the equipment has had from ham-fisted boys.

Programming

One of the main reasons for having a computer at the school is to teach the essentials of computer programming to the boys of the school, starting with the first forms. Other schools in Berkshire have been given paper tape punches and send programs to be run. To teach people at other schools, several courses have been organised for Berkshire teachers and a one-day school

for the Army Education Centre at Beaconsfield was arranged.

While the younger boys have been trying simple programs (often just adding two numbers and printing the result), the writers and other senior boys have experimented with more complex programming.

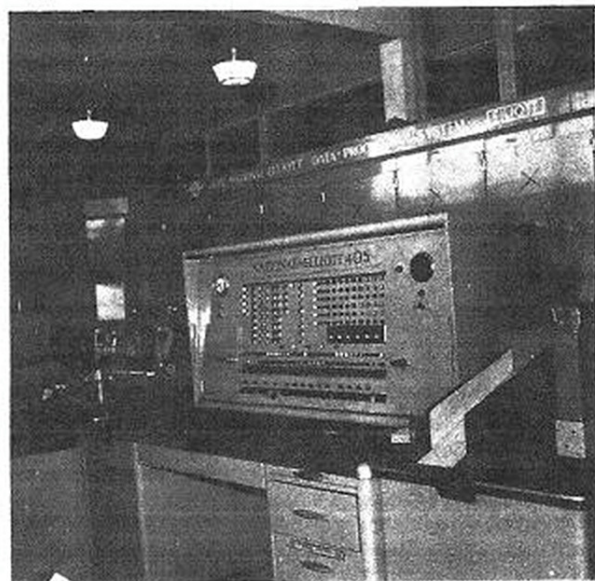
The computer is usually switched on during open evenings at school. For these and other similar occasions a number of demonstration programs have been written or acquired. These include a program which will play tunes on a loudspeaker connected to the computer, a program to play noughts and crosses against a visitor, a program to test the reaction time of a visitor (correct to 0.001 secs) and a program to produce letters and figures as a pattern of holes on paper tape.

A large number of programs have been written or received from other 405 users, to extend the usefulness of the computer. Those worthy of mention are: OFF PAT written by programmers at BICC for general handling of floating point data. AERIAL and MINIGOL are two rather low level 'high level' languages, the former written by programmers at A.E. Reed Limited, the latter by a fifth former at the school. Also a number of subroutines to compute trigonometrical functions, etc.

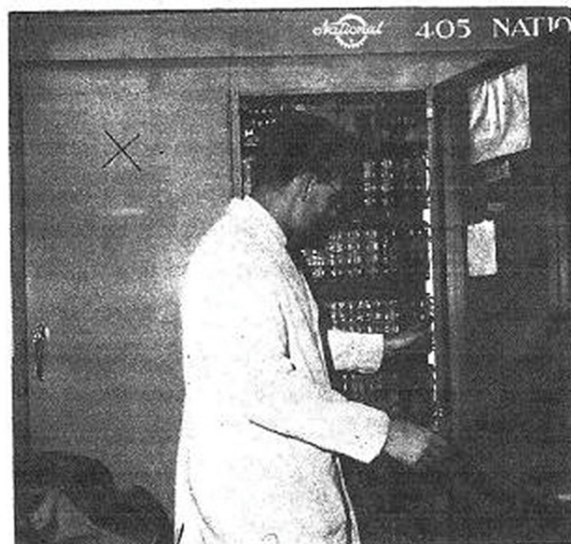
Modifications and developments

When the computer was first installed in the school there was only one input channel available, namely a paper tape reader and one output channel either a paper tape punch or a printer. This was rather a handicap, so we decided to add one more of each channel.

The first essential was to add another output channel so that we could have both tape and printed output. This was not as easy as it first appeared. The logic was already in the computer but we had to find where to make the external connections. After tracing wires through the computer we succeeded in connecting the printer to the computer. When we switched on, however, the channel would not work and the alternator voltage became very unstable. We switched off and checked all the wiring, we tried again and still it did not work. This time one of the writers volunteered to pull the connecting socket off and was almost the first boy round the moon!



A general view of one side of the computer.



A view inside one of the 21 cabinets. 'Only ten errors in labelling and resoldering were made.'

