

**SPECIAL
PREVIEW**

Apple '82

**FIRST NATIONAL CONVENTION
& EXHIBITION**



JUNE 4, 5 & 6, 1982
The Fulcrum Centre, Slough

Your stand-by-stand guide

Stand 1

Owl Microcomputers, The Maltings, Station Road, Sawbridgeworth, Herts. 0279-723848.

New communications packages for Apple are being shown. OwlTel is a combined hardware/software system which converts the Apple into a Prestel or Viewdata terminal and also can be used as the basis of network systems, while Owlsync is a software package which allows an Apple to emulate the communications protocols of the IBM 3780 or 2780, and to communicate with other types of mainframe computer.

Owl is also featuring other communications concepts based on Apple; the APES professional editing system, which provides sophisticated editing facilities for viewdata information providers, and Overview, a local area network viewdata system.

Stand 2

Moore Paragon UK Ltd, Moore House, 75-79 Southwark Street, London. 01-928-9022.

In addition to expert advice on individual requirements Moore Paragon offers a comprehensive supplies package comprising stock and custom-designed input and output forms, magnetic media, forms handling equipment and filing and storage systems to enable small business computer users to maximise their investment.

Also available is a range of forms packages - input and output documentation designed around specific software programs to combine all the advantages of custom-printed stationery with preset form layouts. Moore Paragon's free forms design service offers the added benefit of forms that promote a company's image as well as being functional.

Stand 3

Channel Island Computer Consultants Ltd, 94 Germain Street, London WC1 (1-930-0261) and Grove House, Bodge, St Peterport, Guernsey C.I. (0481-20155).

CICC are demonstrating their new Apple II Mercury MDOS multi-user system. Mercury, which is installed in a 16k ROM card, has very powerful file handling providing full ISAM and DIRECT filing on either 5 $\frac{1}{4}$ " or 8" floppy drives, or on a variety of hard discs. Very rapid programming in Basic, utilising masking facilities, is standard. Up to 14 users can be linked to a common database, providing incredibly fast access.

A growing number of UK Apple dealers and a number of large multi-nationals and banks are currently installing this highly effective yet cheap multi-user system.

Stand 4

Pete and Pam Computers, Waingate Lodge, Waingate Close, Rawtenstall, Rossendale, Lancs. 0706-227011/2/3.

Come and meet... Pete and Pam Computers, the country's largest distributor of Apple related (non-Apple manufactured) products. We carry a range of over 600 items of both hardware and software for Apple and are suppliers to over 95 per cent of the UK's Apple dealers.

The latest products for Apple will be available. London office: 98 Moyser Road, London SW16 6SH. 01-677-2052/7341.

Stand 5

Data and Control Equipment Ltd, Poppy Road, Princes Risborough, Bucks. 0844-43281.

Data and Control Equipment are specialists in business communications and will be demonstrating the following facilities for Apple II and Apple III: TelexBox I, Telex Interface. This device allows any Apple system to send Telex messages to over one million Telex users worldwide. All dialling and answerback checking is automatic and the system can keep trying busy numbers unattended.

772 Telex Punch. This well-established product produces correctly formatted Telex

punched tapes from Apple II or III, thus eliminating a most time-consuming operation for busy Telex users.

Stand 6

ConSup, 62 Tritton Road, London S.E. 21 8DE. 01-670-4411.

ConSup is an exciting new company with a policy of supplying value-for-money consumable products for computer users nationwide. It consistently provides a wide product range at low prices for all computer installations, supplying both trade and end-user customers.

Although the largest area of operations is the disc-based microcomputer user, ConSup has recently branched out into the mini and mainframe markets, with the same competitive pricing policy that has gained them a good reputation among micro owners.

ConSup has a thriving mail order business and is very happy to deal with all enquiries for discs, listing paper, printer ribbons, library boxes, etc... on their London telephone number.

Stand 7

U-Microcomputers Ltd, Winstanley Industrial Estate, Long Lane, Warrington. 0925-54117.

Top Apple dealer and largest UK manufacturer of Apple peripheral cards. More Apple cards than Apple! New professional standard micronetwork software called U-Net on display.

Stand 8

Caxton Software Publishing Co, 10 Bedford Street, Covent Garden, London. 01-379-6502.

Specialising in management aids, productivity tools and personal enrichment software, Caxton publishes and promotes the work of British software authors. On display at the exhibition are:

Optimiser - the linear programming system for finding the best practical solution to resource allocation problems. Cardbox - electronic card index system with sophisticated plain English retrieval and reporting facilities (uses the Microsoft Softcard and an 80 column card).

Potential users and dealers are especially welcome. Please ask for a demonstration at our stand.

Stand 9

Community Computers, P.O. Box No 3 Petersfield, Hants GU32 2ER. 073-087-567.

Principal distributors for a wide range of peripherals for leading microcomputers in the UK. Exhibiting the Apple and Apple compatible Basic 108 computers connected to Cameo and Symbiosis hard discs and a range of high capacity 5 $\frac{1}{4}$ " floppy disc drives.

The specially designed DataMac integrated software package featuring the CP/M operating system and the MDS database will also be displayed. This software has been developed over a period of five years and is particularly aimed at businesses requiring integrated job costing.

The Select CP/M word processing software will be demonstrated and will feature its unique 90 minutes Teach program using an Olivetti ET221 typewriter.

Stands 10, 11

Eicon Research Ltd, Unit 9, Viking Way, Bar Hill, Cambridge. 0954-81825.

Eicon Research are showing new versions of their popular 8in floppy disc systems. Two features in particular make the new disc systems stand out:

Better software - the CP/M operating system can be booted in addition to Pascal and DOS 3.3, there are no 'patch programs' using up memory space, and each 1 megabyte disc is treated as a single volume in all three operating systems. These fundamentally important features are all unique to Eicon 8in systems. LSI and gate-array technology in the con-

troller. Eicon are among the first manufacturers to eliminate the phase-locked-loop (PLL), the Achilles heel of double-density disc operation. Power consumption is only two watts, while fast data throughput is provided by DMA.

On-line capacity is over 2 megabytes, with an intrinsic back-up capability provided by the removable media.

Stand 12

Phoenix Technology/Hantarex (UK) Ltd, 158 Camberwell Road, London SE5 0EE. 01-639-9343.

An importer and distributor of an entire range of attractively designed monitors, all manufactured in Europe. Display monitors for both colour and monochrome are available in plastic or metal cases, both of which are ideally suited to business or personal use.

Sizes are from nine and 12 inch for monochrome (both of which are available with white, green or orange phosphors), through to 14 inch colour monitors which in turn are available in three different resolutions, the highest of which has a phosphor dot pitch of 0.31 mm. All monitors are very competitively priced.

Stands 13, 14

Silver Wheel Accessories Limited, Badingham Road, Framlingham, Suffolk. 0728-723506.

Entering the field for the first time with an entirely unique product is Silver Wheel Accessories Ltd. At last here is a purpose-built computer console designed specifically for the Apple II micro computer. A team of professionals has given priority to operator comfort and office aesthetics. Discs, plugs and flex, all have built-in housing facilities, giving an uncluttered, streamlined dimension to the whole office.

Another first on this console is the simple compact storage feature of the legs, enabling ease and safety during transport.

Another innovation currently under way and to be used in conjunction with the console is the Universal Acoustic Printer Table - the prototype to have its first showing at the exhibition.

Stand 15

GB Computer Products, 14 Greenwood Grove, Winnersh, Wokingham, Berks. 0734-786635.

We will be showing for the first time in this country three printers running simultaneously on one Apple II, made possible by the use of the Microbuffer II 16k and 32k Print Buffer Cards.

The new Acclaim microcomputer will be demonstrating how it runs all Apple II software in a truly businesslike way. Fans of CP/M on the Apple or Acclaim will be able to see the Turnkey system which makes CP/M much more user-friendly and applications-oriented.

Stand 16

MC Computers Ltd, Kenley House, Kenley Lane, Kenley, Surrey. 01-668-4151.

MC Computers, who specialise in industrial interfaces for microcomputers, are able to offer complete Apple-based systems for data acquisition and control, including all hardware, peripherals and menu-driven software routines. In addition, a range of plug-in interface cards is available for users with their own Apple computer, supplied with all device handling software on floppy disc.

Also from MCC are the 2016 range of IEEE 488 compatible modules for low cost, custom-built solutions to industrial interfacing requirements. Digital and analogue I/O units are complemented by an IEEE bus extender and a serial to IEEE converter.

Stands 17, 18

SBD Software, 15 Jocelyn Road, Richmond TW9 2TY. 01-948-0461.

SBD Software distributes software and

Apple Educational Forum

THE First National Educational Forum, to be held on Friday, June 4, is being organised specifically for the benefit of teacher's who use, or want to use, Apple computers in the curriculum. Speakers include:

- **Bill Broderick: The dissemination of educational software.**
- **John Gray: General purpose uses of the Apple.**
- **Dr Gavin Kenny: Effectiveness of computer assisted learning.**
- **Peter Deakin: Employment for the physically handicapped.**
- **Ray Haydon: Apples in primary education.**
- **Barry Holmes: New directions for the Apple.**

Demonstrations of Apple products and software related to education will take place throughout the day, and visitors are invited to attend the exhibition of Apple suppliers being held at the same time.

The Education Forum opens at 9.30am. More details can be obtained by contacting Bob Senior of Apple (UK) on 0442 48151.

hardware for the Apple microcomputer. We have a wide variety of items and our list is both updated and increases monthly. We import most of our items from the United States and try to cover the whole range of packages — business software such as word processors, databases and Visicalc, utility software for programmers and games for everyone.

We can also offer you a subscription to Call A.P.P.L.E magazine where you will find a host of ideas and programs. Please stop by and see us.

Stand 19

TABS Ltd, Sopers House, Chantry Way, Andover, Hants. 0264-58933.

In the past 18 months TABS (The Accounting Business System) Ltd, has established itself in the forefront of the market dealing in accounting software for microcomputers. One out of seven Apple machines sold in the UK use some TABS modules.

TABS modules are individually self-supporting, but are also capable of integration with other modules to satisfy almost any requirement. Product offerings include sales, purchase and nominal ledgers, stock control and payroll, which could be augmented by modules including job costing, fast data entry, sales order processing, mail listing and word processing.

Stand 20

Country Computers Limited, Pipers Road, Park Farm Industrial Estate, Redditch B98 0HU. 0527-29826.

The Acclaim microcomputer is a commercial alternative to the Apple II personal computer, running all Apple software and accepting all Apple hardware add-ons. It is housed in a stylish ergonomically designed cabinet and incorporates a 6 or 12 Mb Winchester, floppy drive and a high quality anti-glare screen.

Its detachable keyboard includes true upper/lower case capability, alpha lock and shift lock, separate numeric keyboard, auto repeat on key holddown, type-ahead buffer and 12 separate programmable function keys. The versatility to switch from the keyboard into either 40/80 column format means that the Acclaim can cater for a wide range of application packages from word processing to Visicalc.

Stand 21

Personal Computers Ltd, 194-200 Bishopsgate, London EC2. 01-626-8121.

We will be demonstrating a full range of Apple products, peripherals and software. On show will be software from Software Publishing Corporation including PFS, PFS Report and PFS Graph (the latest addition in this hard-working software series.) PFS (Personal Filing System) is currently the second-best-selling software package in the USA, challenging Visicalc for the pole position.

The popular Format 80 professional word processing package will also be demonstrated, along with Tax Payer *1, the new personal tax computing package. Both products have been designed for ease of use and offer the user dramatic productivity improvement.

Stand 22

Haigh and Hochland Books, The Precinct Centre, Oxford Road, Manchester M13 9QA. 061-273-4156.

It was in Manchester that programmed computers were first conceived and constructed. They were known then as "the Manchester machine." The close association between computers and Manchester continues to this day, and Haigh and Hochland, as a specialist source for computer books and software, are at the hub of where the research goes on. Few booksellers anywhere carry a comparable range and depth of stock on computer subjects. Write in for your copy of "What's New in Computer Books" and "Personal Computer Books and Software". These catalogues keep you up to date on the

literature and are sent on request free of charge. You can order books from Haigh and Hochland no matter where you live. They can nearly always be supplied from stock by return.

Stand 23

RAM Computer Services, 15-17 North Parade, Bradford. 0274-391166.

RAM Computer Services, an Apple national accounts support dealer, will be featuring two of their latest software developments for Apple computers. Firstly the highly acclaimed and already successful FMS fully integrated financial ledger system on Apple II and a newly released, further enhanced version for Apple III called FMS-Plus.

Secondly they will be showing a new medical computer system for general practitioners called Medic which has also been developed for Apple III. Both systems utilise the Profile hard disc system for which RAM now offer a new cost effective and attractive back-up system. Dealer enquiries are welcome.

Stand 24

Anadex Ltd, Weaver House, Station Road, Hook, Basingstoke, Hampshire. 025672-3401.

Anadex shows its first word processor printer, the WP-6000, and the new 'A' series of dot matrix printers at the show, all of which are now available to the UK and European computer markets. On display is the WP-6000 printing in correspondence quality mode, and the new DP-9620A, offering high print throughput for continuous operation at 1200 baud, linear reproduction of vdu graphics plus the low operating noise level of 55 dBA.

Also on display is the new beautifully quiet DP-9500A alphanumeric printer series with 2.7k standard buffer. All 'A' series printers utilise new acoustically designed covers to provide low operating noise levels and offer high density graphics.

Stand 25

Jarman Systems Ltd, 6A Dolphin Square, Tring, Herts. 044-282-6841.

Jarman Systems will be showing their advanced Pascal-based accounting systems. These integrated systems are designed to be simple to operate and yet provide sophisticated accounting functions and full audit trails. The following programmes are available: Sales accounting, invoicing, purchase accounting, nominal ledger with cash book and budgetary control, stock-recording and payroll.

The software is distributed through a network of carefully chosen dealers who will be able to give you a full analysis of your requirements and provide effective after-sales service.

Stand 26

Blyth Computers Ltd, Heathside Farm,

Wenhaston, Halesworth, Suffolk. 050-270-565.

East Anglia's leading Apple dealer have installed more micros than any other dealer. Blyth are committed to the full support concept of Apple UK.

Stand 27

Dynatech Microsoftware Microsystems Ltd, Summerfield House, Vale, Guernsey. 0481-47377.

Microsystems, a Guernsey-based division of the Dynatech Corporation, are demonstrating CORP, a powerful database, printed reports, forms and menu generator for a 48k Apple II Plus with two disc drives.

Manufactured in Guernsey and distributed worldwide by Microsystems Limited, CORP is very flexible and user-friendly. Once the programs have been generated the user with some knowledge of Applesoft can customise them even further by modifying or inserting program lines or sub-routines.

Microsystems also run holiday computer training courses in Guernsey where all the family can learn something about the world of microcomputers.

Stand 28

BFI Electronics Ltd, 516 Walton Road, West Malsey, Surrey KT8 0QF. 01-941-4066.

BFI Electronics, the major UK distributor for the Verbatim Datalife range of flexible magnetic media, will be exhibiting flexible discs, mini discs, cassettes, cartridges, storage and disc drive head cleaning kits.

Of major interest to the microcomputer users will be the latest disc drive cleaning kits forming part of the Verbatim Datalife product range. The entire Datalife range, which will be on show, incorporates many advanced design benefits which make them the most reliable currently available.

Stand visitors will also be able to see a range of storage units to store flexible discs and BFI representatives will be on hand to discuss the Verbatim products.

Stand 29

Spider Software, 98 Avondale Road, South Croydon, Surrey. 01-680-0267.

Spider Software will be exhibiting a wide range of packaged software including games, utilities, word processing packages and graphics utilities. Their new database management package 'Access' will be on permanent display, and the authors will be available to answer questions concerning the system.

Stand 30, 31

Keen Computers Ltd, 5 Giltspur Street, London EC1. 01-236-5682.

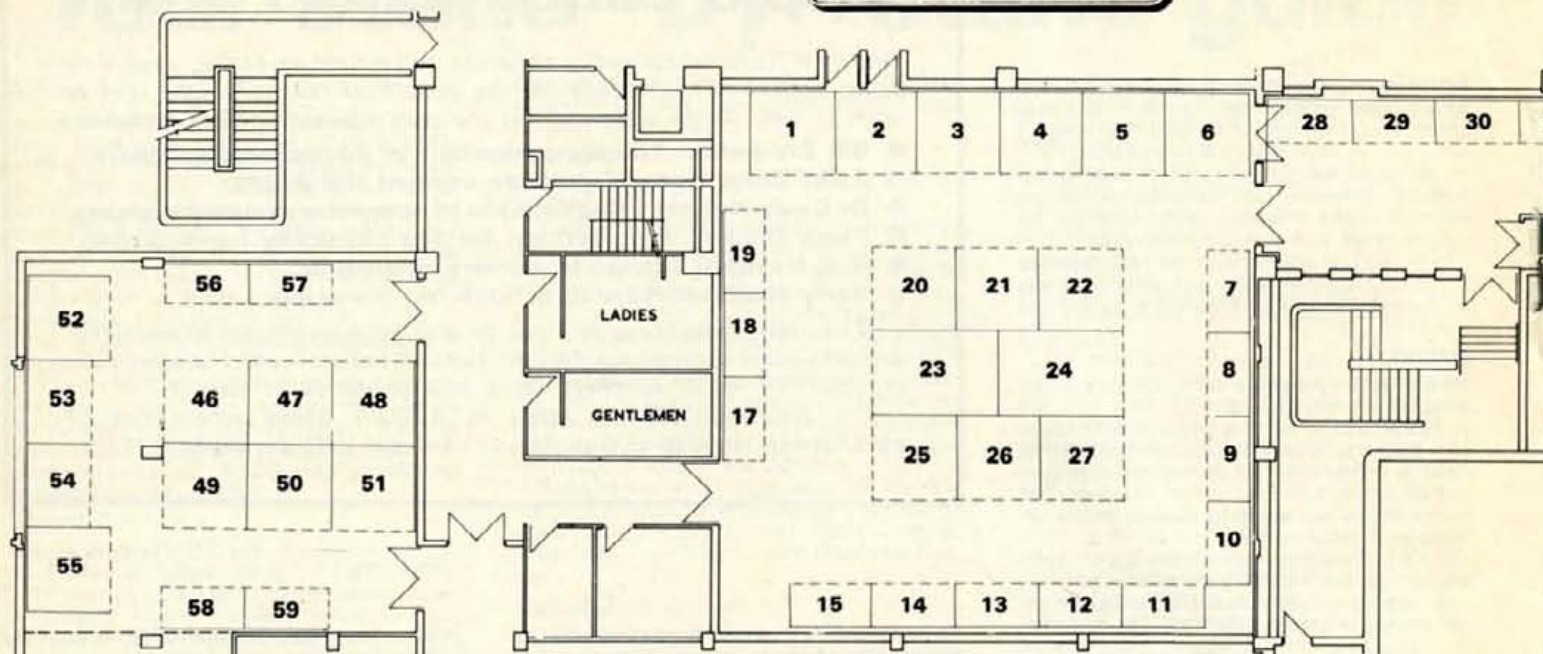
Leaders in microcomputer networking technology, Keen Computers offer an extensive range of microcomputer multi-user networks and software with Apple II and Apple III.

