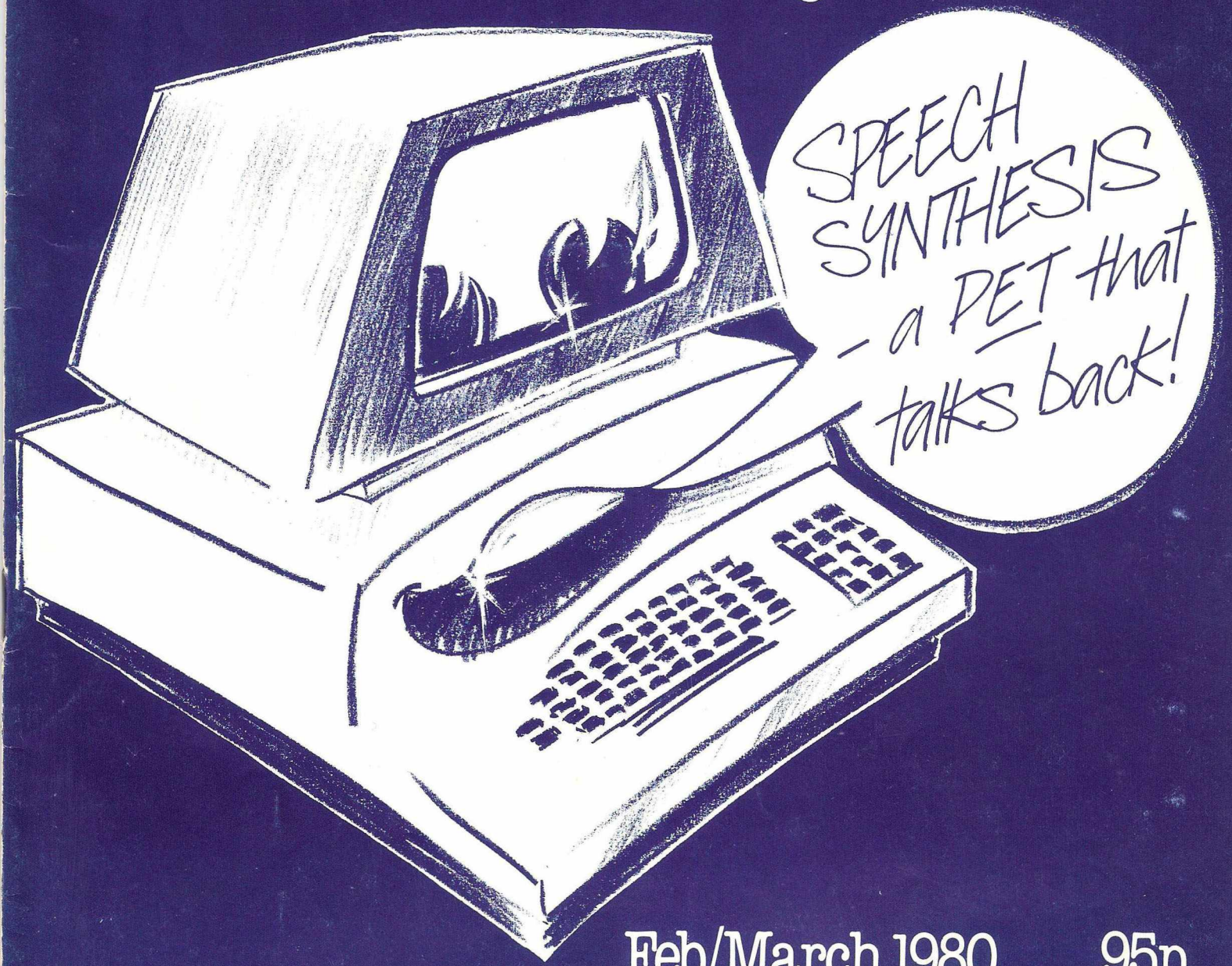
PRINTOUT

Future Shock

The Pet Users Magazine



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EDITORIAL

I have come to the conclusion that knowing about PETs is a great social advantage – you get invited to all the best parties! One afternoon before Christmas we were caught up in a Gadarene rush from the stormy Computer Retailers Association meeting to Practical Computing's party. It is good to see that there is no enmity between that magazine's new owners IPC, and the founders EEC – Richard Hease and several other ex-PC staff were to be spied, having a good time.

Twenty-four hours later, Commodore organised a cruise down the Thames, during which they presented PETs to the winners of a calculator competition run by the Consumer Products division. Feminists in computing will not be amused to hear that the only person to 'take the money' rather than a PET was the only female winner. There followed a presentation in which hints were scattered of a new hand-held BASIC-running calculator to be introduced within a year, and a 'Stack Pointers and Accumulators' talk by the software manager, which caused a migration towards the bar.

Finally, we were invited to the launch of the new Hewlett Packard HP85 personal computer. Why was a PET magazine invited? Don't know – ask HP. Billed by some pundits as an up-market PET, the 85 is built to a very high specification for £2,000. Our opinion was that it would sell well only in HP's traditional market – the scientific and technical field. Without full software support – an area in which HP are reluctant to venture – the machine will never capture the business market.