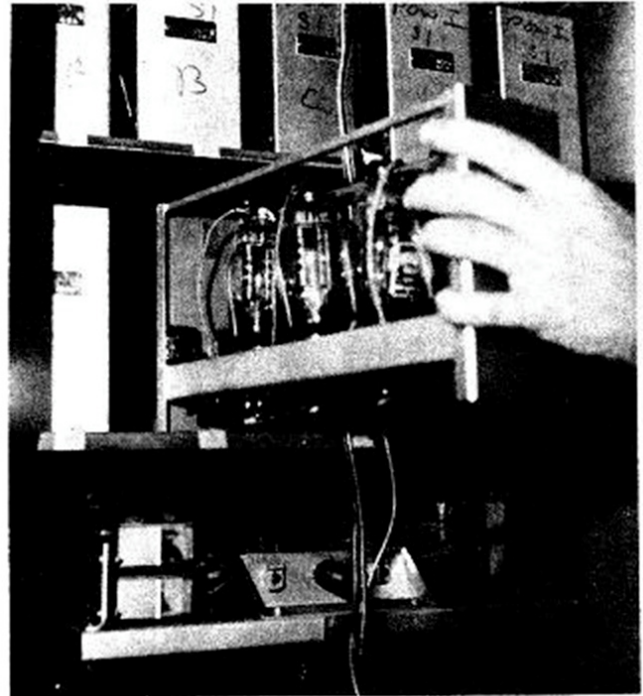
At last we found the trouble. We had used the live and neutral lines of two isolated mains supplies. We corrected this and have had no trouble since. The next task was to connect another input channel. We had no difficulty with this and so for one week we had two tape readers, one tape punch and one printer. Unfortunately we were not able to keep two tape readers in working order, but our work was not wasted. Instead, we took the typewriter keyboard off a piece of faulty editing equipment and after some modification and considerable adjustment we managed to connect this on-line to the computer. This is still in use. Its main use is for connecting programs and also in demonstration programs such as those mentioned earlier.

Tape copying is a slow job on the computer and as it has to be done quite often some of the boys have developed a separate tape copier.

There have been several other modifications but since many of these have been to the logic of the computer they cannot be explained.

One other project in hand is a visual display. This will allow characters and graphs to be shown on an oscilloscope.

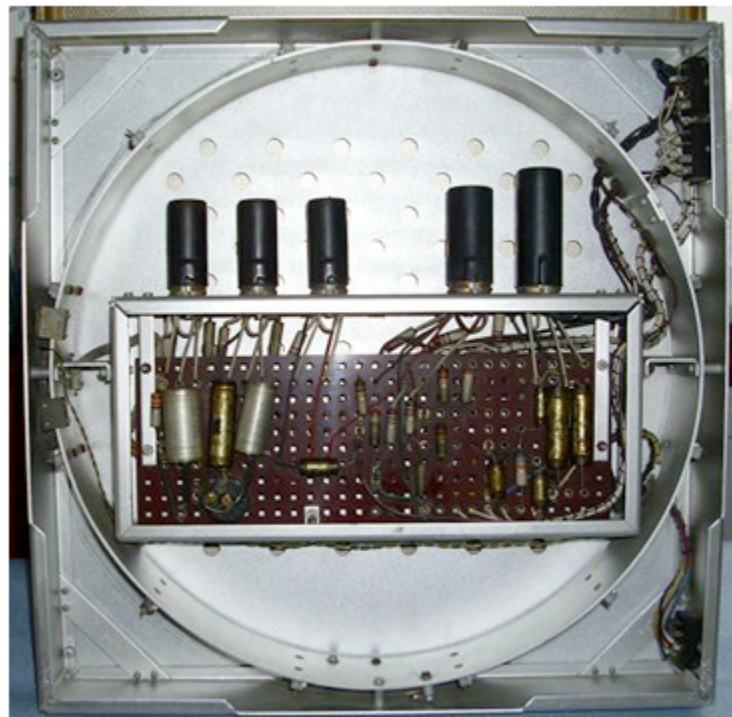
As may be guessed from the above, 'Nellie' rather filled our time during our last two years at school. In conclusion, the writers would like to thank the staff and the school for the invaluable experience they have gained on the computer. As a result, two boys from our year are now studying for a degree in Computer Science at Hatfield Technical College.



Plug-in modules.

'With 3000 valves and 13 000 plugs and sockets it is remarkable that Nellie works for such long intervals without fault.'

The above article was, at the time of writing, (March 2011) at www.vintage-icl-computers.com/icl40, together with the photo below of one of the nickel delay lines from the computer. The article is reproduced with permission from Naace (National Association of Advisers for Computers in Education).



'THE FORESTER' 1966

Computer '66, clickety-click

THE COMPUTER is an Elliott-NCR 405. It is a valve type, built in 1957, and was owned and used by Crosse and Blackwell for their stocks and shares at their head office in London.

