Confrontation with a computer

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The KDF9 computer now in operation at Baddow provides very powerful computing facilities whereby engineers can make substantial savings in time and effort on lengthy calculations. Also, the great speed of the computer enables engineers to increase problem penetration by making a more detailed analysis in a given time than has been possible by systems hitherto available.

LEFT: *Girls of the KDF9 Operating Group's Data Preparation Section punching paper tapes for data input to the computer. In the centre of the back row is Mrs. Yvonne Solly, Data Preparation Supervisor.*
ABOVE: *Feeding the information to the computer are, left to right: David Traish, Computer Operator; Bryn Llewellyn, Leading Operator; John King, Shift Leader; and Shirley Llewellyn, Off-line Job Assembler.*

As applications of electronics become more sophisticated, the systems we design and sell become more complex. This means an increasing amount of theoretical work and it is sometimes very difficult to complete the theoretical analysis in time to feel the full benefit in the design. Engineers may have to spend many hours with slide rules and desk calculators coping with large amounts of computation. Other aids, such as graphs, monograms and tables are available but, because of the time and effort which has to be expended before a reliable set of tables can be published to the world at large, there is a progressively smaller percentage coverage of the required formulae and the requisite ranges of numbers.

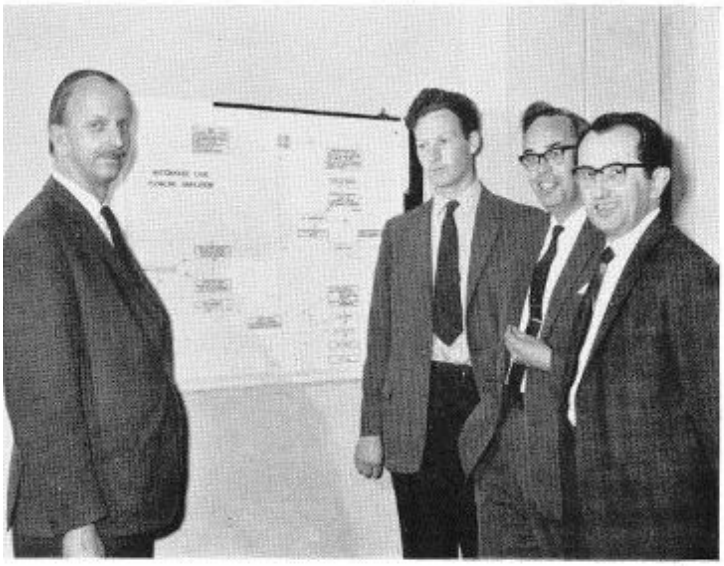
Obviously some solution has to be found to enable the engineer, be he electronic, electrical, mechanical or just plain steam, to spend his time in the most productive way. This implies relieving him of as much of the burden of mathematical work as possible. One solution appears to have been found in the shape of a well-polished abacus which is in daily use in the office of a Young engineer in a certain Way-Out Division. However, abacusians are to be found mainly in the Far East so this would not appear to be a general solution.

A more practical step is to organize a confrontation with a computer, in particular the KDF9 computer which is sited at Baddow and is used for a variety of technical and commercial work. The technical work is the responsibility of the Theoretical Sciences Laboratory. There is a choice of three 'zones' from which one can confront or be confronted.

In the outer zone is the engineer who, on principle, does not admit to the existence of mathematicians or computers. Only in the last resort, when the ultimate ultimate deadline is

This brain is given a break and a 'once over' every day. Left to right, background, Phil Meens, Senior Engineer; Doug Fawcett, Technician; foreground, S. E. McLintock, KDF9 Operating Group Chief; and G. Wardell, KDF9 Engineering Group Chief

The Theoretical Studies Group at Baddow Research use the KDF9 computer to solve engineering and scientific problems. Here are, left to right: P. S. Brandon, Assistant Director of Research, and Manager, Theoretical Sciences Laboratory M. Adler, of Numerical Mathematics and Systems Studies; N. A. Huttly, Chief of Numerical Mathematics and Systems Studies; J. Skwirzynski, Chief of Applied Mathematics and Circuitry



looming up, does he reluctantly ask for some mathematical assistance. His definition of the job will be rather vague, the time-scale unrealistic, and the result very likely unsatisfactory for all concerned.

