Some Uses of Computing in Caving

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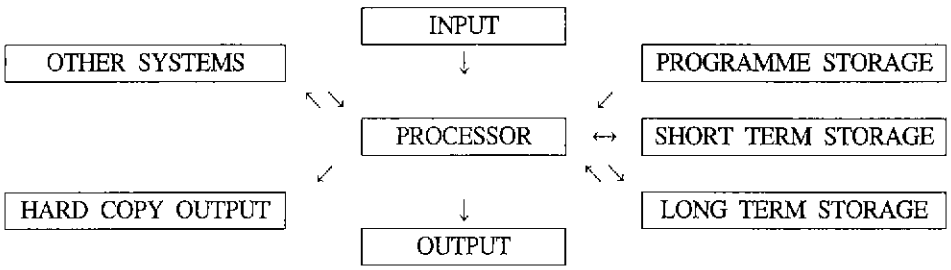
I . Introduction

There may be two groups of readers particularly interested in this subject, those covers with use of a computer who want some ideas on using it and others who want to know if getting a computer to use in connection with caving might be worth their while.

II . Features

The usual elements found in a cpmputer are shown below :



Virtually any computer must have some of these components. In this illustration, OUTPUT and HARD COPY are distinguished although they are often the same thing. In the micro world, however, the basic machine usually has screen output but no printer.

Apart from the physical components of a computer system, there are some other important aspects which will be referred to later such as speed, storage and software. Speed can mean both the rate at which the processor works and the amount of short term storage or memory and affects the complexity of programmes and, to some extent, the efficiency with which they operate.

Finally, software covers all the programmes used and in particular their efficiency in terms of speed and storage besides their aptness for the purpose and their ease of use.

Ⅲ. Equipment

Loosely, computer equipment could be defined as anything desugned to aid in data processing. A simple scale of complexity and power can then be drawn up as below.

Human with abacus, slide rule, log tables etc.

Human with calculator.

These examples are the simplest of systems contaning only an INPUT, a PROCESSOR and an OUTPUT. All other components are manual, such as programme storage, printing of results etc.

Programmable calculator.

This is not a great step forward from step 2 but such equipment can include memory to retain the programme for long periods. Programmable calculators can include a printer and a storage device such as magnetic cards. However, it is more common to have to key in all the data and write out by hand all the results.

Pocket computers.

These are the first full computers and can have all the essential ingredients of a compiter but are often slow and have limited display facilities. They are however eminently portable, self - contained, have low power consumption, and are often supplied with casssette tape interfaces and small printers. In some respets they have taken over from the programmable calculator as a hand computer.

On the border line between pocket computers and micro - computers are some machines such as the recent Epson machine which have all computer facilities built in but are still extremely portable. These are worth a good examination for anyone considering

expedition use etc.

Micro computers

The true micro is really a desk based machine and often requires a TV of monitor to work with. They have all the facilities of a computer but are considerably slower than a powerful machine(but can compare very favourably with a busy time - shared computer).

Larger computers

Some readers may have access to a firm's or university's mainframe computer. If so, less needs to be known about the hardware, more about what software is available, how to enter data into the machine and what means of output it provides. In practice, it may be easier to use a micro than to try to use the office computer unless tou have a very large job to be dne AND you are on good terms with the computer department.

Ⅳ. Applications

1) Survey coordinates

The calculation of three dimensional coordinates from cave survey data is a historic application. Survey computation can be carried out

by hand with slide rule or calculator but the use of a programmable calculator can take away a lot of the hard work and risk of error.

Still at modest prices and having all the facilities of a calculator are the "pocket" computers which can hold a great deal more data and allow mass storage and printing. For example, a relatively small programme can calculate s - D coordinate, keep running totals and store the coordinates of a number of points to allow branching surveys without rekeying station details.

Going one step further to desk - top microcomputers, you get the advantage of mass storage and a lot more memory. Mass storage(disc or tape) is an advantage as it permits the user to survey or the survey of a group of caves. New details and passages can then be added and the survey details recalculated and stored for future use.

The advantage of extra memory is that it allows data be stored temporarily so that it can be reprocessed. For example, the first run of the programme could calcurate the plan on grid north and the next run could turn this through 45 degree to get a better projection, change and reprocess it at will should not be under - estimated.

More advanced programmes on large commercial or scientific machines can be used to draw entire cave outlines instead of hust the passage skeleton and to correct for loop closure errors.