We were first offered it in November, 1965, through a "computer broker" who had recently set up in Winnersh. The school was already interested in computers after building a demonstration unit and starting on a miniature transistorised model, designed by Mr. Dally. It was decided to have the 405 not only for the practical use and attraction of a large computer, but also for its usefulness for educating mathematics and physics students in programming, logic and computer electronics.

But we had to dismantle it ourselves—a difficult task. The computer consisted of 21 cabinets which had to be split into groups of twos and threes for easy handling. This entailed labelling about 2000 wires which would have to be disconnected for transport and each re-connected at the school, each in its appropriate place. Many boys went down to the head office in Soho Square for weekends to carry this out (it is thought the location of the head office acted as no incentive). One weekend was taken up with shifting the alternator, which produces the power for the computer, and its motor up a flight of stairs, to be picked up by the van the following week. These pieces weighed one ton and half a ton, and the rugby 1st Fifteen were invaluable for the job.

At last all was ready for the van to arrive and shift the computer. We went early; after protecting floors and doors of the offices, we moved the parts into the reception hall. The van arrived about an hour late and immediately we started loading it. But alas! the van was full and still the pavement was strewn with cabinets, boxes, and miles of magnetic recording tape, much to the annoyance and, occasionally, to the amusement of passing pedestrians. After much telephoning and two hours, another van arrived and what was left of the computer was packed into it, leaving only a few small, insignificant bits to be collected later. Finally the vans moved away to store the computer until next morning, when it was delivered to the school.

We had plenty of willing helpers to roll the cabinets into the now vacant room 1, marked out for the computer. With the parts in their approximate position, we left them to go to our school Christmas dinner, providentially arranged for that day. The computer remained in that state throughout the Christmas holidays until January, when the next stage started.

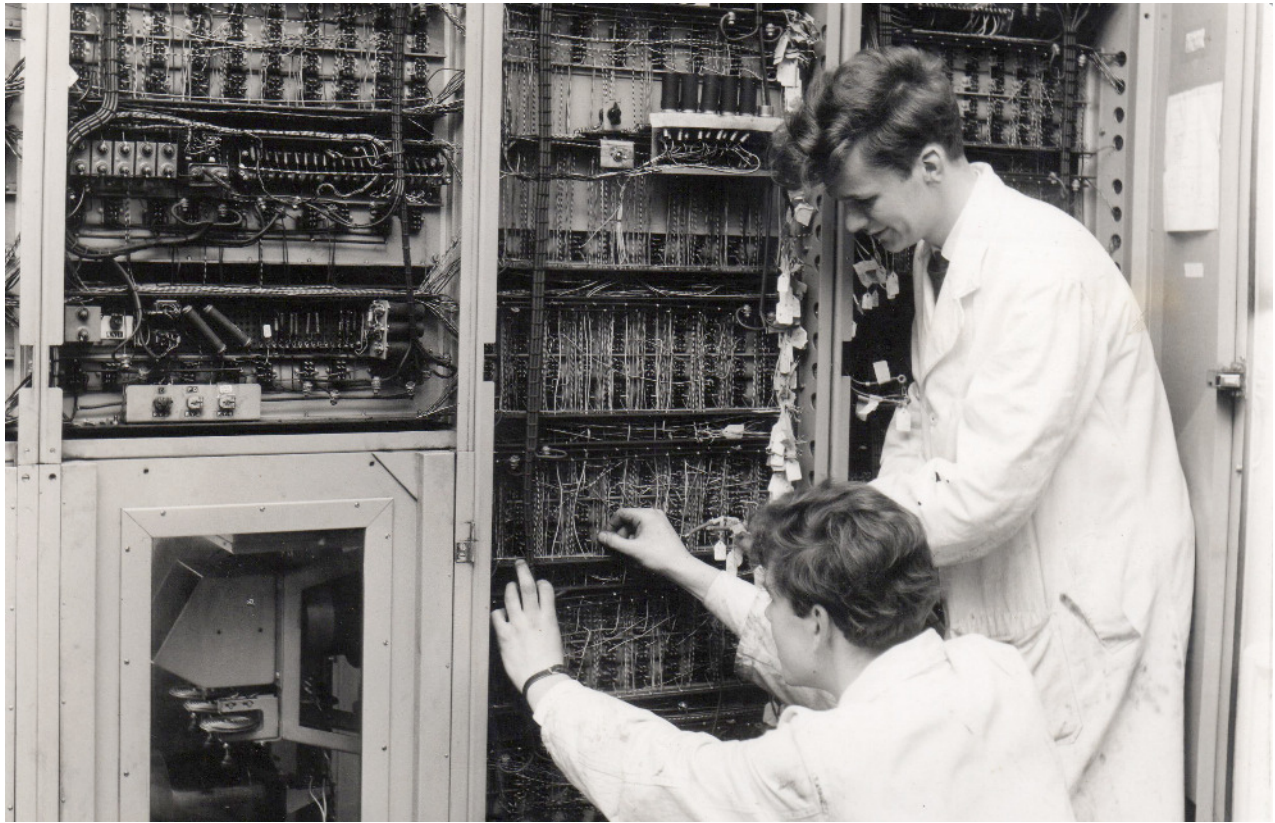
For the first three weeks of the following term the assembling went well, with many boys helping to join up the innumerable wires in their appropriate places. But then, for two reasons, our initial speed stopped dead. Firstly, there were no fans to extract hot air from the cabinets since Crosse and Blackwell had used one large one, which they would not let us have. Secondly, the county council, now interested in our exhibit, proclaimed that all mains input and alternator wiring must be done by their "experts."

