MANUFACTURING MICROBEE A PERSONAL GUIDED TOUR
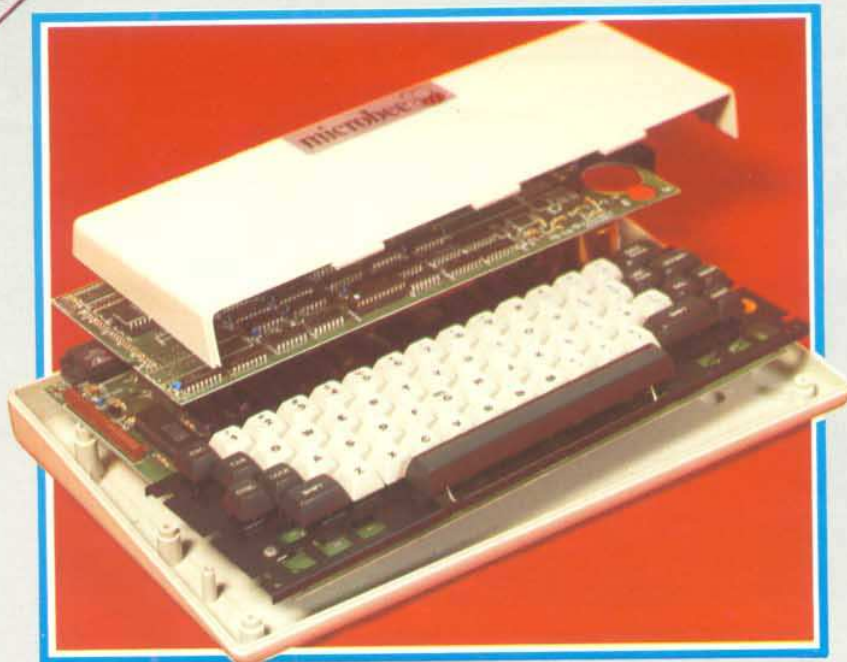
CLASSROOM NETWORKS FOR LEARNING

AUSTRALIAN SOFTWARE INDUSTRY
Does it Exist?

MANUFACTURING MICROBEE

A PERSONAL GUIDED TOUR

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This month's feature in Online gives Microbee owners an idea of not only the production methods involved in assembling the units, but also a feeling for the teamwork associated with what might be called the *total* Manufacturing of Microbee.

The Microbee is the product of advanced Australian technology, engineering and production methods. It is a product that has developed rapidly over the past few years, originally employing five or so individuals, and now demanding the support of over one hundred employees Australia wide. The teamwork necessary to produce and market the Microbee draws on the expertise of the assembly workers, accounting personnel, store people and packers, research and development teams, retail staff and management. Because the Microbee is produced locally, local associated industries also benefit — for example, office suppliers, stationers and printeries.

When Microbees were first produced they were in kit form only. Dedicated enthusiasts assembled the computers and went through the trials and tribu-

lations of getting them running. This situation has rapidly changed. Applied Technology realised the need for the computers to be supplied, assembled and tested, and so the company began to grow and meet the incredible demand.

The process involved in the production of the Microbee starts, naturally, with stores. The stores department is responsible for maintaining stocks of the 100 or more components that go into the average Microbee — from resistors to the main microprocessor chip. The stores job is not an easy one. It is up to the stores manager to liaise with production and co-ordinate suppliers from around Australia and the world so that parts are on hand at all times. This task is made all the more difficult with the world semiconductor shortage, sometimes it is necessary to go to various suppliers to get even the most elementary part.

Stores is the central collection area for all of the parts that come into the company. Once the parts have arrived they are assembled into kit batches of Coreboards and Motherboards and are

then sent to production. The kits are passed to production and are distributed to the production teams. Various different teams are responsible for assembling Coreboards or Motherboards. The Coreboards house the memory chips and determine the 'size' of the computer. The assemblers responsible for these boards insert various components onto the board which are then sent to flow soldering. After the board has been wave soldered* it is then mechanically trimmed and immersed in liquid freon and subjected to ultrasonic cleaning. The reason for this is that the flux in solder (the material used to make electrical connections between the components and the tracks on the board), if left on the board, will eventually eat away at the tracks which can cause failures. After the board has been cleaned it is then returned to the production team for completion and the boards are given a preliminary testing.

If the board is not operational it is sent to the factory service team. The advantage of having a team of people responsible for each unit makes fault finding much easier.

missing from the disk drive systems at this point — the disk drives!

The disk drive units and many other peripherals such as networking systems, are assembled in a separate area of the factory — Memory Products. The Memory Products team is responsible for assembling and fully testing disk drive units. The drive units, once in their cases, are tested extensively to make sure that there are no read/write problems. If the drive unit passes this set of extensive tests (the units are in fact tested by a Microbee with specifically written test software) then it is allowed to proceed to final assembly where the Microbee computer units are waiting to be matched with their respective drives.