Over the past months, we have seen several machines promoted as 'the replacement for PET' but always PET goes on selling, and selling, and selling . . .

RICHARD PAWSON – Editor

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STOP PRESS:

DATA LINE LAS VEGAS JANUARY 8 1980

COMMODORE IS WORKING ON A COLOUR PET. PRINTOUT HAS BEEN ABLE TO OBTAIN AN EXCLUSIVE PREVIEW OF THE TECHNOLOGY UNDER DEVELOPMENT AT THE SANTA CLARA HEADQUARTERS.

AS PREVIOUSLY DISCLOSED ON THIS PAGE COMMODORE HAVE PREPRODUCTION MODELS OF THE NEW SUPERPET WITH ENLARGED 12'' 80 COLUMN SCREENS BUT FEATURING AN IMPROVED AND FASTER BASIC. ONE INTERESTING OPTION IS A TOUCH SENSITIVE SCREEN FOR MENU SLECTION OR DRAWING DIRECTLY ON THE CRT WITH A FINGER.

PRINTOUT WAS ABLE TO TEST A SPEECH SYNTHESISER ON WHICH THE SOFTWARE DEVELOPMENT IS NEARING COMPLETION.

EACH KEY CAN IDENTIFY ITSELF AUDIBLY WHEN DEPRESSED.

THE COMPANY ARE ALSO WORKING ON NO LESS THAN FIVE DIFFERENT DISK SYSTEMS.

THESE RANGE FROM A STRIPPED DOWN SINGLE MINI FLOPPY OF APPROXIMATELY 150K CAPACITY TO ELEVEN MEGABYTE WINCHESTER TECHNOLOGY HARD DISK. IT IS EXPECTED THAT ONE OF THE FISRT OF THE NEW SYSTEMS TO REACH THE MARKET PLACE WILL BE A ONE MEGABYTE DUAL MINI FLOPPY CONFIGURED AS TWO 51/4'' DRIVES OF 512K BYTES EACH. ALSO UNDER DEVELOPMENT IS A FULL SIZE 8'' FLOPPY DRIVE.

IT WAS STRESSED THAT ALTHOUGH PROTO-TYPES WERE UP AND RUNNING NO FINAL DECISION HAD NECESSARILY BEEN TAKEN TO MARKET ALL OR ANY OF THE DEVICES.

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HOTLINE – News & Products

A Samaritans for PET Owners

Many PET dealers who acquired a reputation for being helpful on PET problems, are finding themselves beseiged with phone-calls not necessarily from their own customers. RIIC Business Systems Ltd. (pronounced as in Third Reich) have introduced a practical solution to the problem called, coincidentally, Hotline. For an annual subscription of £25 per person, participants may obtain advice on the special Hotline phone, regarding both hardware and software. The service is restricted to PET related products and a full list of printers, interfaces and other devices covered is obtainable from RIIC at 112 Leagrave Road, Luton, Beds – tel: 424851. Robin Woods, the mastermind behind the enterprise, said: "We expect that the service will be heavily used by business PET users and others, as well as several dealers. We do not want to restrict the advice available to each subscriber, but are setting a nominal limit of one phonecall per day per member to avoid saturation of the line. We will try to answer any query that can be answered on the telephone."

PRINTOUT welcomes this realistic approach and would like to hear the opinions of readers on the subject.

High Resolution Graphics

IJJ Design Ltd. have announced a range of products from MTU (Micro Technology Unlimited) specifically for the PET. Most interesting of the new products is a Visible Memory board which can provide a 200×320 dot matrix on PET's screen – suitable for high resolution graph plotting and other interesting graphics. A versatile mode switch (partly software programmable) allows PET's display to switch between the conventional graphics and the 8K visible memory. A second monitor may be added to show both displays at once, or the graphics may be switched off to provide an extra 8K of RAM to be used.

Prices are £174 for the board, £14 for Graphics and Text software, £71 for the PET to MTU interface and £54 for optional Card File (capable of housing 5 MTU boards), all plus VAT. The whole system is on offer for £299. Other MTU products available include music generators, PROM programmers and prototyping boards. For more details, contact IJJ Design at 37 London Road, Marlborough, Wilts SN8 2AA or telephone 0672-53153.

Mammoth interface

News has reached us of a powerful new interface developed for high speed communications on the PET. The device can simultaneously communicate with *up to 128 (yes, 128)* independent RS232 peripherals via the memory expansion port! Baud rates are programmable and switch selectable from 100 to 19,200, as are parity, start and stop bits and byte lengths. The unit comes complete with case, power supply, 6 conventional output lines with connector and additional lines for handling sophisticated devices such as modems. We were not given details of suitable applications or the price, unfortunately, but interested readers should write to Aptec, 9 Poland Street, London W1V 3DG.

Appreciating your PET

Commodore have now extended their range of training courses to include an Advanced Basic course and one for Assembly Language Programming. It will be interesting to see how the former goes – the provisional syllabus did not look very exciting. We will wait until more details are available before passing official comments.