Available with Apple is the Omninet

What's where at the



exhibition



network using the Corvus hard disc drive linking up to 64 different microcomputers or peripherals into a fast, low cost, local network.

Stand 32

Computopia Ltd, 30 Lake Street, Leighton Buzzard, Beds. 0525-376600.

Computopia Ltd. are showing a range of quality add-ons for Apple, covering the Micro-Sci range of discs for Apple II/III and buffered I/O interfaces. Computopia also specialise in customised technical software.

Stand 33

Software Rental Bank, 58 North Street, Leighton Buzzard, Beds LU7 7EN. 0908-53491.

The Software Rental Bank give members access to over £30,000 worth of original software products on a short term rental basis. Rental is free to members who decide to buy a rented package.

For the first time Apple users can try out a wide range of software packages at length, without any obligation to purchase. Our software listing includes many exciting and controversial new releases as well as "blue chip" packages such as business-planning aids, word processors, accounting systems, utilities and firmware. You may join the Software Rental Bank at the exhibition.

Stand 34

Data Supplies, Braids House, Templewold Lane, Farnham Common, Slough. 02814-2359.

Data Supplies are Apple's local dealer in Slough and provide a level-one sales and service to a broad band of users, commercial and government, throughout East Berkshire and the surrounding areas. As well as appearing on Apple's list of specialist dealers in the fields of education and medical applications, Data Supplies has built up an enviable reputation in the field of communications. Not only have they interfaced the Apple to many of the other popular microcomputers but they have carved out a special niche in the field of communications with ICL host mainframes. If you require advice on getting your Apple to communicate with ICL mainframes 1900 or 2900, working under DME George III or VNE/B, get in touch with ICL specialists Data Supplies. Think communications. Think Data Supplies... the Apple dealer worth a second thought.

Stand 35

DN Computer Services Ltd, West Croft Industrial Estate, Middleton, Manchester M24 4PJ. 061-643-0018.

DNCS, suppliers of all forms of computer accessories, magnetic media and computer

furniture will be exhibiting a range of products in conjunction with our associate company Umbra Software Ltd. On display will be ODP extended performance floppy discs, a new Apple III Profile back-up system, colour monitors and other Apple peripherals.

Also on display will be the CX80 colour printer using an Apple dump card to dump from Apple II in full colour. A 40 page full colour catalogue will be available free of charge on request.

Stand 36

Independent Computing Engineering, 16/18 Littleton Road, Ashford, Middlesex. 07842-47271.

ICE will be showing the latest version of their 5 $\frac{1}{4}$ inch Winchester Subsystem, the WDS200 series, incorporating the new, higher-capacity Rodime drives up to 21 Megabyte capacity, housed in an attractive, low-line cabinet in Apple-compatible colour.

The Winchester is also attachable to the IBM personal computer, Superbrain, S100 Bus and most Z-80 based micros. Backup for the ICE Winchester will be demonstrated with the ICE Tape Streamer, available for both Apple II and Apple III Profile, allowing security backup of 20 Megabytes per removable $\frac{1}{4}$ inch tape cartridge.

The Amlyn 5 $\frac{1}{4}$ inch floppy disc cartridge drive is also offered as alternative backup, with 8 Megabytes of removable capacity.

Stand 37

Extel Statistical Services Ltd, 37-45 Paul Street, London EC2A 4PB. 01-253-3400.

MicroExstat, a data base of company financial information, comes on a set of floppy discs for use initially with the Apple II. It is a product of Extel Statistical Services, a leading supplier of information to the City and to industry.

MicroExstat covers some 1,500 British companies and more are being added. It is updated every month. It comes complete with a sophisticated analytical system, also on floppy disc, to enable the user to interpret the data to maximum advantage. MicroExstat is being demonstrated on stand 37. Why not pay us a visit - NOW.

Stand 38

Microcal, 36 Elm Road, Windsor, Berks. 07535-68009.

Microcal is a young company based in Windsor specialising in computer-aided learning products with a difference in that the courses have a deliberate slant towards business applications. This is reflected in the company's first product, Hands-On Cis-Cobol Programming which teaches the most commonly used business programming language,

Cobol, in the most effective manner - by using it.

The courses have found a ready market in the data processing departments of large organisations, in smaller organisations, commercial training establishments, schools and colleges. A visitor to the Microcal stand will be given the opportunity to try THE method of learning THE business programming language.

Stand 39

Instrumentation Design and Electronic Applications Ltd, 11 Wye Estate, High Wycombe, Bucks. 0494-20707.

If you have found difficulty in connecting your Apple to other equipment you will be pleased to know that one of the exhibitors has experience of computer systems including Apples with special purpose hardware and software.

IDEA is an Apple OEM dealer with the capability for design, development, production and support of electronic projects. This includes interfaces to non-electronic technology. IDEA expects to exhibit a system for pathogenic bacteria research as well as other examples of their electronics expertise.

Stands 40, 41, 42, 43

Symbiotic Computer Systems, 85/87 Station Road, West Croydon. 01-680-8606.

The SyMBfile hard disc subsystem is a complete 5 $\frac{1}{4}$ inch Winchester system for the Apple II. The system comprises the Seagate ST506 hard disc, controller, power supply and interface. The SyMBfile supports DOS 3.3 Apple Pascal and CP/M, different operating systems may be mixed on the same drive. Unique features of the system include an autobooting interface card and a back up system allowing easy back up within the hard disc or on to external storage media.

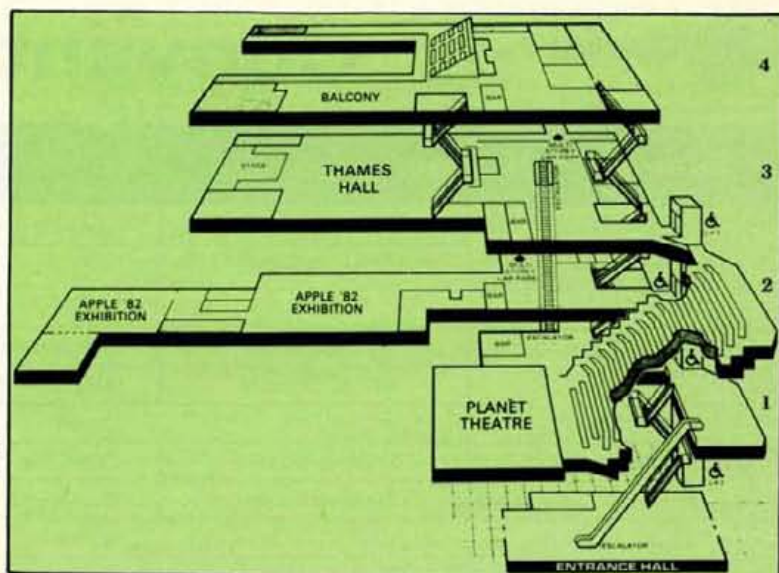
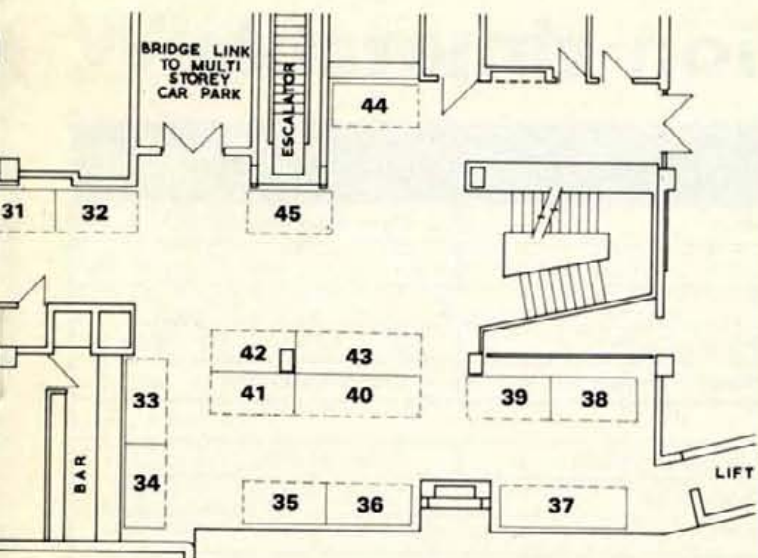
Symbiotic Computer Systems also present the SyMBstore, an 8Mb 5 $\frac{1}{4}$ inch floppy drive for the Apple II. A cartridge containing five single sided floppies is inserted into the drive which then automatically selects the appropriate disc. The system may be used as a stand alone drive or as a back-up to a hard disc.

Stand 44

A.P. Systems, 90-100 Brighton Road, Surbiton, Surrey. 01-399-1257.

Having been involved from the start in the development of the Personal Computer Database with Enterprise Systems, we are going to be selling and advising on communications equipment and software to access this and other systems. Subscribers to the Enterprise System come through us.

The Ormbeta range of software, Pascal based and 80 column, will be demonstrated on our stand. Developed by Ormskirk Computer



Services and built round the Ormbeta Database, this software is rapidly gaining a reputation for sophistication and flexibility. Ormbeta software runs on 5¼in, 8in and hard disc systems.

Stand 45

Enterprise Systems Group, Thameside Computer Centre, Ferry Works, Summer Road, Thames Ditton, Surrey. 01-398-8445.

Based at Thameside Computer Centre, Thames Ditton, Enterprise is able to offer networking and turnkey facilities to organisations requiring full in-house database access, using microcomputers as communications terminals, as well as having 1,000 telephone lines for access to a main database.

Enterprise Systems are making their computing facilities available on a subscription service to personal computer users, who want to access bulletin boards, software, databases of computer and general information. Enterprise are also setting up professional databases for national or local institutions and organisations, accessible in the first instance by Apple computers.

Stand 46

Robocom, Ground Floor CIL Building, Goodwin Street, London N4. 01-836-1072.

"A revolutionary breakthrough in low cost microcomputer graphics" is how the Press have described the Bit Stik interactive graphics system. It is the first in a new generation of finely tuned computer graphic controllers which combined with powerful software programs eliminates the time and patience-consuming inputting of instructions via a keyboard.

Designed and produced by the North London Robotics research and development company, Robocom Ltd, this new user-friendly hardware/software package enables Apple II users to create multi colour graphics, technical drawings, circuit diagrams, text, etc quickly and simply with the minimum of computer knowhow and at very low cost.

Stand 48

The Computer Bookshop, 30 Lincoln Road, Olton, Birmingham B27 6PA. 021-707-7544.

The Computer Bookshop is a wholesale distribution company set up to supply books to the retail microcomputer market, and offer a wide range of books covering most of the popular machines.

On display will be our full range of Apple-related books, plus some general titles.

Stand 49

Ferrari Software Ltd, Hayden House, 5/6 Mill Mead, Guildford, Surrey. 0483-60137.

Ferrari Software are approved dealers in ISM software products MatheMagic and GraphMagic. They also offer the very latest games packages as available in the USA. MatheMagic is a number processing package, a menu driven system that anyone can easily master - the indispensable tool for business people, educators, students, engineers, scientists and the practical home owner.

Anyone in fact, who needs to calculate anything from simple arithmetic to the most sophisticated mathematics.

GraphMagic provides graphic interpretation of numeric data, displayed in line, pie and bar graphs. This product is available as a stand alone package and can interpret both MatheMagic and Visicalc data. For all age groups, the games packages are exceptionally interesting and varied.

Stand 52

INMAC (UK) Ltd, 18 Goddard Road, Astmoor Industrial Estate, Runcorn, Cheshire. 09285-67551.

International Mini/micro Accessories Corporation, provides a service to users of most computers, including of course Apple, supplying on a 30 day risk-free trial basis cables, printer supplies, floppies, disc packs and cartridges, accessories for storage and cleaning, computer room furniture and hundreds of other products. Every order is delivered next day and products are further warranted with a 12 month quality replacement guarantee.

INMAC's customer policy is one founded on the belief that the customer comes first - and that customers should always get what they need - this leads to happy customers and thus continued repeat customers. Their new 56 page catalogue, which is basically an ideas book, is full of useful products and helpful hints to computer departments, it is available to all computer users as a free two-year subscription.

Stand 53

ICI Petrochemicals Division, PO Box 90, Wilton, Middlesborough, Cleveland TS6 8JE. 0642-455522.

"REXAGAN" is a simple but powerful interface system which links microcomputers to laboratory and process instruments for data acquisition and process control. It was designed by ICI to meet the varying needs of its own scientists and engineers.

"REXAGAN" is a versatile and flexible aid for education at all levels from schools to universities. It comes complete with assembly and programming instructions in a well illustrated manual to be used by junior technicians and senior scientists alike.

Stand 54

Dyson Instruments Ltd, Sunderland House, Station Road, Hetton, Houghton-le-Spring, Tyne and Wear DH5 0AT. 0783-260452.

Dyson Instruments specialise in the sale of laboratory data processing equipment to scientists and engineers (91 per cent of sales in 1981) all over the UK and abroad. They are worldwide distributors of ICI's "REXAGAN" system which links Apple (and other microcomputers) to scientific instruments and engineering processes.

"REXAGAN" is a powerful system for data acquisition and process control, yet is extremely simple to use and comes with a very comprehensive manual with full assembly and programming instructions. Working models

displaying the simplicity and power of "REXAGAN" will be on show. Distributor enquiries are invited. Full colour brochures are available.

Stands 56, 57

Hal Computers Ltd, Invincible Road, Farnborough, Hants. 0252-517171.

As part of their 1982 dealer plan Hal Computers will be demonstrating their 10 Megabyte Winchester sub-system for Apple II. This system can be networked. Its back-up options include the new Amlyn 8-Megabyte floppy drive or the quarter back streaming tape drive. They should not be missed.

The system can run a combination of CP/M, Basic or Pascal. Also on the stand will be various Apple add-ons such as the Strobe Plotter - 4 thou resolution for £825 including software, and a digital thermometer which will be of great interest to those of you who have agricultural or food processing applications.

As Dysan's key agent for the UK, Hal offer a four hour turn around on disc orders, quantity discounts for up to one quarter million discs and various dealer schemes.

Stand 58

Mass Micros, Wellson House, Brownfields, Welwyn Garden City, Herts. 07073-31436.

Mass Micros offer complete support to businesses using microcomputers in management, commerce, science or industry. professional advice, training and fast delivery ensure effective purchases, while maintenance schemes, including loan machines and telephone software support give unparalleled security. After sales service includes advice of new developments.

Mass Micros was founded by professional engineers with experience of hardware and software in high technology. Finding solutions for major corporations taught them how to help you. Products include Apple II and Apple III, Pet and Superbrain, hard disc storage, peripherals, printers, plotters, media, furniture and software, including unique Calcomp driver modified as Visicalc interface.

Stand 59

Datarite Terminals Ltd, Caldare House, 144 High Road, Chadwell Heath, Essex. 01-590-1155.

The availability of low-priced word processing programmes for the Apple has meant a great interest in correspondence-quality computer printers. Price has previously been a barrier until Datarite introduced the T/Printer 35.

Based on the well-known Olivetti Praxis electronic typewriter, the T/Printer 35 not only offers excellent print quality at an affordable price, but also gives the user the advantage that it can be used as a typewriter when not needed for computer printing. This versatility is just one of the great advantages of interfacing modern electronic typewriters to computers. As well as the T/Printer 35, Datarite are also showing computer printer/typewriter units based on IBM, Olivetti and Olympia office typewriters.



Convention timetable

Saturday 5th June

0930-1100	Thames Room	Opening Session	Dave King (Apple UK)
	Planet Theatre		
1100-1115		Coffee	
1115-1245	Thames Room	Supercharging the Apple	Gene Finkler, Peter Brameld
	Planet Theatre	Computer Assisted Learning	Dr. Gavin Kenny
1245-1400		Lunch	
1400-1530	Thames Room	Tools for Business Software	Peter Hewitt
	Planet Theatre	The Apple in Industry	Jeff Barringer
1530-1545		Coffee	
1545-1715	Thames Room	Database Systems	Mike Gurr
	Planet Theatre	Pascal	Dr. Tony Addyman Dr Austin Tate
1715-1900		Break	
1900-2030	Thames Room	Apple Olympics Finals	
	Planet Theatre	Music Synthesis	Dr. David Ellis

Sunday 6th June

0930-1100	Thames Room	Communications	Mike Gardner
	Planet Theatre	Apples in Medicine	Dr Gordon Jameson, Dr. Cliff Doust
1100-1115		Coffee	
1115-1245	Thames Room	Graphics Displayed	Alan Norman, Peter Bailey
	Planet Theatre	Computers in Management Education	David Sutton
1245-1400		Lunch	
1400-1530	Thames Room	Hardware Panel	Steve Alsop, Mike Gurr, Lawrence Payne, Geoff Reiss
	Planet Theatre	Commercial Applications	David Jarman
1530-1545		Coffee	
1545-1715	Thames Room	Speech Synthesis	Dr. Martin West
	Planet Theatre	Software Panel	Dr Austin Tate Mike Hardwick Roy Stringer

This timetable is provisional and subject to alteration

David Jarman



Dr Austin Tate



Peter Brameld



Lawrence Payne



Jeff Barringer



Dr Tony Addyman



Mike Gurr



Steve Alsop



Dr Martin West



Gene Finkler



Dr David Ellis



David Sutton



Geoff Reiss



Peter Hewitt



Who's who

Speakers at the convention are:

DAVID SUTTON worked for 12 years in the British aerospace industry in the course of which he graduated with an honours degree in chemistry from Imperial College, London University.

At the time of leaving the aircraft industry his duties included project management, process development and shop floor trouble shooting. Following a two-year postgraduate course at Manchester Business School he graduated as a Master of Business Administration.

The MBA course at Manchester models itself on that at Harvard and is noted for its more practical approach, with greater emphasis on live consultancy projects. Special interests included computer applications in management, modelling of business systems and creative problem solving techniques.

On graduating, he created the System Six Consultancy, whose clients now include BP (UK) Ltd, Ciba Geigy (UK) Ltd, the Hotel and Catering Industries Training Board, the Royal Institute of British Architects, the Booksellers Association and many others.

Presentation. Includes a discussion of the various ways of using computers in education, and will draw on models of trainer/class interaction and the learning process in general to develop a scheme to help people evaluate the potential of computers in their own spheres.

DR AUSTIN TATE is a computer scientist and has performed research in artificial intelligence and data base systems.

He was project leader to a design and implementation team to produce a Fortran interface to ICL's Integrated Data Management System (IDMS). He now heads a microcomputer consultancy and systems programming group at the Edinburgh Regional Computing Centre, and is a leading member of the USUS Pascal Users Group.

Presentation. In conjunction with Dr Tony Addyman, Dr Tate will be outlining the Apple Pascal System, which is based on the UCSD p-system. The advanced features of the system, which makes it suitable for microcomputer software development, will be described.

Mention will be made of the tools available for the writing of application software in Pascal and Fortran-77. The resulting software can be ported to and/or marketed on a very wide range of microcomputers.

