DOWTY
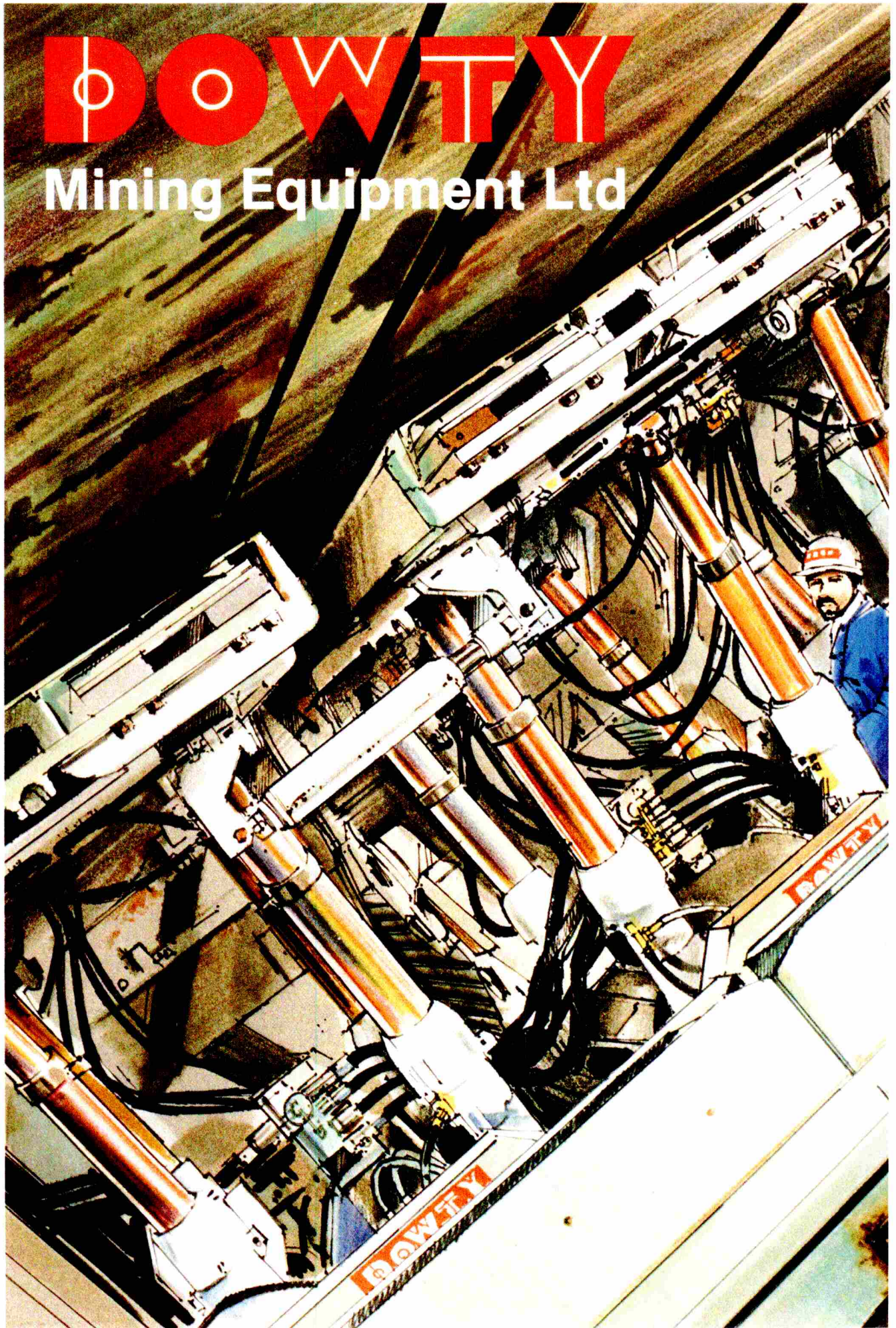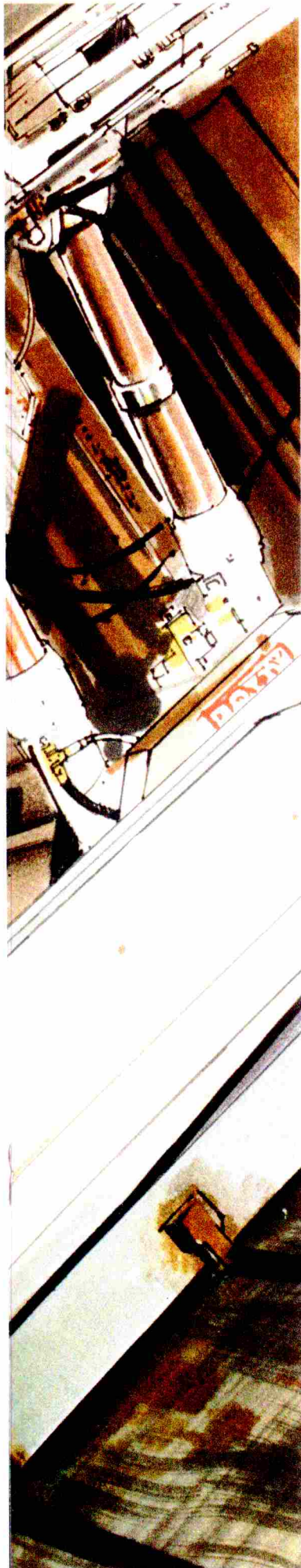## Mining Equipment Ltd