After this process, the fully assembled units then undergo further extensive testing along with the ROM based Microbees. All units progress to the 'heat run' area where they are loaded with test programs and cycle through those programs for a minimum of 24 hours. The reason for having a heat run is to fully test all functions of the system. The team of people responsible for this area of production are so familiar with the test program and the Bee, that any fault that appears can be quickly traced to its cause. Indeed if a fault appears in the Bee, after it has been fixed it must undergo a further 24 hours of testing before it is allowed to proceed to the next section of the factory.

Each Microbee goes through a last final self-test routine. The system is meticulously cleaned and inspected a

When a Coreboard has been given a preliminary seal of approval by the production workers, it is stored in a temporary holding area awaiting the Motherboards to which they will be attached.

The story of the Motherboards, which house the keyboards, is very similar to that of the Coreboards. As with the Coreboards, the Motherboards are supplied in 'kit' form to the production team. The various components are then inserted onto the board and are then sent to the wave solderer. It is notable that at this point in time the Microbee's keyboard is not attached — the holes into which the keyswitches will be inserted are covered so that the wave solderer does not fill those holes with molten solder. After the Motherboards come off the wave solderer they undergo trimming and cleaning as the Coreboards did.

Having done this, the Motherboards are sent for a short trip to the Fairhaven Centre which is approximately one kilometre from the factory. The Fairhaven Centre is a training and employment centre for the moderately and severely handicapped. It is here that the keyboards for the Microbee are fitted. Each keyswitch is soldered to the board and then the keytops are installed. After this has been done the Motherboards return to the factory and undergo a rigorous set of preliminary tests. The Motherboards are not tested at this point with their matching Coreboards but rather with a factory tested, fully verified coreboard. Error detection is therefore made much easier. If the Motherboard passes these tests then it is passed onto final assembly.

It is in final assembly that the Microbee, as you the customer know it, begins to take shape. The Motherboards and the Coreboards are combined to form the whole Microbee. The Microbee is then fitted into its own individually numbered case at this point. The Microbee 16K and 32K machines are complete and ready for final testing and quality control but there is something rather important

final time and passed down the line where it is inserted into its final packing. The manuals, leads and other information are inserted into the packing to allow the user to start computing as soon as the system is unpacked.

You might think that this is the end of the story of how Microbees are assembled, it isn't. The production of Microbees doesn't stop at the factory. To have a successful computer as the Microbee, software and technical backup must be supplied.

Microbees are distributed throughout Australia via a number of channels. A large network of Microbee Computer Centres and Dealerships are supported, along with Education contracts in three states. Microbees are also exported to a growing number of countries. Co-ordinating the equitable distribution of the product to all of these avenues is a difficult task and involves a number of managerial staff. The core of the retail development and management is also centred at Gosford.

Microbee Computer Centres are located in most capital cities and are there to help owners through the majority of teething troubles, from sticky programming situations to minor technical problems. The staff at your local Microbee Computer Centre are also qualified to do a limited number of repairs should any fault appear on your Microbee. If they cannot find the fault then the Bee is sent back to the Gosford factory for servicing by our qualified service team. An advantage of having the service facility and the production facility in the one complex of buildings is that it allows for direct feedback to the factory on any problems that might arise on the Microbee. The solution that service find for a problem is often directly applied to the production of the Microbees, tolerances

are improved in certain components thus making for a better, more reliable computer.

'Non-obsolescence' is one of the major philosophies behind the Microbee. Although not part of the main production run, the Upgrade section is kept constantly busy with providing Microbee owners with upgrades to the latest in technology in an ever increasing range of computers.

An aspect of support that is very important is documentation. Realising the need for better documentation Applied Technology recently established a new department whose specific purpose is to proof-read and field test all manuals. This section is also responsible for the production of 'Online'.

One of the most important departments in any dynamic company is Research and Development. It is in this department that the ideas that many of the imaginative people in the company come up with reach fruition. Research and Development is responsible for taking a design and creating the physical device for that design. Once the design has been tested it is then given to the Art Department so that the preliminary printed circuit design can be made up. From here the design is sent out to a printed circuit board manufacturer and after a brief interval the circuit boards are returned. The board has its components inserted and soldered on, and, if all is well, the printed circuit is finalised and the board can go into production.

The last area of production and support that often goes unnoticed is accounts. This section is responsible for co-ordinating accounts (incoming and outgoing) invoicing and paying wages to the staff of Applied Technology. With the growing number of suppliers and customers, the accounts section is kept well on its toes.

The production of the Microbee is the result of team effort by a dedicated number of Australians. Every member of the company contributes in some vital fashion to the end product that you, the customer, purchase. The production of the Microbee is very complex and it is only through the dedication of all employees from Stores to Sales that the computer is the success that it is today and tomorrow.

*A wave solderer is a machine that takes the boards and passes them over a bath of molten solder. The solder only attaches to the board where the metal pads are exposed.