DR TONY ADDYMAN has been a lecturer in computer science since 1970. He is now based at the University of Manchester and is the author of a book on Pascal.

He is chairman of the BSI Committee on Programming Languages and was responsible for the recently published British Standard for Pascal, which will also be an ISO standard.

Presentation. In conjunction with Dr Tate, Dr Addyman will be discussing the advantages and disadvantages of programming in the Pascal language and the options available to Apple users in this regard.

MICHAEL GURR has been in computing since 1957. Following a first-class honours degree in engineering from London University and post-graduate work in concrete technology, he spent a short time in the Navy as an Instructor Lieutenant before moving into the aircraft industry, working for Short Bros and Hawker Aircraft, where he was involved in early computing.

Michael was responsible for starting the Swansea University Computing Centre in 1962, and entered the stock market as a DP manager in 1967. With BOC Ltd in 1972, he pioneered the "user build it yourself" approach to systems as a database consultant.

His own company, Michael Gurr Associates, was established soon after and since then he has been involved in the production of numerous papers on his ideas, and has been a regular speaker at conferences and shows, here and in America.

His involvement with microcomputers started four years ago with a desire to design large data bases in a logical manner instead of the *ad hoc* techniques then in use.

Presentation. Michael Gurr will be looking at the use of data bases on microcomputers, defining standards for their effective use and talking about some of the systems currently available.

JEFF BARRINGER is a science graduate in electronic engineering from Lanchester Polytechnic and has spent some time with GEC (Telecommunications) Ltd where he gained early experience in computer design and communications.

Since then he has spent a number of years involved in digital processor design and a similar period subsequently in assembler and machine code programming.

For the past six years he has been responsible for providing marketing and sales support with MC Computers, one of the foremost companies involved in industrial applications on the Apple and other microcomputers.

Presentation. Jeff will be explaining the problems involved in interfacing microcomputers to industrial devices and how they are overcome, and will be presenting applications of Apple in industry.

ASIDE from an MA in biochemistry, a D.Phil. in psychology and current medical studies at University College London, DR DAVID ELLIS is a musician who just happens to have got hooked on computers.

Armed with a less than brilliant music diploma, he launched himself into writing and playing classical music but now finds himself most pre-occupied with doing the same for film, TV and rock music.

He writes on the subject of computer music and electronic music in

general for a wide variety of magazines, including Electronics and Music Maker, Personal Computer World, Electronics and Computing, and, of course, Windfall.

Current and future projects include an LP for release in the autumn, a couple of film scores and passing his finals.

Presentation. General chaos! Actually, a sort of vaguely chronological perspective to composing, recording and playing music, with the role of micros in all three thrown in for dessert.

David would like to thank the following companies for the assistance they have given in providing assistance to enable him to spice up his talk with plenty of demonstrations: Casio Electronics Co, Cief Products (Electronics), Craftmaster (UK), Keen Computers, New England Digital Co, Passport Designs, Personal Computers, Scenic Sounds, Syco Systems and Syntauri Co.

MARTIN WEST is a B.Sc Tech(Hons.) graduate in physics, an M.Sc in physics on microphone calibration and a PhD in physics on acoustic waveguides.

Recent research undertaken by Martin in the field of acoustics include sound absorption and room acoustics, open plan office acoustics, speech synthesis by rule, speech perception in infants and the perception of distorted speech.

Martin is currently engaged in research work at the Acoustics laboratory of Salford University.

Presentation. A short historical view and examination of the spectral characteristics of steady phonemes (which will be demonstrated, using a spectral analyser and single phoneme program). Other demonstrations will include Fx variation, develop rule synthesis, votrax rule synthesis and Texas Instruments text-speech program.

PETER HEWITT is the marketing manager for MicroFocus, developers of *CisCobol* as a language for microcomputers, who recently won the Queens Award for industry in connection with their work.

Before joining MicroFocus, he was software editor for *Computer Weekly*. Peter's first involvement with computers was as a *Cobol* programmer on IBM mainframes, and he also worked for some years in a system engineering and software consultancy.

Presentation. The relevance of *Cobol* as a business program development language for microcomputers, demonstrated by the use of *CisCobol*, and a demonstration of visual programming tools developed by MicroFocus - *Animator*, *Forms-2* and *Slideshow*, which show the capabilities of the language.

DR GAVIN KENNY will be assisted in his presentation by Dr Carol Schullion of Glasgow Royal Infirmary and Dr Barry Clark of Western Infirmary, Glasgow.

Dr Kenny is a lecturer in anaesthesia at Glasgow Royal Infirmary, and has made extensive use of microcomputers for education and management, especially in operating theatres and intensive care units.

Dr Schullion, who is a research fellow in the department of anaesthesia, has been involved in the application of microcomputers to teaching and self assessment for qualified doctors.

Dr Clark, who lectures in biochemistry, has developed a number of programs dealing with the tuition of biochemistry, many of which involve the use of graphical displays.

Presentation. The application of microcomputers in a learning environment, with the introduction of the concepts of self-assessment using computer assisted learning.

GENE FINKLER is an American who lives in France and works in Geneva for British Petroleum Chemicals. He has a degree in accounting from the University of Nebraska, a Masters degree in management from the Graduate School in New York and a Masters degree in operations research from the Graduate School of Business, New York University.

Gene, who is a member of CDP, the Data Processing Management Association, has worked for a number of major institutions, both in America and Europe. They include the First National City (Citibank), Sandoz Pharmaceutical, Universal Oil Products, Manufacturers Hanover Trust, Republic National Bank, the Diebold Group, ICL and his present company, BP Chemicals (Suisse).

Presentation. A look at the processor used on the Apple and a discussion on some of the ways of speeding it up, using alternative microprocessors housed on peripheral cards. The cards being looked at include The Mill, Metacard and the Aristocard.

PETER BAILEY, who will be assisted with his presentation by Robert Welch, is an inventor and mathematician previously engaged in designing products for the leisure market. He has been involved with Robotics Development leading into a specialisation in graphics and mathematical modelling.

Robert Welch is a graphic designer who, since leaving Liverpool College of Art and Design (B.A. Graphics Communication) has worked on many projects as a graphics designer audio video engineer leading to an intense interest in the development of electronic drawing systems.

Presentation. A close look at the use of graphics in the following areas - facilitating the creative design process, generating display sequences for video recording, graphic display of business data, developing a multi-dimensional graphic database, the use of graphics libraries for rapidly building complex designed, special applications-circuit board design, technical drawing and education.

PETER BRAMELD has been employed at the University of Manchester Institute of Science and Technology for a number of years as an experimental officer, carrying out research into the application of microcomputers to colour physics and textile processing. He is also

chairman of the North West Apple User Group and technical editor to Windfall.

In these two connections he has been responsible for raising the telephone throughput of UMIST by at least 50 per cent, and has established a good reputation in education establishments in Manchester for his assistance in solving Apple problems. Peter is a consultant to a variety of multinational concerns.

Presentation. Peter Brameld is presenting one half of the section on supercharging the Apple with Gene Finkler. Peter's section will deal with the methods of speeding up the Apple through pure programming techniques or using Compilers.

AFTER leaving Manchester University with a B.Sc honours degree in liberal studies in science, ALAN NORMAN entered marketing where he became involved in 1977 in the use of slides for the presentation of business information. He worked as a marketing executive with De La Rue for a number of years, and as a marketing manager with Taylor Woodrow. He joined Myriad Audio Visual, who have pioneered the development of computer-generated slides in Europe, as marketing director after having associated with them for a brief period as a consultant.

Presentation. In conjunction with Peter Bailey of Robocom, Alan Norman will be demonstrating the efficient use of presenting graphics, once they have been created, by turning screen displays into high quality slides, to be used as professional marketing or presentation aids.

DAVID JARMAN is the managing director of Jarman Systems, the Herts-based microcomputer software company. He has had wide experience of computer systems in Plessey, Honeywell and Microsense Computers. David is now principally involved in product development, specialising in management accounting.

David, who has a B.Sc (Eng) in electronic engineering from Liverpool University, and a Certificate of Advanced Studies in Computer Science from Brunel University, will be assisted in his presentation by Harold Norcross, who is a director of a number of companies, and is a business counsellor for a number of major business and financial institutions.

Presentation. A look at the total aspect of management accounting, explaining the reasons and methods of using computerised systems to the best possible effect, and to maximise the efficiency of the business.

MIKE GARDNER is a physics graduate from Cambridge University, who has worked in Post Office Telecommunications for a number of years, being involved during the last two years in a number of technical market research projects, including a Prestel demand study, satellite communications systems and System X for the long range intelligence division.

Mike bought an Apple II originally to experiment in artificial intelligence. However, he became more involved in communications with the Apple, setting up Owl Computers in 1979. Since then he has developed a number of hardware and software products for the Apple, with particular relevance to communications.

Presentation. A look at the current extent of communications on the Apple, and a consideration of the requirements to link the Apple to a number of external facilities.

DR GORDON JAMESON is a senior lecturer at Middlesex Hospital Medical School in London. The school has been using Apples for about four years in many fields including teaching, scientific applications, laboratory installations and record keeping.

Dr Jameson has been involved in medical computing for 17 years and has a wide experience of many computers including Varian, Data General, Hewlett Packard, university mainframes and time sharing services. He will be assisted in his presentation by Dr Cliff Doust of Whittington Hospital, London.

Dr Doust is principal physicist in the Medical Physics Department at Whittington Hospital, where a number of projects have been underway for the last two years on the Apple, dealing with ultra-sound and medical diets.

Presentation. Dr Gordon Jameson will be giving an overall view of the state of medical computing, with particular reference to the Apple. Dr Doust will be talking about and demonstrating the production of animated diagrams to present the result of ultra-sound scans, and will be showing a program which analyses and specifies dieting requirements from a medical point of view.

Joining in the hardware/software panel are:

STEPHEN ALSOP is an electronics design engineer, computer engineer and programmer. He formed DMS Electronics nine years ago, and supplies mainly government, educational and industrial users with specialised systems based on microcomputers.

Stephen has several patents and designs in industrial electronics, including RGB colour systems, touch keyboards for specialised users, A/D and D/A units for the Apple and has developed systems for Barcode reading and printing.

He has also been involved in the design and installation of many interesting process control and machine analysis control systems using the Apple.

LAURENCE PAYNE is a qualified accountant who was engaged in public practice for more than 25 years. In connection with his work with public companies and small businesses he developed considerable experience in system design and consultancy.

Realising the enormous potential of the computer, particularly in

business systems, he founded Computech as a separate operation in 1966. Originally providing a wide range of computer services, Computech eventually specialised on micros with Laurence designing, programming and implementing one of the earliest data base systems on a dual floppy micro in 1976.

When the Apple was launched, Laurence realised its potential for small businesses and wrote one of the first of a new breed of commercial packages for micros, introducing new concepts in design to ease the use of such systems for non-computer personnel.

Since then Computech has developed its expertise in a number of other areas, including the manufacture of a range of interface cards (the Diplomat series). Laurence has also been responsible for the development of a multiplexer of unique concept, providing the switching and sharing of resources between diverse peripherals and processors. Laurence has developed a wide range of experience in interfacing peripherals and software from different manufacturers and runs specialised training courses and demonstration seminars with a high technical content.

MICHAEL HARDWICK has spent the past 14 years programming, with time off to take in a couple of degrees. He is the co-author of Format-80, which is one of the foremost word processing packages, written in machine code.

He has also written several utility programs and is a specialist in copy protection and assembly language.

He is now a director of Elite Software Company, a consultancy specialising in software.

GEOFF REISS has spent 12 years specialising in project management, and the past four in project management by microcomputer.

He is managing director of Construction Programming Services in Bradford, who are the authors of Apple Project Manager, the only British software package to be sold by Apple in America in the Special Delivery Software collection.

Geoff has been working with Apple III since its initial launch as part of the APM development program.

He has done post-graduate work on microcomputers in project management, and is speaking at the World Congress on Project Management at Copenhagen in September in connection with his work.

ROY STRINGER is a founder member of the North West Apple Computer Club, and a regular contributor to Windfall magazine, where his Appletips have saved hours of frustration for Apple users. He works for U-Microcomputers and has gained an enviable reputation for his helpful assistance in sorting out software problems.

Roy will be answering questions on Applesoft.

How to get to



TRAVELLING BY ROAD?

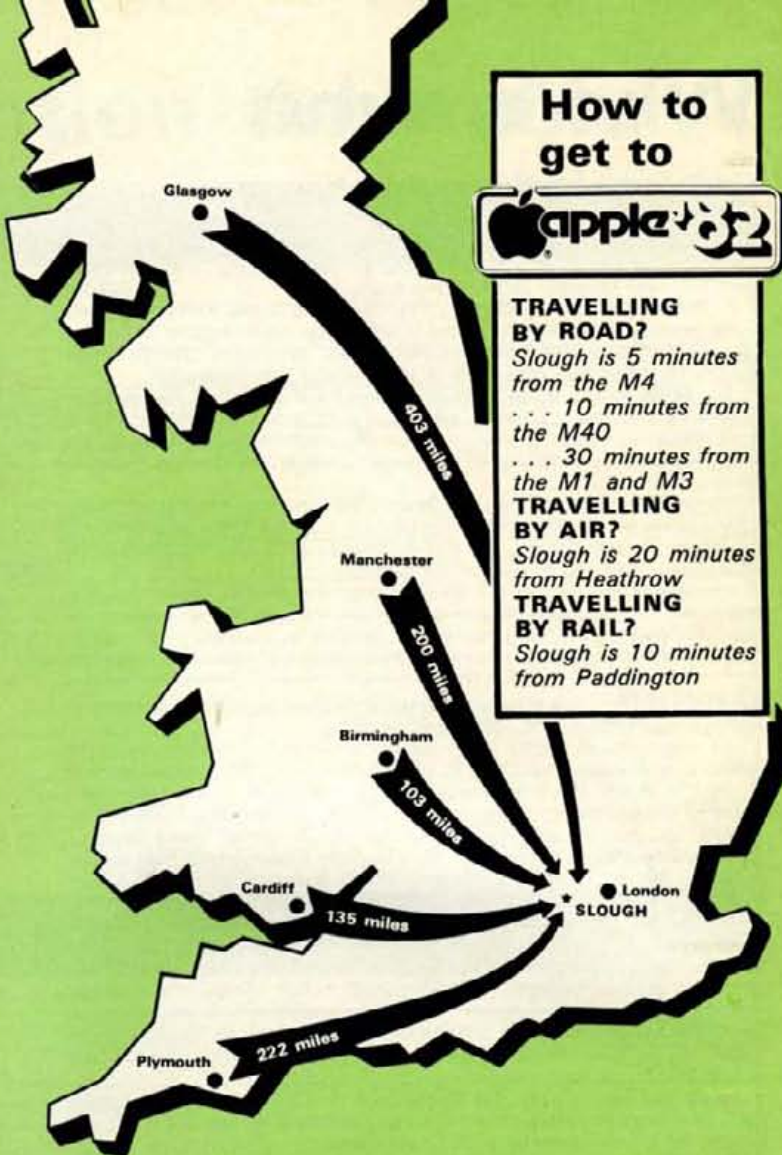
Slough is 5 minutes from the M4
... 10 minutes from the M40
... 30 minutes from the M1 and M3

TRAVELLING BY AIR?

Slough is 20 minutes from Heathrow

TRAVELLING BY RAIL?

Slough is 10 minutes from Paddington



Make your
next decision an
Apple
computer



Go for Apple...

When you become the owner of an Apple Computer, you'll find out why 200,000 other people throughout the World have gone for Apple.

Apples are in business everywhere – giving more time for managerial flair to blossom, sharpening professional expertise and giving all types of business a competitive edge in an increasingly competitive business world.

For general business . . .

Imagine you own an Apple desktop microcomputer. Within a very short time you will have immediate access to a wide variety of business programs – to solve your accounting problems, to monitor cash flow and help your overall planning policy. It is strength in these areas that has made Apple the professional's choice, working for you from the start without the need for intensive professional training or experience. Apple has a standard typewriter keyboard, therefore just add the Apple Writer program and you turn your System into a useful 'word processor'.

For financial planning . . .

Programs such as VisiCalc, Apple Plot and Desktop Plan ensure you have help with forecasting and budgeting under the influence of many changing variables. The presentation of data in the form of charts and graphs can be changed at the touch of a button to show different results.

What you need . . .

The typical Apple Computer Business System, as pictured here, consists of an Apple II computer processor with 48K of RAM (random access memory to store your data whilst in operation), two mini-floppy disc drives (for your programs), a high-resolution video monitor and printer to suit your particular needs. All this costs only £2400* and gives you a truly comprehensive business computer system capable of fulfilling most requirements.

Apple has the widest range of accessories available for any computer which means that it can grow to suit your developing requirements whether you need more computing power or wish to benefit from the graphics, colour, sound, musical or language capabilities.

The professional's choice . . .

As well as general business and accounting programs, there are also hundreds of others to support many different sections of industry, professional groups and scientific applications including architecture, agriculture, building and construction concerns, estate agencies, farmers, the legal and medical professions, personnel bureaux, retail management and stock control. In fact almost everywhere information needs recording, processing, displaying and printing.

All this means that your Apple will be a thoroughly versatile piece of equipment, growing with you as your business grows, but ready to help you right from the moment that your Apple is installed.

The Apple II is a completely assembled and tested computer system. It includes a typewriter style keyboard with high-efficiency switching power supply, ROM-resident Applesoft extended basic interpreter, auto-start ROM, disassembler, AC power cord, reference manuals and the Applesoft Tutorial Manual that makes it simple for those who wish to really get to grips with their Apple.

Every Apple comes with a One-Year Warranty as standard and there's the option of renewing this with Apple's Extended Warranty Plan.

Every Apple Dealer will be pleased to give you details, and to show you how an Apple can help you and your business, there are over 450 Apple Dealers throughout the Country – so help is never far away. You will find their names, addresses and telephone numbers on the back cover.

Get an Apple *now*, and put yourself in the picture.



*Recommended retail price, correct at time of going to press.

and the unique VisiCalc Program...

By investing only £125* as 50,000 other Apple Computer users have done, you could make life easy for yourself or anyone who works with numbers. VisiCalc will help you solve your many numerical problems.

MANAGERS plan budgets, compare actual results to budgeted forecasts, and modify projections faster than ever before. VisiCalc is the most powerful and easy-to-use projection tool ever developed.

FINANCIAL ANALYSTS quickly determine rate-of-return under varying assumptions using the built-in net present value functions. VisiCalc will also compute financial ratios, and predict tax consequences.

ACCOUNTANTS develop financial statements and proformas, making changes and comparisons easily with VisiCalc's 'What if..?' recalculation feature.

ENGINEERS AND SCIENTISTS appreciate VisiCalc's transcendental notation, and features like eleven-digit precision in numerical calculation.

TO MARKETING MANAGERS, VisiCalc is the answer to every forecasting and budgeting need. They refine assumptions-commission rates, sales costs, advertising expenditures, leads, sales closing percentage - and watch the effect on the bottom line . . . and for larger planning tasks - ask to see Micro Modeller.