"I am acknowledged to be the only man who still carries around a five-inch slide rule because you cannot stir a cup of tea with a calculator," said Tom Cutler, commercial engineering manager of Dowty Mining Equipment Ltd.

In 1979, Dowty Mining realised that if they wished to remain in a very competitive market place they must consider automating their estimating department.

Initially, the company thought that a desk top calculator would be the answer to their problems. But they soon found out that nobody manufactured this type of equipment so they called in the experts from head office. Cutler explained his problem, requirements, the type of information his department would want and the experts were given the task of searching for the right computer.

With the success of the Dowty Group in the 1930s and during the Second World War in hydraulically operated undercarriages which pioneered the application of hydraulic power, opened the way to wide-scale use of hydraulic units for aircraft and industry manufactured within the group.

Dowty Mining was an offspring of developments pioneered after the war with the launching of the first Dowty hydraulic pit prop being patented in 1947 and production began that year. With its success this led to the introduction of a 'walking chock' an hydraulic roof support unit functioning in the same manner as the prop, but which could advance itself. Dowty Mining have now developed a complete range of powered supports which can cater for every condition encountered in longwall mining from seams as thin as 2' 2" to those 12' or more in thickness. Supports may have two, four, five or six legs, each support offering resistance to roof loading from 150 to 750 tons at yield. Such roof support installations have greatly increased the speed of coal-cutting machines and in this way very high outputs have been achieved.

The need to computerise, to have information at one's fingertips was vital and the search began in earnest for the right type of equipment to do the job.

THE SEARCH

After an initial selection process the main contenders were CMC, Digico, Rediffusion and ICL, as the Dowty Group are large ICL users, having three of their mainframes. Access to the computer had to be on a 24 hour basis — it had to be up and running when Cutler and his team needed the system. An estimator may come in at any hour and therefore would want to retrieve data immediately. At that time there was still a great deal of overtime being worked on a China contract and information was required sometimes far into the night.

It was quickly accepted that the answer was a stand-alone system and the short-listed manufacturers were approached on this basis. It was decided that Rediffusion offered that little bit extra in terms of further development. They had an excellent support system and Dowty Mining liked what they saw, even though the equipment was more expensive. What Dowty Mining had to be doubly sure of was the fact that should the system 'crash' then an engineer would be on site, say, within 2/4 hours, although the estimators could continue their work manually.

TIME CRITICAL

As already mentioned, the company are in a very competitive business. It is therefore essential and vital that their quotations meet the set deadlines. All the work to be on the mini-computer would be in real-time, there would be no batch update whatsoever — files had to be updated immediately. Working as they do in a time critical situation, there is no time for files to be updated overnight. When an estimator is looking at an assembly he is actually looking at his live file and when he accesses any record he is actually altering the real-time database. The estimators are only the first link in the chain giving the works costs. After that the commercial people have to decide at what price to sell, and therefore it is crucial that people need time to do their homework.

PROGRAM PLANNING

Before the R850 was installed in 1979, estimating had been done manually. The computer was to act as an aid and not a replacement of the existing system. The estimating manual method had been perfected over 20 years and they had built up a system of manufacturing estimates which they considered to be second to none.