Fairhaven

'THE QUIET REVOLUTION'

Applied Technology of West Gosford, is presently participating in one of the most exciting programs yet established in this country for people with moderate to severe intellectual disabilities.

The program involves the systematic individualised training of these people in the assembly of electronic components to printed circuit boards, which is the heart of this company's MICROBEE educational computer.

In previous times, the program participants would have been labelled retarded or sub-normal, and generally regarded by society as having little ability to learn basic tasks, let alone learn sophisticated skills.

Traditionally, the typical work afforded people with intellectual disabilities, in sheltered environments has been packaging, nuts and bolts assembly, or similar types of soul destroying activities.

The concept that given appropriate training, people regarded as slow can perform sophisticated skills, is one that will challenge societal expectations, and if demonstrated to be correct, will have a profound effect on the lives of these people in the years to come.

The training program necessitates that the trainer has an intimate knowledge of the task to be trained, and this major task is subsequently broken down into a series of very small teachable steps.

The learner or worker is then given one to one training for periods ranging from a few hours to many weeks, and once the small steps are chained together to make up the complete task, the learner is brought into production.

The Centre has selected eighteen of its people regarded as having the greatest need, and tasks include attachment of regulators to key frames, assembly of components and frames to printed circuit boards, key switch insertions, soldering of the components to the boards and key tab assembly to the switches.

Depending on the degree of disability, worker's output ranges between twenty-eight (28%) and sixty-three percent (63%) of a non-disabled person. Put another way, where one non-disabled worker may produce a certain amount of work in a given period of time, the
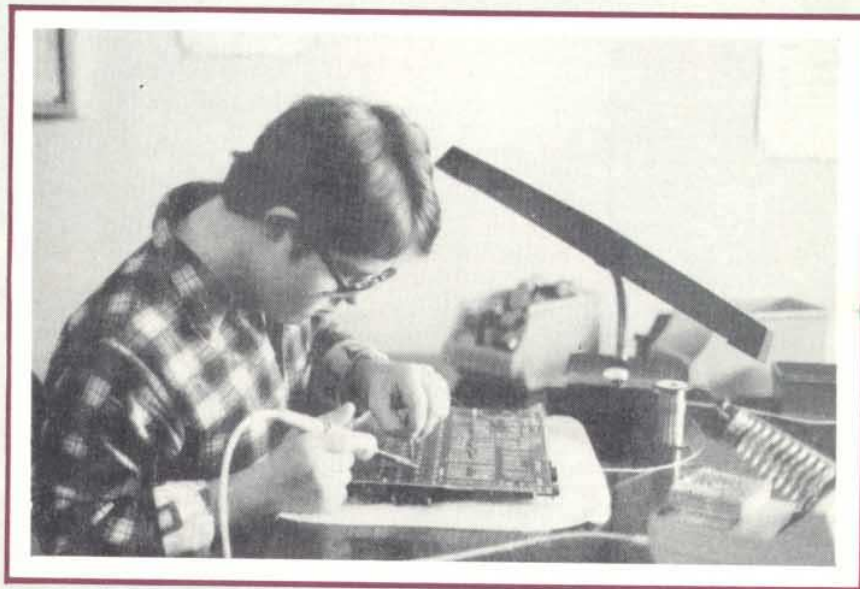
same amount of work may take two or perhaps even three disabled persons to produce. It should be emphasised that this in no way implies that the quality of work is marginal, and on the contrary, once adequately trained the work is precise, meticulous, and of consistently high quality.

There are many side benefits to this exciting program, and these can be measured in human terms, such as self-worth and pride in being able to perform work normally reserved for non-disabled people.

Watching the operation there is no doubt these young people are totally engrossed in their work. They believe the old concept that intellectually handicapped people are not capable of long periods of concentration. Most importantly, they enjoy what they are doing immensely, because it is interesting, sophisticated and productive. Apart from the acquisition of a high level of vocational skills, those participating in the program have developed an exceptional sense of self-worth and seem reinforced by their own quality workmanship and their ability to produce work normally undertaken by the non-disabled.

Simply put, the workers are acutely aware of the value in assembling elect-

ronic components as compared with the work typically offered within sheltered workshops.

The training technology was introduced by the Centre's Program Director, John Leddy, following a Rotary sponsored study tour to the United States in 1983, during which time John worked with world leaders in the field of intellectual disability. The methods of training were researched and developed throughout the seventies, in the United States, and even in that country, are just beginning to be disseminated to service providers and teachers.

As previously explained, the training program at Challenge Foundation, Point Clare (recently known as Fairhaven Centre) is probably the first of its kind to be established in this country, and many Government Departments and organisations interested in the welfare of people with intellectual disabilities, are carefully monitoring its progress.

The Gosford Rotarians who sponsored John's trip are delighted with the outcome of their investment, and are anxious to promote the success of the program to the local community, and hopefully will lead to substantial opportunities in other such Centres right throughout this country.