FOR AS LITTLE AS £1,700* YOU CAN HAVE AN APPLE SYSTEM THAT CAN UTILISE THE VISICALC PROGRAM.

Apple prints ...

Centronics 737 Printer

The Centronics 737 is a versatile, low-cost printer offering proportionally-spaced upper and lower case characters in a high-density dot matrix. The Centronics will print 80 characters per second.

It provides print quality suitable for text processing and letterheads, plus the application flexibility required for data processing. The 737 will print on fanfold or roll paper, has underlining capability and the bi-directional stepper motor allows single sheets to be fed up and down as

well as making the printer remarkably quiet in operation.

Price £424 excluding VAT and carriage.

Silentype Printer

From Apple, the inexpensive and portable Silentype will sit neatly on your desk top and print thermal high-resolution graphics at 60 dots per inch, upper and lower case at 40 characters per second and 80 characters per line - almost silently!

Investing in a Silentype enables you to eliminate the loading or writing of a program to print a screen configuration, because you can dump any high-resolution screen image directly to the printer.

Price £349 excluding VAT and carriage.

Qume Sprint 5/45 RO Daisywheel Printer

The Qume is generally accepted as the printer of choice for high-quality printouts at speeds of up to 45 characters per second. 70 printable typefaces can be obtained and the Qume has more commands available than competitive machines.

In no time at all it will reproduce circular letters, memos and customer communications of all types, each individually "typed" one after another.

Special features of the Qume include plotting, graphics, formulae printing capability. Proportional and incremental spacing are also available.

Price £1,640 excluding VAT and carriage.

Paper Tiger Printers (Complete with Graphics Option)

The popular range of Paper Tiger impact printers provides real versatility from 3 models, the TG445 basic printer, the TG460 with its excellent print quality or the TG560 which has a 15" wide full size listing paper.

This well established range of printers includes full 96 character paper and lower case set, from 8 software-selectable character sizes, parallel and serial interfaces, multiple copy capability, stepper motor driven tractor feed from 1.75 up to 15 inches according to the model. Tigers can print at up to 120 characters per second at both 80 and 132 columns width.

All printers require connector cables and by the addition of software full graphics capability can be obtained.

Price: TG445 £575 TG460 £795 TG560 £995 excluding VAT and carriage.

Then go for...

one of the variety of business and financial planning packages available as standard through Apple dealers.

Vlasak 'Integrated' Systems

Vlasak Computer Systems are specialists in integrated business software covering many areas of accounting and sales administration. Vlasak's payroll program is probably the most widely installed microcomputer system in the Country.

As the manufacturer of the Megastor, Vlasak are able to supply software for both 5¼" and 8" floppy disc drives which allow greater data storage.

Vlasak programs are available through all Apple Dealers.



Systematics 'Controller' Packages

Systematics International have developed two important program packages for Apple users.

The Financial Controller and the Stock Controller are both written in Pascal language, giving more disc space and faster processing than is possible with programs written in Basic. The Financial Controller covers most business accounting functions and is available as a complete suite of business ledgers or as separate modules priced at £250. The Stock Controller also costs £250 and can link to the Financial Controller if required.

These programs are available through over 50 Apple Dealers nationwide.



Jarman 'Tailored Systems'

Jarman Systems offer a range of general business programs for Apple II. These are available as standard packages, or adapted to meet the individual requirements of Directors and Managers in many different areas of business. The programs are written in Pascal to mainframe standards for faster processing and increased data storage. Many accountancy and stock control routines are covered to free managerial time for more creative tasks.



Padmede 'Business Series'

Padmede Computer Services have developed a series of programs for the Apple II based on a thorough knowledge of business applications and their long-standing relationship with Apple.

These systems are in use with many professional firms and have developed a reputation for reliability amongst end-users and the 170 Apple Dealers who have supplied them.

Each program can be run individually and a number will link together by a bridge program. They cover many general business applications including contract costing, quotation and estimating systems.



TABS 'Modular System'

The 14 integrated modular systems which TABS offer cover many business applications including word processing. Each of the modules may be purchased individually and can be tailored to suit particular requirements.

All programs run on Apple Computers with two disc drives or alternatively 8" floppy discs can be added for extra data storage.

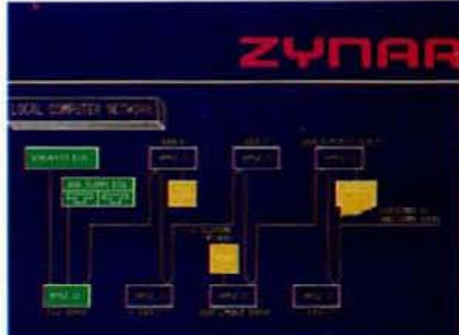
The system is available at only £99 per module from over 150 Apple Dealers.



Local Computer Network - Zynar

The linking of microcomputers in the Local Network provides an effective and economic means of facilitating the flow of information. Committees of users can either work alone, in small groups or at departmental level.

The sharing and pooling of work and information is totally consistent with the way organisations work. The Local Network facilitates the rational organisational use of personal computing. The founders of Zynar have extensive experience in the development of advanced microcomputer concepts and have been responsible for several world-famous products. Zynar's first product - Local Microcomputer Network - offers unequal cost performance and is indicative of the computer's future direction.



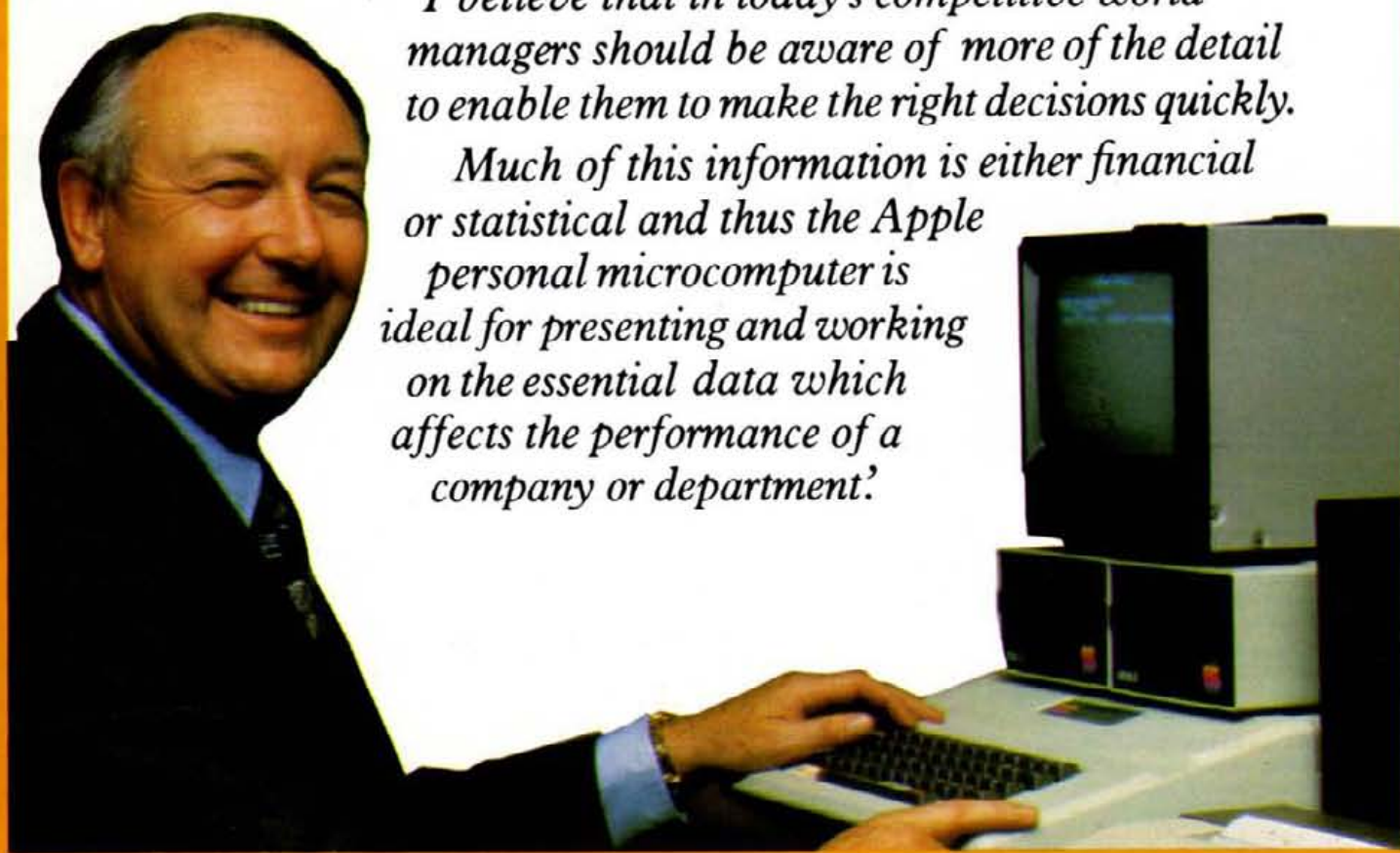
To find out more about Apple Computers and the many hundreds of business and specialist application packages please contact any one of 450+ Apple Dealers throughout the UK. You'll find their names, addresses and telephone numbers on the back cover.

Who says so? *The decision makers...*

...like **Sir Freddie Laker** **LAKER**
Chairman and Managing Director **AIRWAYS**

'I believe that in today's competitive world managers should be aware of more of the detail to enable them to make the right decisions quickly.

Much of this information is either financial or statistical and thus the Apple personal microcomputer is ideal for presenting and working on the essential data which affects the performance of a company or department.'



apple computer

Apple dealers

ENGLAND

AVON Information Systems

Tel: Bristol 0272 23352 & 29422
Devon Computers
Tel: Paignton 0893 526363
J A D Integrated Services (Plymouth) Ltd
Tel: Plymouth 0752 662616
Nicomtec Ltd
Tel: Plymouth 0752 668801
Crystal Electronics
Tel: Torquay 0893 22699

DORSET

Deverill Computer Services Ltd
Tel: Blandford Forum 0256 53634
Nibbles Systems
Tel: Poole 0202 708888
Adrian R Tesson
Tel: Wimborne 0202 886262

ESSEX

Distributed Data Processing Ltd
Tel: Basildon 0268 728494
Systematics International Ltd
Tel: Basildon 0268 284601
Direct Data Marketing Ltd
Tel: Brentwood 0277 229379
Kinfield Ltd
Tel: Chelmsford 0245 64230
Oyster Business Systems Ltd
Tel: Colchester 0206 863090
Empire Ltd
Tel: Colchester 0206 865926
Stallion Computer Systems
Tel: Colchester 020 622 5535
Micro Management
Tel: Frinton-on-Sea 02556 4592
Dair Electronics
Tel: Halstead 07874 472533
Datum Ltd
Tel: Halstead 07874 237006
Kewell & Sherrin (Cavendish) Ltd
Tel: Reading 0734 481955
Computer Arts Ltd
Tel: Reading 0734 583886
Personal Computer Palace
Tel: Reading 0734 589249
Lynx Computers
Tel: Windsor 07535 56322

BUCKINGHAMSHIRE

Electrad
Tel: Aylesbury 0296 87309
Moons Strip Systems (Computers) Ltd
Tel: Buckingham 02802 2910
C O E Computers
Tel: Chesham 02440 75532
Chiltern Microcomputers Ltd
Tel: Gerrards Cross 02813 86332
Viasat Electronics Ltd
Tel: High Wycombe 0494 448633
The Spastics Society
Tel: Milton Keynes 0908 660364
Photo Acoustics Ltd
Tel: Newport Pagnell 0908 610623
Tarax Ltd
Tel: Aylesbury 0296 623965

CAMBRIDGESHIRE

Cambridge Computer Store
Tel: Eton 0462 223 6534
Econ Research Ltd
Tel: Cambridge 0954 81829
The Avery Computer Co
Tel: Cambridge 0954 81803
Topmark Computers
Tel: Huntingdon 0460 212563
Beam Business Centre
Tel: Peterborough 0733 67041
Q I S Computer Services Ltd
Tel: Peterborough 0733 47191 & 47180

CHESHIRE

Systems Integration Ltd
Tel: Altrincham 061 928 5784
Tristan Computer Systems Ltd
Tel: Bramhall 061 439 7431
Ballard Electronics Ltd
Tel: Chester 0244 388123-388223
Audiomatic Instrument Development
(Northern) Ltd
Tel: Culcheth 092 576 5082
Kestrel Computers Ltd
Tel: Handforth 0625 525235
Hewart Electronics Ltd
Tel: Macclesfield 0925 22030
Umbra Software Ltd
Tel: Stockport 061 477 8177
J J Sigma Graphics Ltd
Tel: Stockport 061 480 3220
Newbar
Tel: Stockport 061 491 2290
Oval Computer Systems
Tel: Stockport 061 427 4131
U-Microcomputers Ltd
Tel: Warrington 0925 54117/8
Northern Computers
Tel: Warrington 0925 601663
Fairhead Instruments Ltd
Tel: Winslow 0625 525694

CLEVELAND

Elton Ltd
Tel: Hartlepool 0429 61770
Micro-Tech Electronics
Tel: Middlesbrough 0642 217106

CORNWALL

Dislike Ltd
Tel: Callington 05793 3780

COUNTY DURHAM

R Berriman
Tel: Ferryhill 0740 51516
Aughton Micro Systems Ltd
Tel: Peterlee 0783 86833/4

CUMBRIA

Furness Computer Services Ltd
Tel: Barrow In Furness 0229 24621

DERBYSHIRE

Michael Ludlam & Ass Ltd
Tel: Codner 0773 44039/42321
Donington Computers
Tel: Derby 0332 810789

DEVON

Peter Scott (Exeter) Ltd
Tel: Exeter 0392 73309
Micro C Ltd
Tel: Exeter 0392 213391
The Exeter Computer Bureau
Tel: Exeter 03952 37522
Exeter Computers Ltd
Tel: Exeter 03952 73778/77537
Frida Ltd
Tel: Widecombe 305

C & G Computer Group Ltd
Tel: Newton Abbot 0626 62101/2

DEVON Computers

Tel: Paignton 0893 526363
J A D Integrated Services (Plymouth) Ltd
Tel: Plymouth 0752 662616
Nicomtec Ltd
Tel: Plymouth 0752 668801
Crystal Electronics
Tel: Torquay 0893 22699

DORSET

Deverill Computer Services Ltd
Tel: Blandford Forum 0256 53634
Nibbles Systems
Tel: Poole 0202 708888
Adrian R Tesson
Tel: Wimborne 0202 886262

ESSEX

Distributed Data Processing Ltd
Tel: Basildon 0268 728494
Systematics International Ltd
Tel: Basildon 0268 284601
Direct Data Marketing Ltd
Tel: Brentwood 0277 229379
Kinfield Ltd
Tel: Chelmsford 0245 64230
Oyster Business Systems Ltd
Tel: Colchester 0206 863090
Empire Ltd
Tel: Colchester 0206 865926
Stallion Computer Systems
Tel: Colchester 020 622 5535
Micro Management
Tel: Frinton-on-Sea 02556 4592
Dair Electronics
Tel: Halstead 07874 472533
Datum Ltd
Tel: Halstead 07874 237006
Kewell & Sherrin (Cavendish) Ltd
Tel: Reading 0734 481955
Computer Arts Ltd
Tel: Reading 0734 583886
Personal Computer Palace
Tel: Reading 0734 589249
Lynx Computers
Tel: Windsor 07535 56322

BUCKINGHAMSHIRE

Electrad
Tel: Aylesbury 0296 87309
Moons Strip Systems (Computers) Ltd
Tel: Buckingham 02802 2910
C O E Computers
Tel: Chesham 02440 75532
Chiltern Microcomputers Ltd
Tel: Gerrards Cross 02813 86332
Viasat Electronics Ltd
Tel: High Wycombe 0494 448633
The Spastics Society
Tel: Milton Keynes 0908 660364
Photo Acoustics Ltd
Tel: Newport Pagnell 0908 610623
Tarax Ltd
Tel: Aylesbury 0296 623965

CAMBRIDGESHIRE

Cambridge Computer Store
Tel: Eton 0462 223 6534
Econ Research Ltd
Tel: Cambridge 0954 81829
The Avery Computer Co
Tel: Cambridge 0954 81803
Topmark Computers
Tel: Huntingdon 0460 212563
Beam Business Centre
Tel: Peterborough 0733 67041
Q I S Computer Services Ltd
Tel: Peterborough 0733 47191 & 47180

CHESHIRE

Systems Integration Ltd
Tel: Altrincham 061 928 5784
Tristan Computer Systems Ltd
Tel: Bramhall 061 439 7431
Ballard Electronics Ltd
Tel: Chester 0244 388123-388223
Audiomatic Instrument Development
(Northern) Ltd
Tel: Culcheth 092 576 5082
Kestrel Computers Ltd
Tel: Handforth 0625 525235
Hewart Electronics Ltd
Tel: Macclesfield 0925 22030
Umbra Software Ltd
Tel: Stockport 061 477 8177
J J Sigma Graphics Ltd
Tel: Stockport 061 480 3220
Newbar
Tel: Stockport 061 491 2290
Oval Computer Systems
Tel: Stockport 061 427 4131
U-Microcomputers Ltd
Tel: Warrington 0925 54117/8
Northern Computers
Tel: Warrington 0925 601663
Fairhead Instruments Ltd
Tel: Winslow 0625 525694

CLEVELAND

Elton Ltd
Tel: Hartlepool 0429 61770
Micro-Tech Electronics
Tel: Middlesbrough 0642 217106

CORNWALL

Dislike Ltd
Tel: Callington 05793 3780

COUNTY DURHAM

R Berriman
Tel: Ferryhill 0740 51516
Aughton Micro Systems Ltd
Tel: Peterlee 0783 86833/4

CUMBRIA

Furness Computer Services Ltd
Tel: Barrow In Furness 0229 24621

DERBYSHIRE

Michael Ludlam & Ass Ltd
Tel: Codner 0773 44039/42321
Donington Computers
Tel: Derby 0332 810789

DEVON

Peter Scott (Exeter) Ltd
Tel: Exeter 0392 73309
Micro C Ltd
Tel: Exeter 0392 213391
The Exeter Computer Bureau
Tel: Exeter 03952 37522
Exeter Computers Ltd
Tel: Exeter 03952 73778/77537
Frida Ltd
Tel: Widecombe 305

Cowper Morris Ltd
Tel: Tring 0442 82 66678
Jarman Systems
Tel: Tring 0442 82 6575
Sirefield Ltd
Tel: Waltham Cross 0992 29310
Marchess Ltd
Tel: Ware 077094
Microsystems Applications Ltd
Tel: Watlington 0923 47112
LuX Computer Services Ltd
Tel: Watford 0923 29513 & 29734
Local Business Technology Ltd
Tel: Wormley 09924 86157