When Kevin Poole (who has now left the Dowty Group) was assigned as Project Analyst he assured the estimators that he had not come to change their concept of estimating. Here was a well tried and tested system carefully built up over the years and from his view it was pretty sound and a good basis from which to create a computer system tailor made for them. It meant that the estimators did not need extensive training in this new area of technology, but it was important to remember that the applications had to be easy to understand. One problem was that an estimator was not keying in details from a 'standard sized' computerised input document, the information would come from a drawing which may be 4' long and 3' wide which he would study in detail then key in the details to build the component, which when finalised produces rates, prices, factors — the magic answers. It was also important to take into consideration the age range of the estimating department. The younger members would naturally streak ahead and learn new tricks but how does one bring the chaps with the slide rule into the computer age? Much thought and planning was done before any programs were written. Poole held meetings with Cutler and his staff to discuss the best way of achieving the results they required. Ideas were carefully discussed and considered. The R850 had to store good clean data which the estimators could quickly retrieve at will. They did not want to spend hours/days searching around for information.

Poole commented: "The danger of going into any department and computerising it without giving it very deep thought is obvious — chaos and a loss of valuable existing expertise. It is fine to automate, to have a robotic estimator who does nothing more than press a button and then to let the computer do the work, but knowledge, expertise and experience must not be lost in the process."

He continued: "The R850 had to be a system which would not upset them and which would not change their working methods significantly. Any drastic improvements to their existing system simply to make programming easier would be all very well for me, but Cutler's workforce would have suffered as a result." Consequently, after these in-depth discussions the estimating department now has a first-class, easy to use system, and with some help, of their own creation.

A most important factor which also had to be taken into account was costs — paying for a systems analyst and programmer. Cutler had a budget to adhere to and having paid for his hardware his next big headache was programming costs. Specialists are expensive and usually at the end of the day, more expensive than hardware. But because the Rediffusion language is Editor and is similar to COBOL, as an ICL user the Dowty Group computer

staff found it very easy to compile programs. Poole and the programmers would sit down with the estimators and actually write a program with them, test it with them, and make any necessary corrections until the program was to their satisfaction. The analyst found that by using the R850 for the project a great deal could be saved on development time and consequently costs. Comparing estimated development time using COBOL programs and Editor running the same application and functions it was found that in many cases it took about a quarter of the time on the R850, this being a significant saving when one weighs that up in terms of costs.

FOUR PHASES

The project was divided into four phases because it was huge in terms of scope, and there were so many differing factors and needs to be taken into consideration such as, for example, a mass update facility.

The first phase set up the components database with calculations to produce the price of a nut, bolt, piece of metal or whatever. Estimators have to decide the size and type of the material used, how much time it takes to turn it into a component across various operations and how long it takes to assemble the component, i.e. the finished job. However, this can cover a small sub-assembly costing five pence, to a chock which is in the region of £20,000. The weight of material, the price of material, machining it into a component, adding all the components together, putting it together in an assembly and testing it results eventually in a chock being made. When the raw material prices go up or the factors alter such as the rate per minute for an operation, then the estimators use the excellent Rediffusion command macro system and procedures and link together various output programs which go through the whole database and simply update each record. When this has been completed, the estimator can then immediately recover the component with the new details having been applied.

There are now some 4000 components on the system and although there has been a definite improvement, in the workflow of the department, the real benefits will start to come when they have achieved their goal of 6000 components.

Phase two involved the stringing together of components to make assembly and sub-assembly files. Once the assembling of components started, another set of times, factors and values were applied.
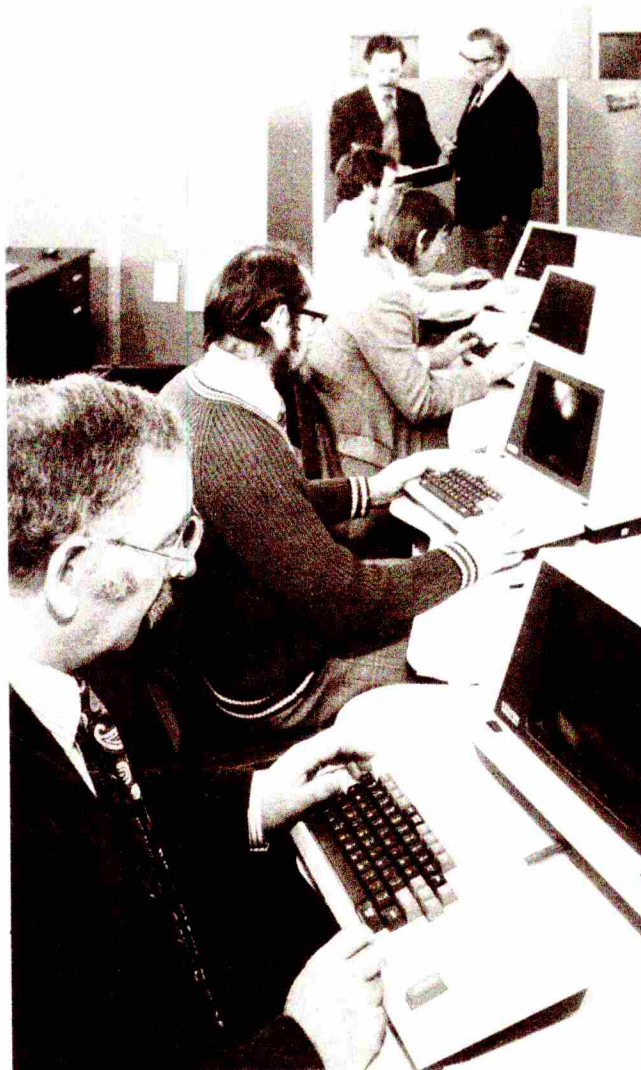
Dowty Mining set-up another database for these assemblies which is large and now takes up quite a slice of their 66MB disk. The database files have headers, trailers and part lines, the latter being the components which were set up in Phase 1.