2) Filing systems

There is a wide range of similar applications that can be broadly classify as "filing", ie : the storage of data in a systemetic manner. Typical applications are members' names and address, cave details, library records and lists of archeological finds. This is an area that can be made as simple or as complicated as the user wishes and his facilitates permit.

For instance, a mailing list in alphabetical order may be quite sufficiebt given the facilities to create, amend and delete entries. Such as an application requires a PRINTER, a PROCESSOR, INPUT and OUTPUT and a form of mass storage(tape is quite sdequate). By the addition of facilities tp select and short records on the basis of part of the data contained in each record, much more use can be obtained from the data.

The requirements in general are for greater short term storage and processor power which are well within normal micro limits. In fact, given discs and random access to them, there is little in this field that a micro cannot do just as well if not more easily than a mainframe. An interesting fevelopment in the use of filing systems is to display grahically the information extracted from the file as demonstrated by Juan Corrin at the Conference(see below).

3) Word processing

Of passing interest perhaps to most readers but deserving a brief mention is the use of computers to process and store text - word processing.

This can be used in caving circles for things such as journal articles that may need editing and reshaping. Alternatively, word processing can be used to prepare a number of short repetative items such as letters to beg for gifts to an expedition.

In this case, all that has to change is the addressee andperhaps a fragment of text. General requirements for this application are for a minimal processor, mass storage(tape is suitable in many cases), a printer (essential) and reasonable word processing software. A letter quality (daisy wheel) printer is highly desirable.

4) Accounts

Club Treasurers could use their micros to hold the club's accounts (if any). This is typical of an application that is more likely to be a use for already existing software rather than a justification on its own for buying a microcomputer.

5) Data acqusition

There is on need for a micro - computer to be used solely for INPUT and OUTPUT in the conventional manner.

Up until quite recently, most field experimental recording had to be carried out either by hand (eg : sampling for dye hourly over a 24 hour period) or with the use of expensive and heavy equipment (eg : chart recorders).

However, you can now take a relatively cheap micro with processor and internal storage and programme it to carry out the same sort of tasks. Some sort of elementary communications are required so that data can be collected and stored for later processing but various items of equipment are now available to the home enthusiast.

The example shown by Lank Mills at the conference was a Sinclair ZX81 micro(£40) connected by analogue - to - digital converts to water depth and temporature sensors. This setup was used to record the passage of storm flood pulses through a Spanish cave this summer over a period of two days.

One of the methods of OUTPUT now readily available is the use of graphic (ie : symbols other that letters and figures) which with the use of colour and animation can convey a great deal more information than words alone.

This raises and interesting possibility of using a micro to carry a message direct to the "public". This is directly different from many of the options covered above where the micro produces printed output which is then presented to the ultimate user.

There are degree to which this type of application can be taken ranging from a frame - by - frame display of information like a conventional slide show tp a question and answer system where the user has control over what information he wants to see next. This is an interenting application with plenty of scope for inventiveness and it can be carried out for say £150 to £200.

At the 1983 Conference Juan Corin described how the use od display on a Spectrum micro adds a further dimension to a data filing system containing details of 500 caves in the Matienzo area of Northern Spain.

6) Critical path analysis

It was suggested by a speaker by at the conference that Critical Path Analysis(sometimes called PERT) can be used to advantage in the planning of expeditions. Critical Path Analysis is a method of predictiong what parts of a lengthy project are most critical to the timing of the overall project.

When many individual activities are concerned in the make - up of the project, a fairly powerful computer is required to provid answers in reasonable time. This sort of power together with the required programmes may be more readily available on the firm's or university's computer.

7) Statistics

"Number crunching" has traditionally been an important use for

computers. The speed at which micros can calculate is nowhere near that of a mainframe computer but they can be used for statistical analysis given a bit of patience.

The idea behind statistics is to collect a lrage amount of data about some human or natural phenomenon and then use numeric methods to analyse the data and extract conclusions. For example, statistics have been used by archeologists to classify their finds and could also to analyse data such as the frequency of visits to caves, patterns of cave accidents and so on.

8) Amusement

To conclude, computers can even be used to take up the spare times that most cavers have before the pubs open! If you are fed up of putting ten pences onto the Space Invaders machine you can always play an Adventure game which is guaranteed to keep you in front of the screen for hours at a time while tou exlore the mysterious cave from your armchair!

Finally, I have some details of caving "users" arising from the discussion at Nottingham in 1981 and some other people expressed an interest this year in forming a casual association of computer users within the BCRA membership. I would be pleased to hear anyone's comments on this idea, either direct to myself of through the correspondence pages of Caves and Caving.