HUMBERSIDE

Northern Pig Development Co
Tel: Beeston 0268 86 426/7/8
System Computers Ltd
Tel: Driffield 0377 43656
Allen Computers
Tel: Grimsby 0472 40568
Microware Ltd
Tel: Hull 0482 562107
Small Business Systems
Tel: Hull 0482 225161 & 225648
Computer Facilities Ltd
Tel: Scunthorpe 0724 63167

ISLE OF MAN

Delta Systems Ltd
Tel: Douglas 0624 4586

KENT

M D Wright Data Services Ltd
Tel: Canterbury 0227 69090
Aughton Micro Systems Ltd
Tel: Dartford 0322 862942
Kwale Investments Ltd
Tel: Gillingham 0934 51224 & 52502
P B R Computer Consultants Ltd
Tel: Herne Bay 02273 67351
Microspot
Tel: Maidstone 0622 858753
Compass (Maidstone) Ltd
Tel: Maidstone 0622 863121
Kent Micro Computers Ltd
Tel: Maidstone 0622 673026
South East Computers Ltd
Tel: Maidstone 0622 681263
Warner Computer Systems
Tel: Minster-in-Sheppey 0795 87479
Microten
Tel: Snodland 0732 845412
Michael Gurr Associates
Tel: Tonbridge 05806 4278
Computer Room
Tel: Tonbridge 0732 35562
Computer Room
Tel: Tunbridge Wells 0892 41645
Compass Ltd
Tel: Tunbridge Wells 0892 44888/9

LANCASHIRE

Distributed Management Systems Ltd
Tel: Blackburn 0254 28419 & 28410
K G Business Systems
Tel: Blackburn 0254 676077
Cook & Naylor Ltd
Tel: Blackpool 0253 23911
Western Computers
Tel: Blackpool 0253 42660
B & B (Computers) Ltd
Tel: Bolton 0204 28644
Aide Data Systems Ltd
Tel: Burnley 0622 56065
F H Brown Ltd
Tel: Burnley 0282 26622
Style Systems Ltd
Tel: Darwen 0254 71838
Minicom Business Machines
Tel: Kirkham 0772 866617
Access Computer Services
Tel: Rochdale 0716 685 2326
Cobden Computer Services
Tel: Ormskirk 0695 77043
Lancaster Computing Centre
Tel: Preston 0772 24083
Modac Data Systems
Tel: Preston 0772 55553
Compaquest
Tel: St Annes on Sea 0253 725101
Methods Workshop
Tel: Wigan 0942 47138
North West Computer Systems
Tel: Wigan 0257 426514

LEICESTERSHIRE

Hinckley Micro Systems Ltd
Tel: Hinckley 0455 616147
Leicester Computer Centre Ltd
Tel: Leicester 0533 556268
Argen Data Processing
Tel: Leicester 0533 22255
New Business Centres
Tel: Leicester 0533 549909
Trisico (Leicester) Ltd
Tel: Leicester 0533 530256

LINCOLNSHIRE

Computer Facilities Ltd
Tel: Lincoln 0522 30433
Western Electronics (UK) Ltd
Tel: Louth 0507 804985
Estate Computer Systems Ltd
Tel: Sleaford 0529 305637

LONDON

EAST
Jessop Acoustics Ltd
Tel: London 01 739 3232 & 01 7291851
Computer Modelling Ltd
Tel: London 01 980 3239
C S S (Business Equipment) Ltd
Tel: London 01 254 9293 & 1674
Sumico London Ltd
Tel: London 01 250 0505
Keen Computers Ltd
Tel: London 01 248 7307
ACS (Commercial Systems) Ltd
Tel: London 01 278 6426
Atlanta Leasing
Tel: London 01 739 5889
Euro-Calc Ltd
Tel: London 01 729 4555
Marchess Ltd
Tel: London 01 726 4809
D P N A Ltd
Tel: London 01 606 9440
Personal Computers Ltd
Tel: London 01 626 8121
Crest Office Equipment Ltd
Tel: London 01 621 0590
Electronic Office Services (UK) Ltd
Tel: London 01 236 9065
Time & People Ltd
Tel: London 01 242 4706

NORTH

Data Management Systems
Tel: London 01 739 8692 & 8695

Promlog Ltd
Tel: London 01 368 9002
Alliance Computer Services
Tel: London 01 563 3061
G W & A E Thomson Ltd
Tel: London 01 485 6430
Kay Jay Studios
Tel: London 01 450 6993
Computech Systems
Tel: London 01 794 0202
Inquet Ltd
Tel: London 01 485 4226
Komputation Automation Information
Tel: London 01 328 3968
SOUTH
S W Winter
Tel: London 01 633 9611
Data Word Equipment Ltd
Tel: London 01 633 0243
Beimartin Group Holdings
Tel: London 01 926 5322 & 5323
Informex-London Ltd
Tel: London 01 318 4213
Stallion Computer Systems Ltd
Tel: London 01 639 4913
Logic Box Ltd
Tel: London 01 222 1122 & 5492
Metrotech (Ryman Store)
Tel: London 01 839 2343
Beta Systems
Tel: London 01 834 7480
M O Brien Hi-Fi
Tel: London 01 946 1528 & 0331
Prince Maine & Co Ltd
Tel: London 01 222 2208
Monitor Business Machines
Tel: London 01 736 1575
Integral Project Consultants Ltd
Tel: London 01 735 2773

WEST

Software House
Tel: London 01 637 2108
The Xerox Store
Tel: London 01 629 8096
Euro-Calc Ltd
Tel: London 01 636 5560 & 8161
Euro-Calc Ltd
Tel: London 01 631 4084
Metrotech (Ryman Store)
Tel: London 01 637 2181
In-Shop Video
Tel: London 01 727 8666
The West London Micro Centre
Tel: London 01 743 9000
Adia Computers
Tel: London 01 579 5645
Micro Management
Tel: London 01 380 0388
Lion House (Retail) Ltd
Tel: London 01 580 7383 & 01 637 1681
Micro Control
Tel: London 01 402 8842
Office Installations Ltd
Tel: London 01 579 6771
Dean & Sons (Edgware) Ltd
Tel: London 01 937 7896
Compass Ltd
Tel: London 01 636 0485
Euro-Calc Ltd
Tel: London 01 406 3225 & 3113
Metrotech (Ryman Store)
Tel: London 01 242 9819
Data Systems London Ltd
Tel: London 01 242 9218
Diplux Ltd
Tel: London 01 405 6761
The Xerox Store
Tel: London 01 405 5659
Myriad Audio Visual Sales Ltd
Tel: London 01 240 1941

MERSEYSIDE

Rockliff Brothers Ltd
Tel: Aintree 051 521 5830
Merseyside Microcomputer Systems
Tel: Birkenhead 051 427 5450
Stack Computer Services Ltd
Tel: Bootle 051 933 5511
Aughton Microsystems Ltd
Tel: Kirby 051 548 7786
Merseyside Computers (North West) Ltd
Tel: Liverpool 051 709 7188
Microdigital Ltd
Tel: Liverpool 051 227 2535/6/7
Computer Age
Tel: Southport 0704 85470 & 0772 53635 & 0794 32418
Thornburg Ltd
Tel: Wirral 051 648 2162

MIDDLESEX

Microscope Computer Services Ltd
Tel: Edgware 01 951 8218-9
Leeway Computer Systems
Tel: Feltham 01 898 5757
Micro Facilities Ltd
Tel: Hampton Hill 01 979 4546
Sea Technical Staff Ltd
Tel: Harrow 01 863 0833
Autocraft Computers
Tel: Harrow 01 908 3636
Data Profile
Tel: Hounslow 01 572 8381
Fletcher Dennis Systems Ltd
Tel: Hounslow 01 570 8999
Granata Computer Systems
Tel: Southall 01 843 1971
C A B S Ltd
Tel: Tooting 01 977 5912
Microtech
Tel: Uxbridge 0895 58111
Access Data Communications Ltd
Tel: Uxbridge 0895 30831
YBOC 55 Ltd
Tel: West Drayton 08954 45017

NORFOLK

Grassroot Computers
Tel: Dereham 036 281 353
Carlton Computers Ltd
Tel: Great Yarmouth 0483 58888
Data Key Computer Services Ltd
Tel: Norwich 060542 520
Jarrod Office Equipment
Tel: Norwich 0603 80861
Anglia Computer Centre
Tel: Norwich 0603 29652

NORTHANTS

Co-Compute Ltd
Tel: Northampton 0604 33767
Polebrook Management Systems
Tel: Peterborough, Oundle 08322 3890/2052
NORTHUMBERLAND
Computech 0670 56812
NOTTINGHAMSHIRE
Keen Computers Ltd
Tel: Nottingham 0602 583254
Micro Computers Ltd
Tel: Nottingham 0602 412455
Parr Computer Services Ltd
Tel: Nottingham 0602 54004-5

OXON

Roxon Ltd
Tel: Abingdon 0235 24206
The Computer Shop (Banbury) Ltd
Tel: Banbury 0295 3477
Totaldata Micro Computers
Tel: Banbury 0295 52895/73635
Micro Mark
Tel: Henley on Thames 04912 77926
Courtyard Data Systems
Tel: Oxford 0865 779 282
Oxford Computer Centre
Tel: Oxford 0865 45172
T & V Johnson (Microcomputers etc) Ltd
Tel: Oxford 0865 721461
Cyberpress Ltd
Tel: Wallingford 0491 37789/38098

SALOP

Cressage Computer Services
Tel: Shrewsbury 0743 69009

SOMERSET

Woodside Microcomputer Consultancy
Tel: Bruton 074981 2300
Micro Applications Ltd
Tel: Walsall 0922 644234
H & H Business Systems
Tel: West Bromwich 021 553 7606/7
Micro-Business Centre
Tel: Wolverhampton 0902 725687

STAFFORDSHIRE

Hours Computing Ltd
Tel: Stoke 0785 44221
Yokada Ltd
Tel: Stoke on Trent 0782 813631
Kratos Intelem Ltd
Tel: Stone 0785 812131
Micro Applications Ltd
Tel: Stone 0785 817313-5
Able Computer Systems Ltd
Tel: Tamworth 0827 50804
SUFFOLK
Blyth Computers Ltd
Tel: Halesworth 050 278 371
Ramm Computer Services Ltd
Tel: Haverhill 0440 3760
Micro Management
Tel: Ipswich 0473 57871
Database
Tel: Newmarket 0638 730625

SURREY

Professional Video Services
Tel: Banstead 07373 81162/61973
T & V Johnson (Microcomputers etc) Ltd
Tel: Camberley 0276 20446
Wego Computers Ltd
Tel: Caterham 0863 49235
Vega Computers Ltd
Tel: Croydon 01 580 4484
Simon Computers Ltd
Tel: Croydon 01 680 4646
Symbolic Computer Systems
Tel: Dorking 01 880 8836
Micro Computer Connections Ltd
Tel: Egham 0794 37433
Surrey Micros Ltd
Tel: Godalming 04868 22318
Germilles Ltd
Tel: Kingston upon Thames 01 546 9944
Hamm & Gibson
Tel: New Malden 01 942 9635/7
Micro C Ltd
Tel: New Malden 01 949 2093
Data Systems Electronics Ltd
Tel: Trowbridge 01 292 4021
Ferguson Computer Services
Tel: West Byfleet 093 23 45330
Gemsoll Ltd
Tel: Woking 04862 22881
Penmark Precision Measurement Ltd
Tel: Woking 04862 80111
Petalcat Electronic Service Ltd
Tel: Woking 04862 69032 & 68497
Phillips Business Systems
Tel: Woking 04862 66096

SUSSEX

IDT Computers
Tel: Brighton 044 483 370
Commercial & Professional Computer Systems
Tel: Bognor Regis 02432 66643
Robert Harding T V Ltd
Tel: Brighton 0273 688444
Data Systems Southern Ltd
Tel: Brighton 0273 27 238
Lion House (Retail) Ltd
Tel: Brighton 0273 601838
Sadelectronics Ltd
Tel: Brighton 0273 29949
Wintec Ltd
Tel: Brighton 0273 23020
Lewis & Co
Tel: Crawley 0293 542244
Datatech Ltd
Tel: Eastbourne 0323 36268
South East Computers Ltd
Tel: Hastings 0424 440099
Supabase
Tel: Horsham 0403 61647
Oval Automation Ltd
Tel: Hove 0273 777626
Greyhound Microcomputers
Tel: Newhaven 07914 3702
Jelly Electronics Ltd
Tel: Robertsbridge 0580 83605
Oval Automation Ltd
Tel: Worthing 0903 501355 & 44831
Dattex Micros Ltd
Tel: Worthing West 0903 39290

TYNE & WEAR

Dawne Instruments & Electronics
Tel: Gateshead 0632 38057
P I P Computer Services
Tel: Newcastle upon Tyne 0632 614939
Knowledge Ltd
Tel: Washington 0632 464162

WEST MIDLANDS

Weswood Computers
Tel: Birmingham 021 632 5824
Data Systems Ltd
Tel: Birmingham 021 359 7377
C P S (Data Systems) Ltd
Tel: Birmingham 021 707 3866
Ward Electronics
Tel: Birmingham 021 554 8786

Totaldata Micro Computers

Tel: Birmingham 021 454 8131/2
Microcine
Tel: Birmingham 021 550 8036
Camden Electronics
Tel: Birmingham 021 773 8240
Beam Business Centre
Tel: Birmingham 021 429 4631
Callisto Computers
Tel: Birmingham 021 632 6458
Mavitta Drafting Machines Ltd
Tel: Birmingham 021 236 8912
Micro C Ltd
Tel: Birmingham 021 233 1105
Aldridge Micro Ltd
Tel: Birmingham 021 455 7431
Newbar
Tel: Birmingham 021 707 7170
Q Com Electronics Ltd
Tel: Birmingham 021 643 3540
Above Systems Ltd
Tel: Coventry 0293 414258
Business Office Links Ltd
Tel: Coventry 0293 78851
Britannia Computer Systems
Tel: Dudley 0384 233433
Micro Applications Ltd
Tel: Walsall 0922 644234
H & H Business Systems
Tel: West Bromwich 021 553 7606/7
Micro-Business Centre
Tel: Wolverhampton 0902 725687

W

MICRO MODELLER **MICRO MODELLER** **MICRO MODELLER**

gives the Apple II
main-frame power
at micro costs.

"Fantastic Value"
Wiggins Teape
Basingstoke

**"Multi-level consolidations
easily handled by
MicroModeller"**
Westland Helicopters
Yeovil



Widely acclaimed as the most advanced financial planning tool yet released, MicroModeller is a complete alternative to costly time-sharing services. If you have been put off by high bureau charges, but want to use a financial planning program, MicroModeller on Apple is the answer.

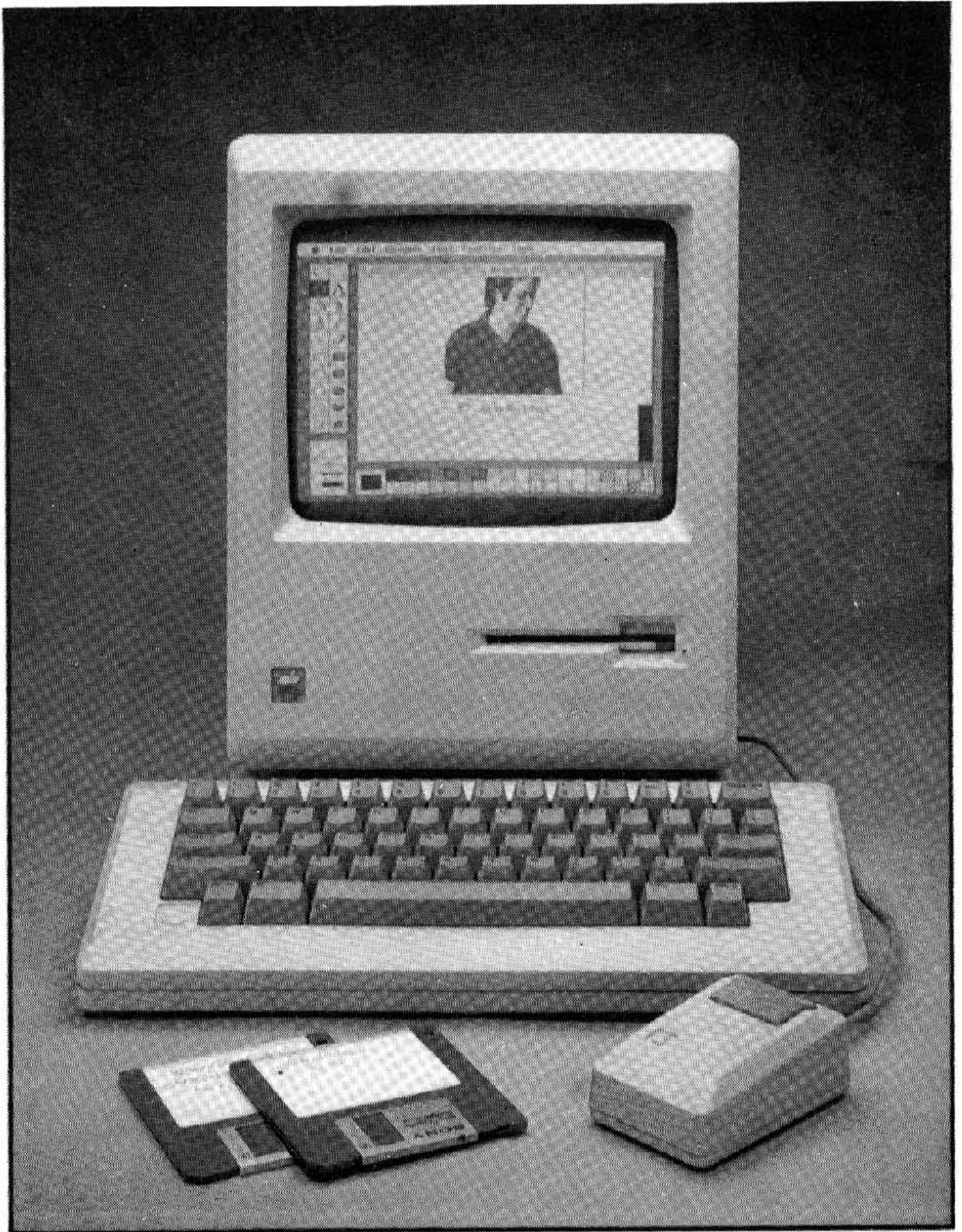
For further information contact:-

Intelligence (UK) Limited
30 Lingfield Road
Wimbledon Village
London SW19 4PU
Telephone 01-947 9846/7

MicroModeller is used by management for:-

- Management Reporting
- Cash Flow Forecasting
- Short-Term Planning
- Merger & Acquisition Analysis
- Investment Analysis
- Budgeting
- Multi-Level Consolidations
- Currency Conversions
- Computer Slides
- Computer Graphics
- Strategic Planning

Recommended retail price £425.00 excluding VAT and carriage.



The Apple Macintosh Computer

by Gregg Williams a Senior Editor of *BYTE Magazine*. As featured in the February edition 1984.