Having done that they looked at the metal which is cut out and forms part of the valve packs, base and legs for example, which are welded to make various fabrications. This phase solely covered the chopping up or flame cutting of sheet metal, welding it, shot blasting, machining, painting it, and lots of other processes to achieve the final product.

Phase four was very similar to phase two in that it covered assembly, but this took the completed sub-assemblies and the fabrications which together make up the total chock. Having created a data retrieval system, Dowty Mining wished to reap benefits from some form of mass updating on completed assemblies and fabrications. Now estimators can pick up a particular assembly which has

been made, alter any details therein, and run a program against it which gives them a new picture thus saving the valuable time of estimators having to write out the whole assembly again and recalculating all the answers.

ENQUIRY SYSTEM

The estimating department probably run one of the most complex enquiry systems that is run on any Rediffusion system and it has to be very fast and efficient. For example, an estimator can now get at a component by its part number, description, factor code, and at

least a dozen other different ways. The estimators are grateful that Rediffusion have this in-built enquiry system because if they resume any file in the database they can actually search on a character sequence. Poole maintains that by using this simple system one can actually step around having an enquiry program specially written and use the Rediffusion enquiry facility to seek out required records.

SPARES

The R850 also handles the manufacturing spares. When a chock requires repair or alteration then the estimators have to calculate the latest prices and details for the replacement part, no matter what it is. Therefore the R850 also handles within its capacity, a spares function.

NEW PROJECT

A new project is currently being developed — bill of materials processing type application which is no mean feat on a mini-computer. However, a limitation to the R850's software architecture has been found. The department is making the system stand on its head and toes simultaneously. They have tried to follow the logic paths which are permissible on the equipment, but unfortunately the software cannot cope at this stage with the very difficult and intricate programs required. To understand the problem one must consider the work involved, the size of the programs, and the linkages where the R850 is calling up no less than 15 x 250 page output programs within 12 macros, which themselves are part of a command procedure, then one realises that the task is of marathon proportions. By putting their heads together and working in close co-operation, the Rediffusion and Dowty analysts have now found a solution. It means adding fifteen minutes to the overall run time of about 90 minutes per chock and perhaps inserting another module thus avoiding the area where the Editor language does not wish to tread. "There are always two ways of skinning a cat. Analysts and programmers should never be reluctant to seek out all the possible options no matter how daunting the task," said Poole. The command procedure will update every required component, assemble those components, and produce the finished chock containing around 1000 components. A print out will accompany this which is an indented print showing all the levels of breakdown. With the system tackling the drudgery, this will save the estimators considerable time. It will allow them to do more of the productive elements of estimating — the more 'thinking' aspects of estimating. The rewards of having such a system is already bearing fruit. With the data being assembled on the R850 and the use of mass update programs, the old details on each record will soon be updated whereas with the old manual method it would take months to complete. It cannot be

stressed too strongly, that it is an enormous saving in terms of time. Time is a very precious commodity — not to be wasted.

RECORDS

There are 4000 component records, 1500 fabrication-type assembly files and approximately 400 actual assemblies on the R850 and these will grow until the records are old and ready to be deleted. However, one of the problems with estimating is that you should not throw anything away. A designer may wish to check on a five-year-old drawing to see how the price was arrived at then, and what it would cost today. Now that Dowty Mining have these records on the R850 all they require is the drawing number, tap it in, and give the designer any information he requires. Before the computer was installed the estimators would say "Oh God, where did I put that file: down in the strong room or was it thrown away? — Sorry Jack, we will have to start all over again." That might be three days work or even three weeks work.