The middle zone contains the engineers who recognize the computer as a friendly calculating robot and who make use of mathematicians to carry out the computer implementation. The engineer and the mathematician find common ground in recasting the engineering problem into a set of mathematical equations which can be solved by the computer in a logical sequence of well-defined arithmetical steps. The problems of input and output to the computer are discussed until a specification is agreed. As work proceeds, there is continuing liaison between engineer and mathematician which provides feedback to keep the mathematical formulation and the engineering reality as close together as possible.

The third and inner zone consists of engineers who have gone software[1] in the head and who, armed with not a little gritty determination and a good measure of enthusiasm, have determined to

[1] Software is the library of computer programmes.

write their own computer programmes. They will have attended one or other of the computer language courses and successfully completed programmes to calculate compound interest or mortgage repayments. Having then started on a very much more complex problem from their own laboratories they may feel for a while that the computer resembles not so much a benign calculator as a temperamental coffee machine. But they are in good company alongside the thousands of programmers up and down the land who are constantly being outsmarted by theoretically moronic computers.

In fairness to the computer, one should point out that most of the difficulties lie in the operating systems and the languages which have been interposed between the programmer and the heart of the computer. At the heart lies the arithmetic unit, which is quite willing to work at its maximum capacity of several hundreds of thousands of additions per second for twenty-four hours a day. Unfortunately, it is frustrated by the inefficiencies of the less enthusiastic items of hardware[2] and software all around it and so the arithmetic unit is usually working at less than a quarter of its peak capacity.

Nevertheless, although certain problems do face the user, the computer is still a very powerful tool indeed and is vital to the continuing progress of technical work in The Marconi Company. A good deal of work is being done to make access to the computer more straightforward and thus to make its use more effective.

It is interesting to consider the range of technical problems which are being solved using the KDF9 computer. The more straightforward problems are those for which a computer programme already exists. Typically these might include the solving of sets of simultaneous equations, polynomial root-finding, latent roots and vectors of matrices, fourier analysis, aerial and filter design, structural analysis, critical path analysis and so on. A few problems might be solved by small modifications to existing programmes but the majority of cases require new programmes to be developed. They will range from jobs of only a week or two to jobs involving many man-years of effort. Some of the projects now being undertaken are the automated production of wiring schedules, mathematical simulation of defence systems, advanced design techniques for a wide range of electronic devices, techniques in graphical computer output and many others. A more comprehensive list is included in the section on the Theoretical Sciences Laboratory in the recently published pamphlet 'Research and The Marconi Company'.

[2] Hardware is the computer and its peripherals.

More paper tapes for data input to the computer being punched by girls of the KDF9 Operating Group's Data Preparation Section

The question of whether the engineer decides to take up a position in the middle zone (non-programming) or the inner zone (programming) will depend on the problem in hand. Engineer programming will usually be done in a language not requiring much knowledge of any particular computer. Whereas such a language speeds up the programming time it runs less efficiently on the computer than a machine-code programme. Thus programmes written in machine-independent languages are suitable for small jobs, for one-off jobs and for jobs which are very fluid and likely to require a good deal of chop and change. When a programme is to be used frequently or is so large as to use considerable machine time, then probably it would be better written by skilled programmers in an efficient code. The decision as to how to implement a particular calculation on the computer is best made by consultation with some of the technical programming staff.

As mentioned earlier, work is being done to bring the computer closer to the user. This work includes the development of a system which will provide users with remote terminals from which programmes can be written, tested and run. This should provide a very effective addition to the facilities in present standard system, and should reduce substantially programme development time and turn-round time for runs. One hopes that more and more engineers with sticky slide rules or numerical indigestion will find the computer a useful tool.