Apple established itself as one of the leading innovators in personal computing technology a year ago by introducing the Lisa, a synthesis and extension of human-interface technology that has since been widely imitated. Now the company has strengthened that reputation with a new machine, the Macintosh (above). In terms of technological sophistication and probable effect on the marketplace, the Macintosh will outdistance the Lisa as much as the Lisa has outdistanced its predecessors.

The Macintosh arrives, finally, after a history of colorful rumors. It will cost from \$1995 to \$2495, weighs 22.7 pounds, and improves on the mouse-window-desktop technology started by the impressive but expensive Lisa computer. A system with printer and second disk drive costs about \$900 more, but even at that price, the Macintosh is worth waiting for.

The Macintosh at Work

Before we look at the Macintosh (or Mac) in more detail, let's look at how it works. When you turn the Mac on, its screen tells you to insert a 3½-inch Sony floppy disk. When you do that, the Macintosh puts a disk icon on the screen along with the disk's name. As with the Lisa computer, you first select an object, then choose a menu item that works on the object. Say, for example, we choose the disk by moving the cursor to the disk icon and clicking the mouse button once (figure 1a). The disk "opens up," showing a window containing icons, each one of which corresponds to an item on the disk. To start using the Mac Paint program, we select the Mac Paint icon and choose the menu item "open," as shown in figure 1b. (We also could have opened Mac Paint by double-clicking on the icon.)

What follows is a brief example of how the Mac Paint program works. When we open the program, we get the screen of figure 1c. The large blank area is a window onto the drawing area, the boxes on the left are tools, the boxes on the bottom row are patterns, and the lines in the corner are selections for the current line width. By selecting the "open oval" tool and the thickest line width, we can draw empty ovals with thick

borders (figure 1d). By selecting the "paint bucket" tool and the "diagonal bricks" pattern, we can fill the oval with that texture (figure 1e). The "eraser" tool lets us erase part of the image (figure 1f); for finer control, we can give the FAT BITS command (figure 1g), which allows us to erase or paint on a pixel-by-pixel basis. When we are finished with our image and select the QUIT command, the program displays an alert box that asks if we want to save our changes (figure 1h).

Foundations of Macintosh Design

The Macintosh computer is built on three cornerstone ideas: second-generation Lisa technology, reliability and low cost through simplicity, and maximum synergy between hardware and software. Each of these ideas contributes significantly to the uniqueness of the Mac's design.

Second-Generation Lisa Technology

Without question, the strongest influence on the Mac is that of the Apple Lisa computer, which proved the viability of certain concepts in a commercial product: the graphics/mouse orientation, the desktop metaphor, the data-as-concrete-object metaphor, and the shared user interface between programs. The Mac has inherited these concepts; for further details on them, see my article, "The Lisa Computer System" (February 1983 *BYTE*, page 33).

Four differences between the Lisa and the Mac make the latter a second-generation computer. First, the Mac runs at a higher clock speed, 7.83 MHz (compared to the Lisa's 5 MHz). Second, the Mac, which has a smaller amount of memory to work with than the Lisa, uses its memory more efficiently because its programs and subroutines are coded in 68000 assembly language (as opposed to the Lisa, which uses less efficient 68000 machine-language programs that are compiled from high-level Pascal source code). Third, the Macintosh eliminates add-on peripheral cards and uses instead a high-speed serial bus that implements what Apple calls "virtual slots." (I will talk about this in greater detail below.)

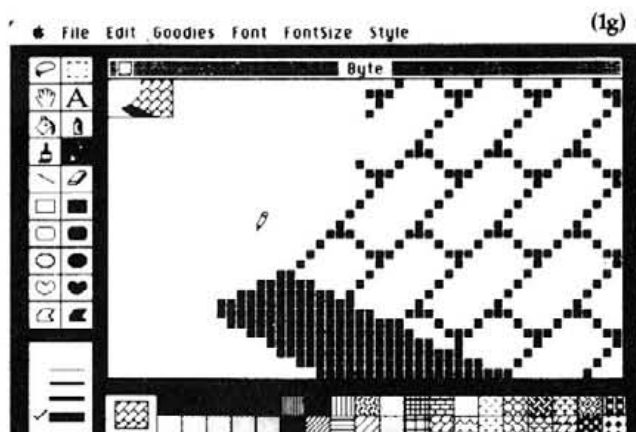
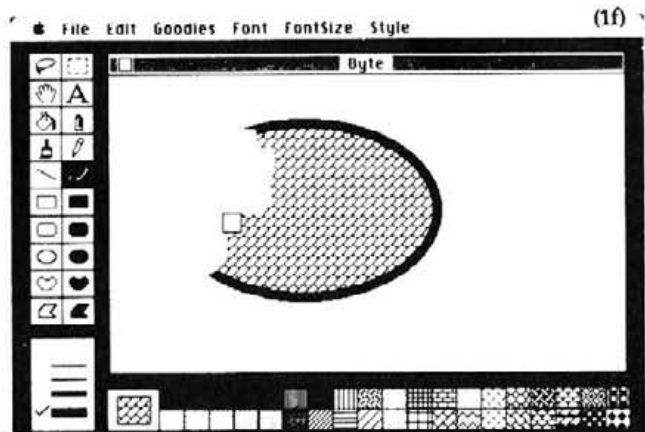
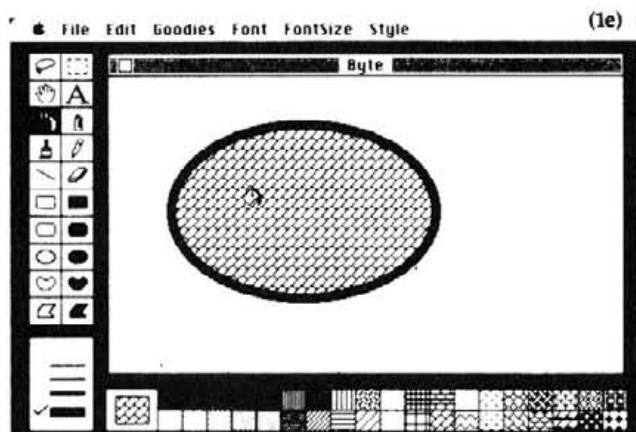
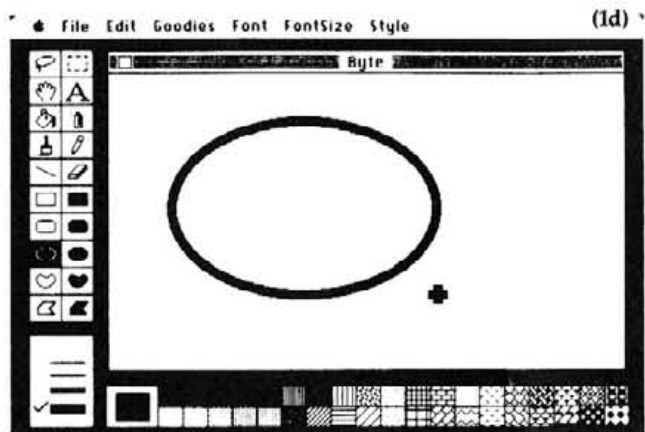
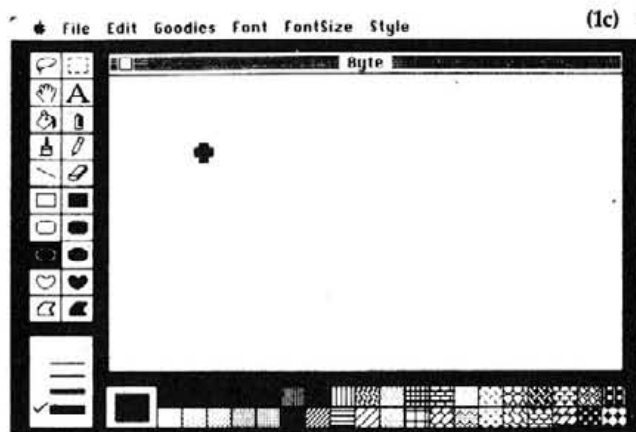
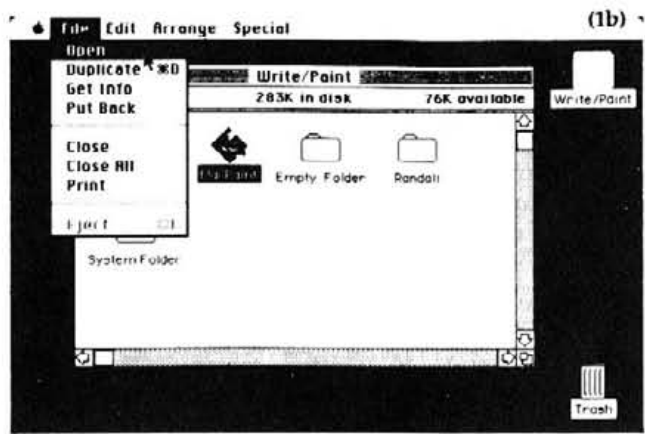
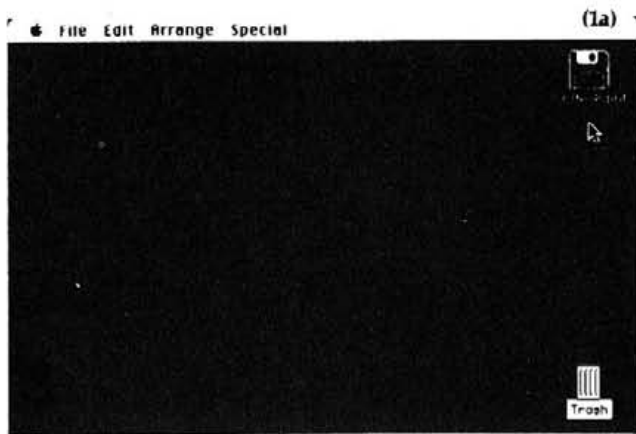
The final difference is actually an important limitation of the Macintosh: it allows only one major application program to be active at a time (the Mac BASIC and "desk accessory" programs are two exceptions that I'll cover later). This limitation is largely due to the Mac's small memory space and the overall design of the software, which assumes that the current program has access to all the machine's memory. This is not as bad as it sounds; a single application can use multiple windows, and material can be cut and pasted from one document to another by storing the material to be pasted on a "clipboard" before loading in the second document (which replaces the first). Still, the absence of hardware slots and the inability to run two applications simultaneously are two important ways in which the Macintosh is fundamentally different from the Lisa computer.

Reliability and Low Cost through Simplicity

Although the Macintosh costs approximately one-third the price of a Lisa, the Mac has much more than one-third of the Lisa's power. The idea of reliability through simplicity not only makes the Macintosh possible at a relatively low price but also produces a machine that has a reliability normally associated with much simpler computers.

One component of the Mac's simplicity is its low chip count—it contains about 50 ICs (integrated circuits), which decreases its physical size and price and increases its reliability. Mac reduces its chip count by combining the functions of many standard chips into eight programmable-logic arrays (PALs).

The Macintosh has only two circuit boards, one that holds all its analog circuitry and one that holds all its digital circuitry (see photos 2a and 2b). By partitioning its functions and reducing the number of connectors (by decreasing the number of boards to be connected), the designers have made the Mac both more reliable and less expensive. They carried this philosophy farther by eliminating hardware slots; you add peripherals to a Mac through its two high-speed serial ports.



Figures 1a-1h: Working with Mac Paint on the Macintosh computer. See text for details.

The Macintosh was designed to reduce (or, in the case of the digital board, eliminate) the number of places in which hardware must be fine-tuned during assembly. In some

cases, the designers eliminated the need for adjustment through clever circuit design, which also means there's one less thing to go wrong with the computer once it is in the

owner's hands. In other cases, Apple eliminated fine-tuning by requiring a vendor of externally manufactured subassemblies to tune the part before delivery; for example, the video-dis-

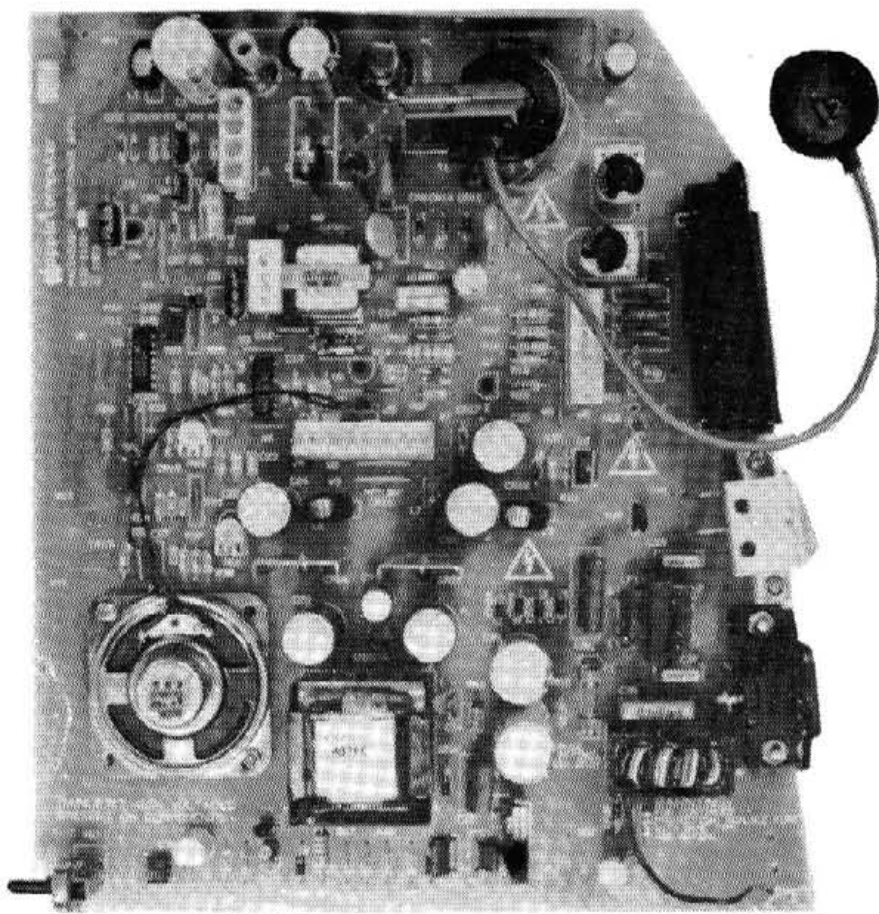
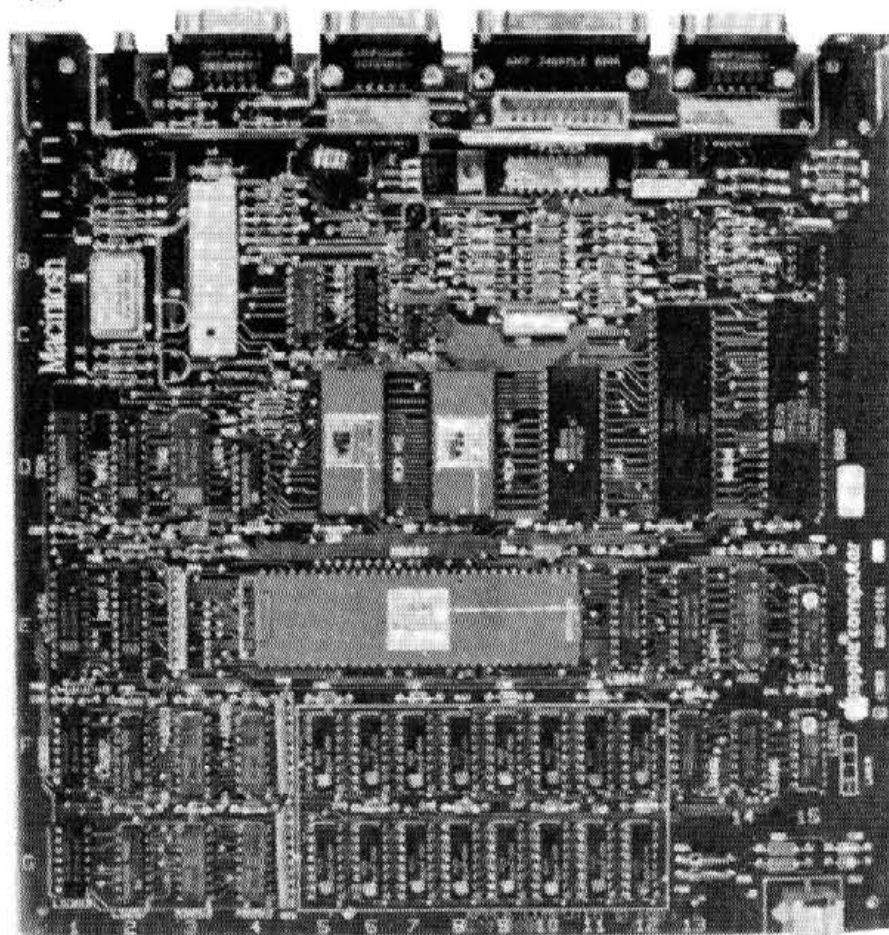


Photo 2: The Macintosh circuit boards. Photo 2a shows the analog board, while photo 2b shows the digital board. These two boards plus the video display, 3½-inch disk drive, and housing make up the main unit; only the keyboard and mouse are needed to make a complete Macintosh system.

(2b)



play tube and yoke are delivered pre-adjusted, and the Sony 3½-inch disk drive is delivered tested and with several Apple-specified modifications.

Maximum Synergy between Hardware and Software

The Macintosh's hardware and software were optimized for maximum performance. This means that the hardware and software evolved over a period of time in a process of mutual give and take. For example, the pixels displayed on the Mac's video display are square (not rectangular, as in other computers); this greatly simplifies the software that draws squares and circles, scales text and graphics, and prints screen images.

Hardware

The main unit of the Macintosh consists of eight parts: two circuit boards, a cable to connect them, a metal chassis, a 3½-inch disk drive, a video-display tube with yoke, and a plastic front bezel and rear housing (see photos 3a and 3b). An external mouse and keyboard make for a total of 10 parts. The main unit takes up an amazingly small 10-inch by 10-inch area (it is 13½ inches high). True, the keyboard and mouse take up more area than that, but the footprint of the main unit is considerably smaller than that of comparable computers. The Mac is also pleasantly compact and light; an entire Mac system in an optional padded satchel weighs 25.6 pounds (less than many transportable computers) and can be carried onto an airplane.