Now the information is to hand, and covers component details, drawing number of component, description of component, weight of material used in the component and type of manufacture. Records now exist of components making up a sub-assembly, with a sub-assembly at another stage calling up those components on that sub-assembly plus other sub-assemblies added in. A facility for calling up all the assemblies and making a complete chock also exists.

What they have on the Rediffusion computer is the ability to look at items — say a block of piston heads varying in diameter and varying in size where there should be an inter-relationship between price of these components. They can now pull out all the piston heads under that heading, and analyse them in a much faster way than they were able to do before.

To prove that time was actually being saved a little exercise was undertaken where the estimators took a sample of components and altered the labour and material rates. It was taking an average of six minutes per component to find the card, and change these rates manually to arrive at a new value. When the same exercise was run on the computer it took an average of six seconds. Having this effective tool has eliminated an onerous task and allowed them to get on with the job they are paid to do.

INVOLVEMENT

Estimators are involved in the daily running of the system from systems saves to operating it generally. The whole R850 framework is user friendly and this is possibly one of its most attractive features. The R850 is not some sort of monster hidden away in a corner and if a button is touched the reaction is 'Oh Dear!' what is going to happen next. The estimators have confidence in their system and when you have confidence in something then any problems take care of themselves.
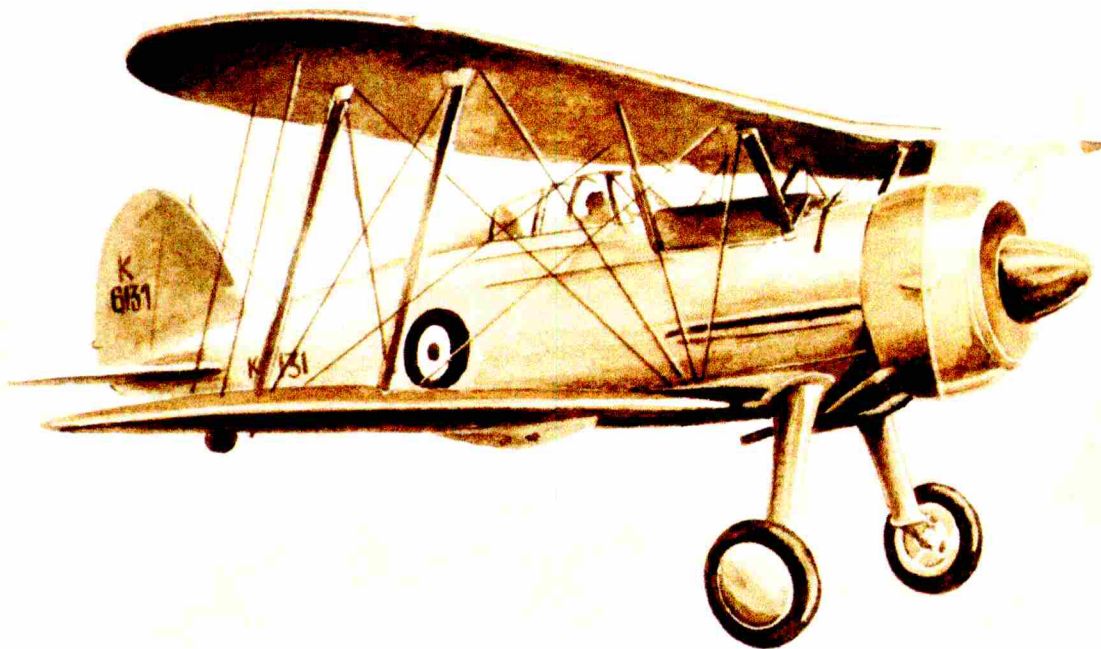
PRICE RECORDS DEPARTMENT

With the success of the R850 the next link in the computer chain is to be the price records department. The senior dp management, having witnessed and approved the results to date agreed to upgrade the system thus offering a computer facility to the price records personnel. Six terminals are to be installed later this year. This department will be attempting text editing (word processing) on the system producing quotations and spares order notes as well as running their own suites of programs.

CONCLUSION

In summing up, when Cutler was asked whether he had been pleased with the system's performance to date he replied: "Yes, so far it has done everything we wanted it to do, and we shall continue to test its capabilities even further."

Gloster Gladiator