The first of these problems was solved by writing to owners of similar computers who were soon to get rid of them and asking for their fans. We managed to obtain half of the necessary fans this way from Cambridge University, and the rest from B.I.C.C. From both these places we also got many spares for the computer.

The second problem was not so easily solved. But, at long last, during the Easter holidays, workmen arrived to put in the wires from the computer to the non-existent alternator room and to the mains. All that was to be done, it seemed, was to build the alternator room. This was done by both members of the school and an outside bricklayer. With the help of the upper sixth the roof was put in place and the alternator in position. Thus by the end of the summer term, all the wiring had been completed and the computer could be started. Unfortunately, this did not take place owing to the lack of time available to test all the various parts. So this event, the climax of all the work and speculation, was postponed until the next term.

By the time this is in print the computer should be ready, if not in action. It has been a great experience for all concerned with the project and I hope, and feel sure, it will be a great asset to the school.

P. R. Cooper.



Installing the computer in 1966

'THE FORESTER' 1967

Computer News

THE COMPUTER is now almost fully operational and, apart from the monotonous regularity of breakdowns, is in continuous use.

When the computer was switched on for the first time last summer it succeeded in fusing two thirds of the school's mains supply.

We worked slowly during the autumn term getting it to function, interrupted only by such faults as the fans going round backwards. Eventually on the 13th November, 1966 it first obeyed an order. By February we were running full programmes.

Programmes have been written by boys from the second year to the Upper sixth, programmes to play noughts and crosses, to draw graphs, to solve equations, to integrate functions and to evaluate square roots. In the future we hope to extend the usefulness of the computer by building a television display, by commissioning the magnetic tape units and by incorporating a high-level computer language, such as Algol.

We would like to thank all the masters who have come in to supervise the running of the programmes during the year.

R. Spencer.

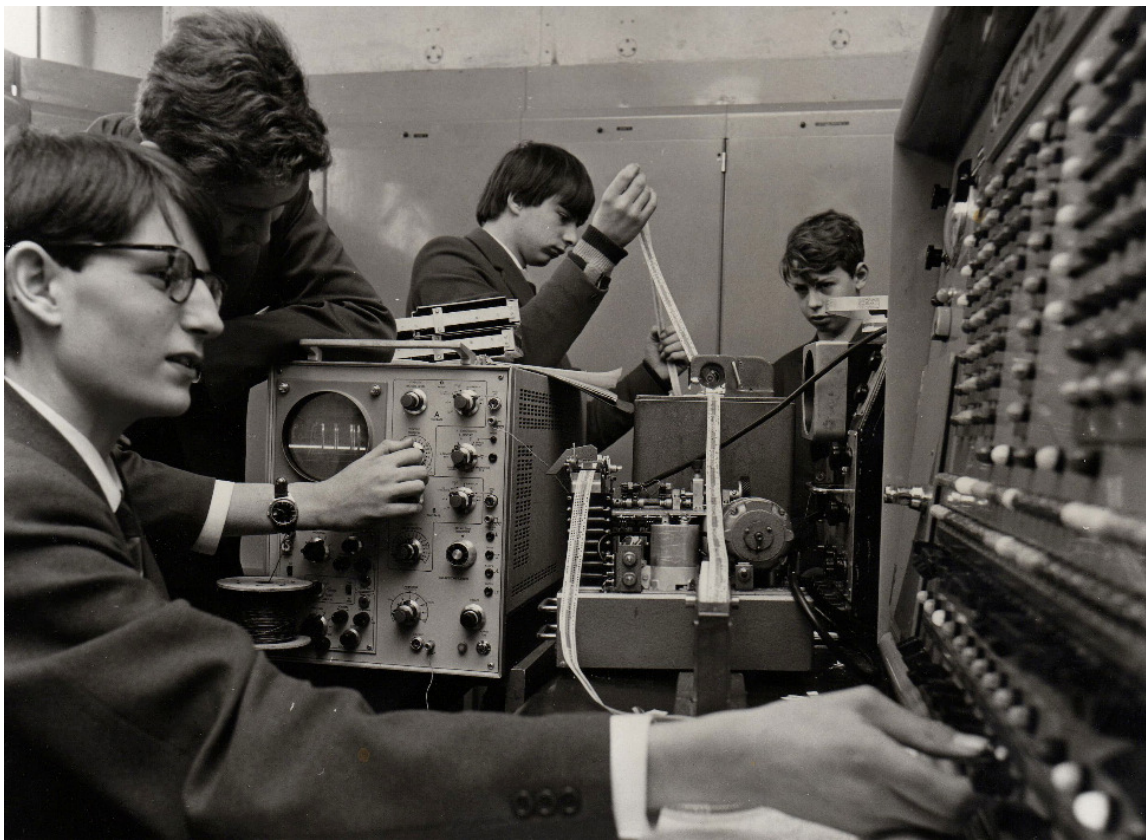
'Nellie the Elephant' is hardly the sort of title one usually associates with a school magazine article, so an explanation would be appropriate. 'Nellie' is the nick-name of the school computer, possibly the biggest white elephant the school has known.