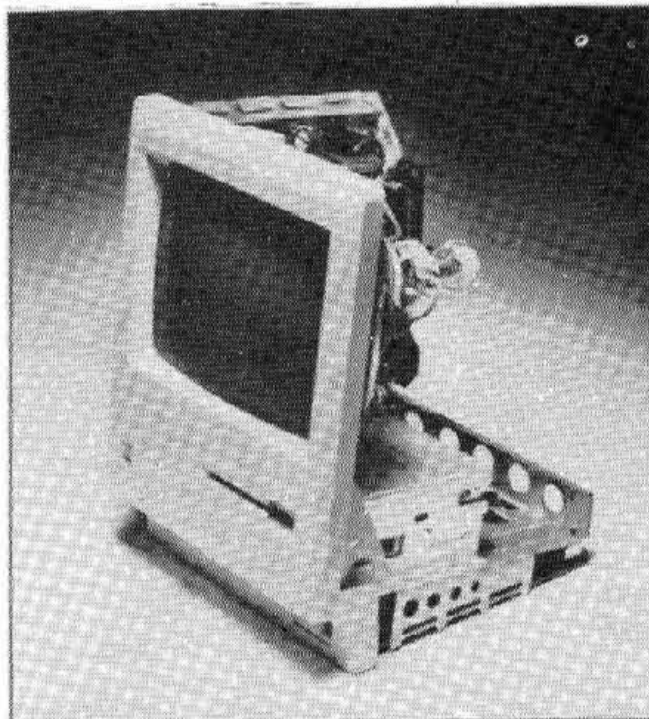
Figure 2 shows a block diagram of the Macintosh hardware; for more details, see the "Macintosh System Architecture" text box. For now, let's look at the machine's major subassemblies:

Processor: The Macintosh uses a Motorola 68000 processor running at 7.83 MHz.

Video display: The Mac has a 9-inch monitor that displays a non-interlaced image at 60.15 Hz. The resolution of the video image is 80 pixels per inch, so the overall screen is 512 by 342 pixels.

ROM: The Mac uses two 256K-bit ROMs configured as 64K bytes of memory. The ROM (read-only memory) contains most of the Mac's operating system and a "toolbox" of optimized 68000 user interface related routines (see the text box "The User

(3a)



(3b)

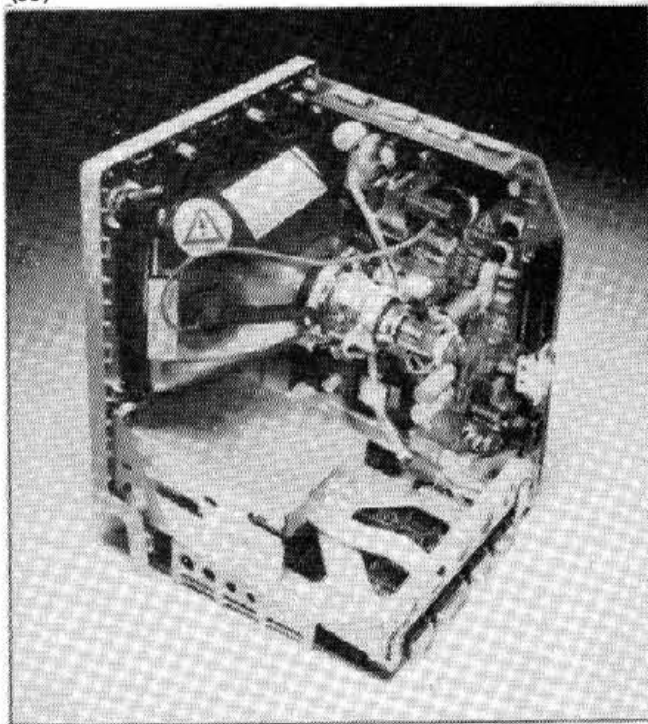


Photo 3: Inside the Macintosh computer. From the front (photo 3a), you can see the video display and the 3½-inch disk drive. From the rear (photo 3b), you can see the two main circuit boards (right and bottom), the rear of the video-display tube, the 3½-inch disk drive, and a row of connectors at the bottom of the unit. The connections go, from left to right, to the mouse, a second disk drive, two peripherals (these are two serial ports), and an external amplifier (for sound output).

Interface Toolbox" for more detail). The ROM is always accessed at full speed, 7.83 MHz.

RAM: The Mac has 128K bytes of memory; at some point (Apple says by the end of 1984), this will be expandable to 512K bytes (by substituting 256K-bit dynamic RAM (random-access read/write memory) chips for the 64K-bit chips currently being used). The screen display uses 21,888 bytes and is drawn using this memory and DMA (direct memory access) circuitry. Apple has an undisclosed proprietary technique for phase-locking the 68000 to less expensive memory, which lowers the product cost without sacrificing the speed of memory access.

When the Mac is drawing a horizontal line of the video display, the 68000 and the video DMA circuitry alternate (interleave) their accesses to the RAM address and data lines. Since these two can never access RAM simultaneously, the 68000 can never produce hashing or other glitches in the video display by accessing RAM at the wrong time. Because of this interleaving, the 68000 accesses RAM at 3.92 MHz, half of the full 7.83 MHz rate, during the display of a horizontal line of the screen. This is done in the following way: the DMA circuitry puts a word from RAM into the video shift register; while the register is sending out those 16 bits serially to the screen, the 68000 uses

RAM for its own purposes; then the cycle begins again with the DMA circuitry.

When the video display is doing a horizontal or vertical retrace, however, the 68000 gets exclusive use of the RAM at its full speed, 7.83 MHz. This has a significant effect on the average speed of RAM access. Out of the 45 μ s (microseconds) for each horizontal display line, over 12 μ s (about 27 percent of the time) are occupied by horizontal retrace. Of these 12 μ s, about 0.5 μ s is used to send data to the sound and disk-speed circuitry, while the rest is available to the 68000. Furthermore, out of the 16.626 ms (milliseconds) used to draw each complete screen, 1.258 ms (about 7.6 percent of the time) are devoted to vertical retrace. Of this, about 14 μ s are used for sound and disk-speed control (representing the control work done at the end of the equivalent of 28 unused horizontal lines of video), leaving more than 1.244 ms for the 68000 to access RAM at full speed.

To summarize, the ROM is always accessed at 7.83 MHz, regardless of screen display. The RAM is accessed at 3.92 MHz during screen display and at 7.83 MHz otherwise. The average speed of the system is around 6 MHz.

One memory area of interest is the *sound buffer*. Along with associated hardware, this buffer enables you to

create four channels of arbitrary sound while using no more than 50 percent of the 68000's computing power. The 68000 performs look-up operations every 44 μ s on up to four 256-byte waveform tables; the result of these lookups is placed in a 370-byte sound buffer, from which the sound hardware fetches 1 byte every 44 μ s to deliver to an 8-bit digital-to-analog circuit (DAC). An internal VIA (versatile interface adapter) can also be used to generate a single square-wave tone while using an insignificant part of the 68000's computing power.

Mass storage: The Macintosh uses a custom version of the Sony 3½-inch disk and drive (see photo 4): The drive can store 400K bytes on a single-sided 3½-inch disk; the Mac is designed to be able to use double-sided drives to get 800K bytes per disk, an option that Apple may pursue at a later date. The standard Sony 3½-inch disk (used to date by Hewlett-Packard and other vendors) puts 70 tracks of data at 135 tpi (tracks per inch) onto each disk. At Apple's urging, Sony now makes the drive in another model that has 80 tracks of data at 135 tpi. As a comparison, the Hewlett-Packard HP 150 uses the 70-track version and conventional sectoring to get 270K bytes per single-sided disk.

In addition to the change to 80 tpi, Apple contracted Sony to modify the

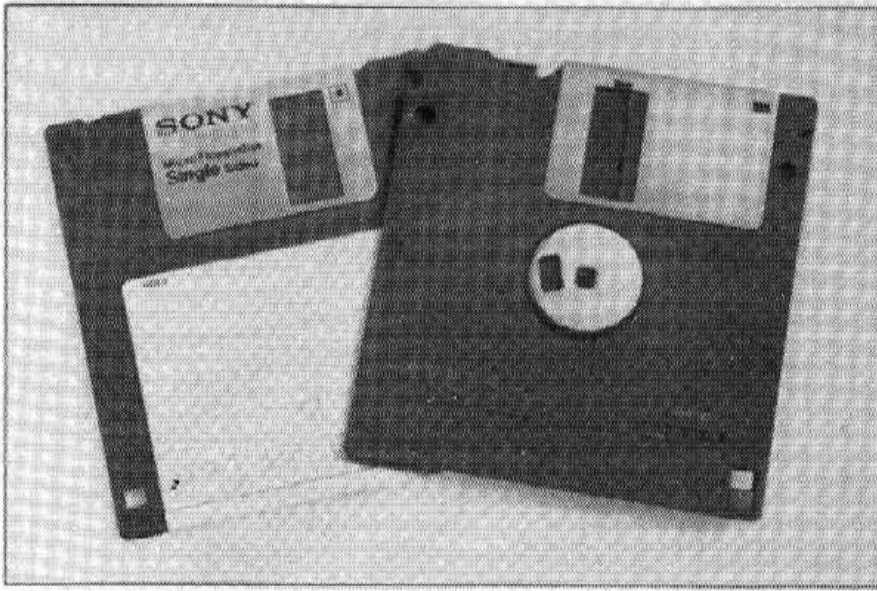


Photo 4: The Sony 3½-inch disk is encased in a rigid plastic housing, and the oval window through which the magnetic medium is accessed is protected by a metal shutter that slides out of the way when the disk is inserted in the drive. These factors help protect the disk from casual use.

drive in several other ways. Two changes allow the Sony drive to mimic the behavior of the Lisa "twiggy" drives (which were originally chosen for use in the Mac): disk ejection under software control and variable disk-rotation speed. The first change allows the Mac to ensure that a disk is correctly updated before it is surrendered to the user (that is, you can't take a disk out of the drive until the Mac software permits it). The second change enables the Mac to record onto the disk at a constant linear density (which means you can put more data on the outermost tracks), as opposed to the constant radial density approach most computers use (which puts the same amount of data on each track regardless of position).

The Macintosh's drive rotates under software control between 390 and 600 rpm (revolutions per minute) and transfers data at the rate of 489.6K bits per second (bits as recorded on the disk, not decoded data bits). Most computers use a disk-controller chip instead of the processor to control the drive. The Mac (like the Apple II) uses its processor to directly control the drive. Because the Macintosh can control more disk-related parameters than the Apple II (the variable motor speed, for example), Macintosh owners will be treated to an even greater wealth of copy-protection schemes than Apple II owners enjoy. Also, the Macintosh drive uses *modified group code recording* to encode data onto the disk. This technique, invented by Steve Woz-

niak for use with the Apple II, encodes 6 bits of data into an eight-transition group that is recorded onto the disk surface.

Keyboard: The keyboard has 58 keys; the left Shift key is split on the international version of the Macintosh, giving it a total of 59 keys. The keyboard includes Return, Caps Lock, and Shift keys in their usual places, two Option keys, and a cloverleaf command key (see photo 5). Combinations of the Shift, Caps Lock, and Option keys give each key up to six meanings; the command key acts as a modifier and is often used with a letter key as the keyboard substitute for a mouse-selected menu item. The keyboard contains an 8021 microprocessor and is connected to the main box by a four-wire bidirectional serial connection. The connections on both ends use the same kind of square modular plug found in most telephones.

Mouse: The Mac's one-button mechanical mouse, about the size of a pack of cigarettes, is essentially the same as the Lisa's; it differs only in the shape of the plastic housing. The mouse is used to position the cursor on the screen; when you slide the mouse over a horizontal surface, the cursor moves in the same direction on the screen.

Serial bus: The Macintosh's serial bus is very important because it is the way that most future peripherals (except the second 3½-inch disk drive and the keypad) will connect to the computer. The bus can run in two modes: with an external clock, it can

transfer data at up to 1 megabit per second; with internal clocking (which embeds clock bits in the data stream itself), it can transfer data at up to 230.4K bits per second. The latter scheme will be used to connect most peripherals, which need only a low to medium data-transfer rate, to the Macintosh in a passive daisy-chained line. This scheme implements what the Mac's designers call "virtual slots."

Virtual slots have several advantages over conventional hardware peripheral slots. They reduce the potential problems inherent in any added mechanical connection (a serial interface connector has fewer pins than a typical interface board). They reduce RFI (radio-frequency interference) by keeping the main box leakproof and allowing easy, inexpensive shielding of the serial line. By deciding that peripherals will supply their own power, the Macintosh designers were able to streamline the power supply of the main box without worrying about the power needs of unspecified future peripherals. Finally, virtual slots eliminate the need of peripheral cards to insert themselves somewhere in the computer's memory map; the unchanging memory map creates a known, unchanging system architecture that all software designers can be assured of, regardless of the peripherals connected.

The virtual-slot scheme is both practical and elegant; it offers a simple, standard way to connect unspecified future peripherals. The 230.4K bit-per-second data-transfer rate is high enough to meet the needs of most peripherals—printers, modems, plotters, music synthesizers, and so on. However, one class of add-on card will not work using this scheme: processor cards like the Microsoft Softcard, which allow a computer to run another processor's software. Such cards require full access to the data and address lines and will not work via a serial "virtual slot." As a result, despite some rumors to the contrary, the Macintosh will never use IBM PC- or MS-DOS-based software.

Power supply: Apple designed two power supplies for the Macintosh. The first one uses a 60-watt switching power supply similar to one used in the Apple II family; it can operate on 85 to 135 V AC at either 50 or 60 Hz. For technical reasons, use of this power supply would have delayed



Photo 5: The Macintosh keyboard.

the introduction of the machine, so Apple designed and produced a simpler nonswitching power supply (105 to 130 V AC, 60 Hz) for initial use in the first U.S. models of the Macintosh. The first switching power supply will be used later in the year for the international model and possibly for the U.S. model.

The supply was designed to drive two twiggly disks; when the design was changed to include two 3½-inch disks instead, the supply had a sizable margin of unused power.

System Software

As stated before, the Macintosh contains 64K bytes of ROM accessed at 7.83 MHz. The ROM contains most of the Mac operating system and a set of optimized 68000 routines called the Macintosh User-Interface Toolbox. The operating-system software interacts at the lowest level with the hardware; it includes such things as device drivers and memory- and file-management routines. The toolbox contains various routines that let you manipulate windows, text, the mouse, pull-down menus, desk accessories, dialogue boxes, fonts, and other aspects of the Mac user interface. These are high-level routines that perform the details of such complicated operations with minimum programming on the application designer's part. For example, the window-management routines take care of correctly redrawing the dis-

play when a window is moved or changed. For more details, see the text box "The User-Interface Toolbox."

The designers intend for you to access all ROM routines indirectly via the 68000 "line 1010 unimplemented" instructions, which receive their addresses from a table in RAM; this table can be changed to point to other routines, thereby allowing future versions of Mac software to patch the inevitable bugs that will be found in the Mac ROM. Because the application drives the ROM routines (instead of the other way around), the Macintosh is an "open" system whose behavior is completely determined by the contents of the disk inserted into it—that is, software designers can use the ROM routines to create a "standard" Macintosh application, or they can write their own code to create an application that behaves the way they want it to.

Although the designers of the Macintosh have a general philosophy of allowing only one application program to be open at a time, they have included in the main menu a collection of short, useful programs that can run without forcing you to end your current program. Apple calls these programs *desk accessories*. Many of the accessories are simply conveniences—the clock accessory, for example, shows you the current date and time—but a very powerful accessory is called the *scrapbook*. Ordinarily, you can cut and paste data

from one document to another by cutting the data into the clipboard, loading in the new document, and pasting in the data; this process would be tedious if you had several items of the same type to cut and paste. The scrapbook is a sequence of data items—text or graphics—that can be stored or recalled together, thus minimizing the number of document changes and allowing you to recall often-used data items easily. The scrapbook is actually implemented as a disk file; as a result, it tends to be rather large.

System software reacts to all peripherals on an asynchronous basis—peripherals compete for the attention of the 68000 by sending it interrupts, which the 68000 services according to the level of the interrupt. This keeps the 68000 from being tied exclusively to a peripheral—for example, to the 3½-inch disk drive waiting to get up to its full speed—when it could be doing something more useful. The Mac's designers have managed to do this even with high-speed peripherals that usually require the full attention of a processor. For example, disk and serial-port routines have been dovetailed to permit the use of both peripherals at the same time.

Disk Reliability

Reliability was one of the main reasons that Apple decided to use the 3½-inch Sony disk drive instead of the 5¼-inch twiggly drive. (A pro-

jected shortage of twiggy drives was another reason.) Apple is expecting the Macintosh to be the first real consumer-oriented computer, and it sees the magnetic medium as being more likely to fail than the electronics. The Sony 3½-inch disk is better suited to the consumer environment. The drive can hold an acceptable amount of storage per disk, and the small disk, with its rigid shell and normally closed access window, is less likely to suffer from bad handling than a conventional 5¼-inch floppy disk. In addition, the magnetic medium is connected to a steel hub that the drive mates with and rotates. This is an improvement over 5¼-inch floppy-disk drives, which clamp the Mylar edge of the center hole. The 3½-inch disk hub is needed to get accurate enough disk-head placement to make a data density of 135 tracks per inch possible.

The data on the disk is encoded in a way that enables the Macintosh to recover from some disk medium or disk file errors. The file directory is duplicated in a normal disk file (which can be used if, for some reason, the directory is damaged). Also, each block of data on the disk includes a 12-byte identifier that gives the file number, sequence-within-file number, and date/time stamp for the data in the rest of that block; this can

be used in many situations to recover most or all of the data on the disk.

Applications and Languages

Neither application software nor a language is included in the basic Macintosh package. However, a two-program set will be available for \$195; both programs require the recently introduced Imagewriter printer to print things out. The first program is Mac Paint, the drawing program we looked at earlier. Created in house at Apple, Mac Paint is limited to drawings that will fit on one 8½-by-11-inch page. Mac Paint is unlike the Lisa drawing program (Lisa Draw) in that it manipulates the drawing on a bit-by-bit level (a Lisa Draw drawing is stored as a collection of elementary objects—circles, text, boxes, etc.). This representation makes some things, such as arbitrary erasures, easier on the Mac and other things, such as deleting a single object within the drawing, harder.

The second program in the set is Mac Write (figure 3), which was created out of house for Apple and can handle documents up to 10 single-spaced or 20 double-spaced pages. Like Lisa Write, Mac Write can handle multiple fonts and sizes as well as variations achieved by adding any combination of five modifiers—underline, bold, italic, outline, and

shadow.

Apple Macintosh Pascal, Assembler/Debugger, BASIC, and Logo will cost \$99 each; the first two will be available during the second quarter of 1984, and the other two will follow in the third quarter. The Logo is from LCSI, which developed Apple II Logo. Both the BASIC and Pascal compile on a line-by-line basis into an intermediate pseudocode, which gives them the speed of compiled languages while retaining the interactive nature of interpreted languages. Both languages use separate windows for program source code and output, and both can be debugged on a line-by-line basis. Both have graphics and mouse commands that call on the toolbox routines in ROM, and both use floating-point arithmetic routines (in RAM) that meet the IEEE-754 floating-point standard.

Mac Pascal, which was created out of house, is interesting in that it is the only Pascal I know of that can be executed interactively. Another nice feature is its syntax checker, an item that can be called from its "Run" menu. This menu item is often handy for finding those petty syntax errors to which Pascal code is prone.