The computer made its arrival known at the school, by fusing two-thirds of the schools' electricity supply. The school magazine faithfully records the computer's progress since. One reads of such things as 'apart from the monotonous regularity of breakdowns, the computer has been in continuous use', while last year, hopes were expressed that a 'new, **working** computer might be obtained in the future'. The computer has achieved sufficient recognition to have attracted a B.B.C. camera team, and a feature on it was broadcast on the TV programme, 'Tomorrow's World', although we learn that it was touch-and-go as to whether the machine would remain operational for the film to be completed.

But the computer was not acquired solely to be an attraction to television companies (we hope!). The object of its installation was 'for its usefulness in educating maths and physics students in programming, logic and computer electronics'. Very fine ideals, but to what extent have they been fulfilled? Sixth form mathematicians and physicists can, and do, complete their studies without setting foot in the room at all. The regular users of the computer room number about six, out of the school's six hundred. As computer science is not available as a course at the school, the practical applications of the machine are few indeed. Discreet enquiries made of the computer operators reveal that the present machine would not be adequate for teaching computer science — it is now thirteen years old — and would have to be replaced by a new, smaller machine. It would seem that the computer is unable to fulfil its *raison d'être*.

This would seem to show that the money expended on transporting the computer to the school, installing it, and its subsequent upkeep, have been largely wasted. Not only this, the computer's presence in what is one of the largest rooms in the school, means that this room, which is currently used by a regular six, is not available to the remaining six hundred. Is it not ironic that the computer room is adjacent to the library, which, as everyone knows, is inadequate to say the very least. There is an extremely small staff room, no language labs — far more people take languages than are likely to want to use a computer — while sixth accommodation is non-existent. Recently, extra terrapins were installed, because of lack of space.

While it is realized that computers have given great benefits in relieving man of tedious, mundane work, the case for the school computer is not as convincing. A large number of people in the school are of the opinion that the computer's existence is not justified, and the room which it occupies, and the money which has been spent on it could have been put to far better use.



The Forester

COMPUTER SOCIETY

1971

During the winter and spring terms, the Computer Society was dormant, and in a state of mourning, at the expected, and then eventual decease of Nellie. At the time of writing this report, we are just recovering, and seeing to the job of re-organising things for the winter term, when, not surprisingly, we have the greatest attendance at our meetings.

Now, just a word on Nellie (National Elliott 405 Electronic Data Processing System). After last year's totally unreasonable attack by an Upper Sixth member, I feel I must reply on behalf of all the boys who devoted a lot of time and effort to the 'White Elephant', as she was labelled by her 'enemies'.

It is not widely known that after the first few years of her stay at the Forest, she was allocated no funds. Apart from that, however, I must say that the practical knowledge of the operators did slowly fade, as sixth form followed sixth form until the boys who had helped to install her in school, and thus knew the most about her, went on to University, or into 'business'.

To reply to the 'wasted time and effort' charge of several people, I can only say that had our eloquent friends spent less time spiting us, and helped only a little in the hard work of running a complex computing machine, the whole project might not have ended with the scrapping of the machine over the holidays.

M. Davies.