Mac BASIC was created in house by Donn Denman, who worked on Apple III Business BASIC. An interactive, multitasking BASIC, it can ex-

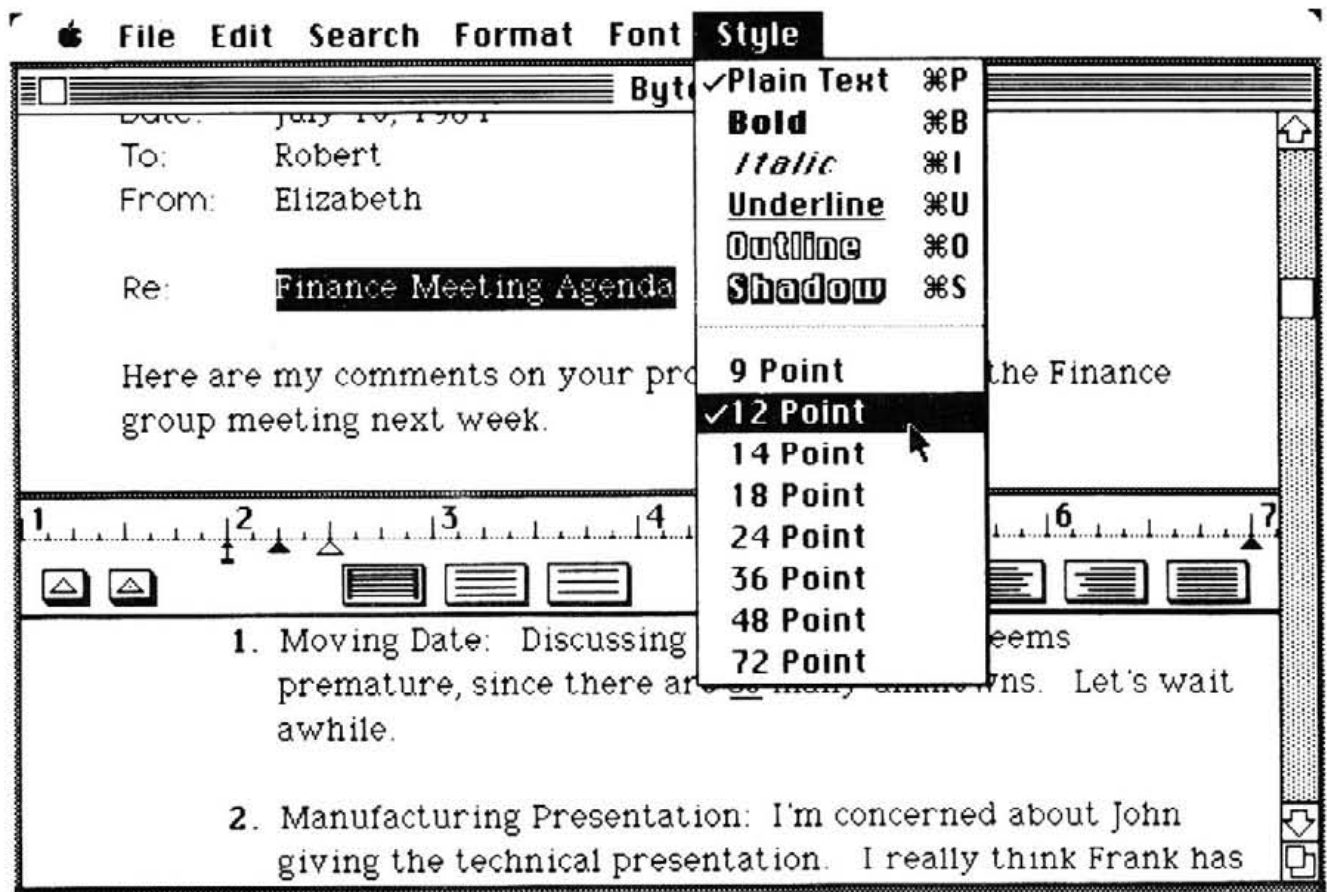
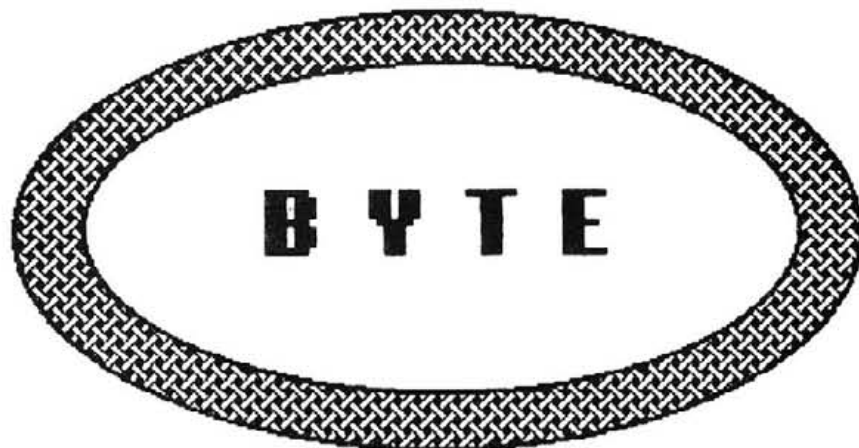


Figure 3: The Mac Write word-processing program.

Listing 1: Graphics (listing 1a) and text (listings 1b and 1c) as printed by the Macintosh and the Imagewriter printer. The text shown in listings 1b and 1c is representative only; some of the fonts shown may not be included with Mac Write or may have different names. Listing 1b is text printed out in high-resolution mode; listing 1c shows the same text printed out in medium-resolution mode. These print samples are reproduced at the same size as the originals.

(1a)



The Small Systems Journal

(1b)

This is 9-point Rosemont

This is 12-point Old English

This is 12-point City

This is 12-point Overbrook

This is 12-point System

This is 12-point Rosemont

This is 12-point Ardmore

This is 12-point Merion

This is 12-point variants:

-- **Rosemont bold**

-- *Rosemont italic*

-- Rosemont underline

-- **Rosemont outline**

-- **Rosemont shadow**

-- **Rosemont out-**

line shadow

bold

These are size variants:

-- 14-point

-- 18-point

-- 24-point

-36-pt.

(1c)

This is 9-point Rosemont

This is 12-point Old English

This is 12-point City

This is 12-point Overbrook

This is 12-point System

This is 12-point Rosemont

This is 12-point Ardmore

This is 12-point Merion

This is 12-point variants:

-- **Rosemont bold**

-- *Rosemont italic*

-- Rosemont underline

-- **Rosemont outline**

-- **Rosemont shadow**

-- **Rosemont out-**

line shadow

bold

These are size variants:

-- 14-point

-- 18-point

-- 24-point

-36-pt.

ecute multiple copies of the same program or multiple programs simultaneously; each program and each running task has its own window.

Other Apple programs announced for delivery in 1984 include Mac Ter-

terminal (which emulates the DEC VT-52 and VT-100 and Teletype ASR33 terminals—available first quarter, \$99). Also planned are Mac Draw (an object-oriented drawing program) and Mac Project (a scheduling and

project-management program). These are both Macintosh versions of two Lisa application programs; each costs \$125 and will be available in the third quarter of 1984.

Third-Party Software

Apple has not spent all its energy trying to write all the software that the Macintosh needs. Instead, it has created two exemplary Macintosh packages and gone to third-party software developers to get *them* to create the bulk of available Macintosh software. Apple estimates that by the time you read this, the Mac will be in the hands of more than 100 software vendors.

At the time this was written, some software developers had made commitments to market Macintosh software. Microsoft Multiplan and BASIC will be available at the Mac's introduction; Microsoft File, Chart, and Word will be available by mid-February. Lotus is working on converting its popular 1-2-3 spreadsheet program. Software Publishing Corporation will have its PFS File and PFS Report programs available sometime in April.

Optional Hardware

The Macintosh uses Apple's new \$495 dot-matrix Imagewriter printer, the only printer that is supported by the current print driver within the Macintosh. To get its level of graphics and text quality (see listings 1a through 1c), the Imagewriter usually stays in a graphics mode that prints a single column of dots for every byte sent to it by the Mac. However, the Imagewriter can print text in three modes: a high-resolution mode (listing 1b), a medium-resolution mode (listing 1c), and a draft mode that uses the printer's built-in character set for quick text-only printing. (I found I prefer the medium- over the high-resolution text.) Although the Imagewriter could hardly be called fast, it is not unacceptably slow, and it is considerably faster than the Apple Dot-Matrix Printer running under the Lisa computer's parallel port.

Two other pieces of hardware are an external disk drive (at \$395, available during the first quarter) and a numeric keypad (\$99, at introduction). The external disk driver connects to the main unit via a dedicated "second disk" connector in back. When the keypad is connected, the keyboard line runs from the Mac, through the keypad, and into the keyboard itself. Another product, announced but not scheduled, is external hardware that will give the Mac IBM 3270 emulation capability.

Documentation and Training

In its ads, Apple is stressing the necessity of going to a Macintosh dealer and trying the computer out. Once you have bought it, though, you will probably be learning how to use the Mac on your own. Apple will help you in this process by providing you with a cassette/disk combination. You boot up the 3½-inch disk tutorial and listen to the interactive lesson provided on the cassette. (Of course, you have to have a cassette player.) Although I have not seen the cassette/disk tutorial program, I think it will work well; text-only tutorial programs are fine, but many buyers of the Mac will benefit from the warmth of a human voice teaching them.

I saw final-draft copies of only two Macintosh product documents. *Explore Mac Paint* is a booklet (about 25 pages) that teaches you about Mac Paint by showing you what it does. It is very easy to read because it has more pictures in it than text. *Mac Write* is much longer and looks more like conventional documentation. It is sensibly divided into three sections: "Learning Mac Write" (a do-by-example tutorial that shows you most of the features of the program), "Using Mac Write" (a "cookbook" showing you how to accomplish many common tasks), and "Reference." All in all, the documentation should be quite good.

Service

The Macintosh has no user-serviceable parts. Unlike the Lisa computer, the Mac is *not* meant to be opened by the user; you are expected to return your Mac to an authorized Apple service center for repair. The Mac comes with Apple's standard 90-day parts-and-labor warranty. You can also buy a one-year maintenance contract. According to Apple, other service plans will be available, including options for large-volume purchasers of the Macintosh.

Caveats

I wrote this article after two days of meetings with various members of the Macintosh staff, studying preliminary Mac documentation, making numerous phone calls to Apple, and working for several days (over a period of weeks) with a Macintosh computer. I used several final-draft versions of Mac Write and Mac Paint, though I occasionally found operating-system features that "crashed" the system or weren't yet imple-

mented. Apple was still making minor changes to both software and pricing when this was written.

Commentary

There is a lot to like about the Macintosh; it is a superb example of what American technology can do when given the chance. The simple, compact, economical design, the virtual slots, and the enhanced performance of 128K bytes of memory because of the 64K-byte ROM code are all important innovations done well.

I'm glad that Apple decided to go with a Sony 3½-inch disk (as compared to the Lisa 1, which needs special, expensive, hard-to-get twiggy floppy disks). However, I'm disappointed that both Apple and Hewlett-Packard have used nonstandard formats that are incompatible with each other. It would have been nice to start the widespread use of the Sony microfloppy with a standard disk format, but the incentive to sacrifice standardization for performance is one of the drawbacks of a competitive industry.

I also feel strongly that the basic Macintosh package should include two disk drives. With a one-drive system, it will take at least eight disk swaps to back up a 3½-inch disk. How many people (especially novices) will go to this trouble, and how many will suffer when they don't? (I am not alone in feeling this way; the first thing two BYTE editors said when they first saw the Macintosh was, "Only one disk drive? You've got to be kidding!" After numerous disk swaps when trying to load Mac Paint from one disk and a drawing from another, I am convinced that most users will eventually buy the second disk drive.)

At the time this was written, Apple was committed to a totally unbundled pricing of the Macintosh—that is, the basic Macintosh package (at \$1995 to \$2495) includes the main unit, the keyboard, the mouse, necessary cables, a tutorial disk, and a disk containing the operating system. Everything else—Mac Write, Mac Print, all languages, the Imagewriter printer, and the second disk drive—is priced separately. Since manufacturers want to claim the lowest possible price for their products, unbundling is common (IBM, for example, introduced the IBM PC with a low-end model, 16K bytes of memory, and a cassette port for \$1265). True, the low-end Macintosh

is far more complete than most manufacturers' low-end products, but Apple has taken unbundling farther than any other microcomputer vendor—no one has sold a computer without BASIC (or some other language) in years.

A usable Macintosh system with Mac Write, Mac Draw, a programming language, and the Imagewriter printer costs from \$2589 to \$3189; a second disk drive will add another \$395. Apple would be wise to make this package available at a discounted package price, just as it now does for the Apple IIe. Apple contends that the Macintosh will become a home machine because office users will take it home a few times and like it enough to buy themselves one for their personal use. However, the Mac is still too expensive to penetrate the home market significantly; that will be left to less expensive machines, such as the Commodore 64, the IBM PCjr, the Apple II family, and the Coleco Adam.

Finally, I have to point out that, although Apple's advertisements call the Macintosh a 32-bit system, its MC68000 processor is generally regarded as a 16-bit processor (the limiting factor is its inability to deal with multiplicands greater than 16 bits). This is no different from the vendors of some other 68000-based microcomputers, but I hate to see Apple hyping a machine that easily stands on its own merits.

Conclusions

Exactly a year ago, in a product description of the Apple Lisa computer, I said, "Technology, while expensive to create, is much cheaper to

The Macintosh is still too expensive to penetrate the home market significantly; that will be left to less expensive machines.

distribute. Apple knows this machine is expensive and is also not unaware that most people would be incredibly interested in a similar but less expensive machine. We'll see what happens."

Now we have seen what has happened, and it is rather impressive. The Lisa computer was important

because it was the first commercial product to use the mouse-window-desktop environment. The Macintosh is equally important because it makes that same environment very affordable. It is also important because it is a second-generation design that, in several areas, improves on the original.

The Macintosh will have three important effects. First, like the Lisa, it will be imitated but not copied. In the year since the Lisa was announced, dozens of hardware and software companies have announced products that duplicate part of the Lisa user environment—the mouse, the windows, the integrated software. Some, like Microsoft's mouse-based series of packages and Visicorp's Visi On, have tried to mimic that environment on a smaller, less expensive machine (the IBM PC) with only partial success.

In a similar way, companies will be out to imitate the Macintosh, but their attempts will be less successful. Those companies that try to imitate the Mac on other machines will have trouble matching its price/performance combination. So far, attempts to imitate the Lisa by enhancing an existing computer (usually an IBM PC) have been given the benefit of the doubt because they are less expensive than the Lisa; attempts to imitate the Macintosh will now have a harder time because the Mac with software is about as cheap as the host hardware alone.

The only other way to match the Mac would be to design an entirely new system that would be comparably priced. This will probably not be attempted; only a few corporations have the ability to duplicate Apple's design and manufacturing effort, and still fewer will make such a large financial commitment. (Apple is the only American company that does not live under the tyranny of next quarter's profits; if any company tries to duplicate Apple's effort, it will probably be a Japanese one.) Those that try will find it hard to create similar technology that competes with the Macintosh in size and price; Apple is confident that a number of its components and manufacturing techniques will be difficult to copy. Even though Apple has suffered from carbon-copy Apple II machines, it does not expect to have the same thing happen with the Macintosh.

Second, the Macintosh will secure the place of the Sony 3½-inch disk as the magnetic medium of choice for the next generation of personal computers. I was disappointed when I first saw that the Mac used the 3½-inch disk—"Another disk format to contend with," I thought, "and you can't use disks from the Lisa." (You will be able to use Mac disks with the new Lisa 2; see "Apple Announces the Lisa 2," on page 84.) Once I had heard Apple's line of reasoning, though, I had to agree with its choice. Hewlett-Packard's HP 150 is the only other major computer to use the Sony 3½-inch disk to date; Apple's use of it will tip the scales in Sony's favor, and other manufacturers will follow.

Third, the Macintosh will increase Apple's reputation in the market; in fact, to some people Apple will be as synonymous with the phrase "personal computer" as IBM is synonymous with "computer." The Mac will compete with IBM's PC, not its cheaper sibling, the IBM PCjr. Many business users will stay with the "safer" IBM PC. However, people new to computing and those who are maverick enough to see the value and promise of the Mac will favor it. The Mac will delay IBM's domination of the personal computer market.

Overall, the Macintosh is a very important machine that, in my opinion, replaces the Lisa as the most important development in computers in the last five years. The Macintosh brings us one step closer to the ideal of computer as appliance. We're not there yet—at least, not until the next set of improvements (which, in this industry, we may see fairly soon). Who knows who the next innovator will be? ■

At a Glance

Name

Macintosh

Dimensions

9.75 by 9.75 by 13.5 inches

Weight

Main unit, keyboard and mouse—22.7 lbs.

Power Requirements

105–130 V AC, 60 Hz (U.S. model);
85–135 V AC, 50/60 Hz (international model)

Memory

128K bytes of RAM, 64K bytes of ROM

Standard Configuration

Main unit with 128K bytes of RAM, 64K bytes of ROM, integral Sony 3½-inch disk drive, 9-inch video monitor, two serial ports; external mechanical mouse; external keyboard

Mass Storage

One Sony 3½-inch disk drive; 3½-inch disk holds 400K bytes and is encased in a rigid plastic housing

Video Display

9-inch monitor, noninterlaced 60.15-Hz image, 512- by 342-pixel resolution

Pointing Device

Mechanical mouse

Keyboard

Detached keyboard; 58 keys (59 in international version); autorepeat; two-key rollover

Hardware Options

Second disk drive, keypad, Imagewriter printer, security kit (for chaining computer to table)

Software Options

Mac Paint (drawing program), Mac Write (a simple word processor), Mac BASIC, Mac Pascal, others (see text)



PPC
MICRO
DISTRIBUTORS LTD.



Head Office:
NEW HALL HEY ROAD,
Rossendale, Lancs., BB4 6JG
Tel: Ross. (0706) 212321 & 227011
Telex: 635740 PETPAM G

London Office:
1, GLENEAGLES ROAD,
London, SW16 6AY
Tel: 01-769 1022 & 01-677 7631
Telex: 923070 PPCOMP G

TESCO BUSINESS CENTRE

- UNREPEATABLE OFFERS

- APPLE IIc SOFTWARE

- APPLE III HARDWARE & SOFTWARE

BITSTIK + ROBO 500 SOFTWARE (SEALED)		£125
APPLEWRITER II (IIc)	(- " -)	£55
QUICKFILE II (IIc)	(- " -)	£35
MICROSOFT MULTIPLAN (IIc)	(- " -)	£60
BUSINESS GRAPHICS (II + II Plus)		£20
DAVONG 16K MEMORY BOARD (II + II Plus)		£20

APPLE III 256K + MONITOR III + ADDITIONAL DISKETTE DRIVE + SYSTEMS SOFTWARE	} NEW	£950!
		} EX-DEMO

APPLE III SOFTWARE (VARIOUS) £50 EACH

* PRICES EXCLUDE VAT BUT INCLUDE DELIVERY (UK MAINLAND)

TESCO BUSINESS CENTRE

BESSEMER RD

WELWYN GARDEN CITY

HERTS ALY 1HB

TEL: (07073) 25161

PETER MEAD