A new idea is the PET Appreciation Seminar with talks by "senior Commodore managers and guest speakers who are acknowledged experts in the field". Kicking off with 'Microcomputers and the Businessman' and 'Microcomputers in Control Systems', the seminars will be one-day events held in hotels around the country for £50+VAT. A new leaflet giving date and price details can be obtained from your PET dealer.

Super word processor

More details are coming in regarding the specifications of WORDCRAFT – the word processor program reputed to be to the Commodore WORDPRO what WORDPRO is to the Petsoft CMC version!

As well as up-and-down scrolling, WORDCRAFT has a 'panning' action with the screen moving as you type, in a 100 character by 55 line field. Pages can be printed with automatic headers, trailers and page numbers.

An intelligent search and exchange function is provided which will even change lower to upper case to suit the context of the changed string. Automatic underlining of words and paragraphs plus dynamically variable tab settings are other unusual features.

WORDCRAFT costs £325 plus VAT from Dataview, 9 Church Street, Colchester, Essex CO1 1NF – tel: 0206-78811. CompuThink Disk version available from Petsoft.

Dataview also supply a range of PET-compatible printers suitable for using with the program.

Mains interference suppressors

The latest gadget to add to your system is a mains interference suppressor. Whether you need one of these depends on the environment in which your PET operates. Mains fluctuations can be nasty, causing crashes and loss of data – Commodore once had 10 systems crash embarrassingly in front of 10 top journalists because the hotel lifts caused fluctuations in the voltage. If you experience this kind of problem, two companies have sent us details of different suppressors:

Logic Box Ltd., 31 Palmer Street, London SW1 – tel: 01-222 1122 (see photograph), and Lightning Elimination Associates Ltd., Vine Cottage, Moreton, Thame, Oxon – tel: 084421-3204.

READ/WRITE
Your Questions Answered

They say it never rains but it pours. Evidently a PET user has to feel pretty strongly about something to put pen to paper. But when he does, the flood gates open – we have had quite a few 6-page letters recently. For practical reasons we must reserve the right to edit letters before printing, and to facilitate the process we are developing a hybrid text editor program. Letters can be reduced by any percentage and undesirable phrases removed (unprintable words, names of competitors, etc.). The routine which converts all criticisms of PRINTOUT to glowing praise has regrettably not been perfected yet!

Wrists slapped

I can't help feeling that Gavin Sanders' 'Unexplainable Corner' was put up as an Aunt Sally, for the answer must surely have appeared in print before.

When shifted characters are to be included in a REM statement, they must be included in quotes (see the handbook). This is so that on listing the program the characters are not treated as 'tokens' and converted to 'keywords' such as NEW, IF, END, TAB(, ABS, etc. by the BASIC interpreter. The list of keywords in BASIC is listed in order from END to MID$ in ROM from $C092 (49298) to C18F. The last character in each keyword is detected by its most significant bit being set, and the end of the list by a zero. In the new ROM sets the keyword GO is added with token 203 to allow embedded spaces in 'GO TO'.

Ron Geere, IPUG Editor

We hadn't actually seen a full explanation in print, but we have printed a list of tokens in this issue. The challenge of finding a use still stands.

* * * *

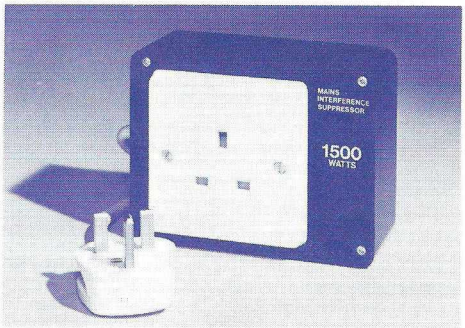
Quick one

Just a quick comment for PRINTOUT. Yes, Jim Butterfield's un-crasher does work (with new ROMs) and we have not found it necessary to use de-bounced switching in the Reset line.

M. J. Smyth

Since publishing the article, Commodore have told us that they call it the 'Hairpin Method'. A bent hairpin can be used to ground Reset if you are very careful not to short out anything else!

* * * *



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DELETE	Removes groups of BASIC program lines
FIND	Locates and displays the BASIC program lines that contain a specified string
APPEND	Adds a previously SAVEd program to the one currently in your PET
DUMP	Displays the names and values of all the variables used by your program (excluding arrays)
HELP	If your program stops due to an error, HELP displays the offending line and where the PET detected the error.
TRACE	As a program runs, the last six line numbers being executed are shown in the upper right corner of the PET's screen.
STEP	Executes one BASIC line and stops. Pressing SHIFT executes the next line. The line number is displayed in the upper right corner of the screen
OFF	Turns TRACE or STEP off

For the new 16K and 32K PETS, the tool kit consists of a single ROM chip which plugs into the left most empty socket inside the PET. Price £55 plus VAT.
For 8K and other 'old ROM' PETs a small printed circuit board is attached to **the memory expansion and 2nd cassette ports of the PET. Price £75 plus VAT.** Also available for 8K PETS with new ROMS. Please state configuration when ordering.

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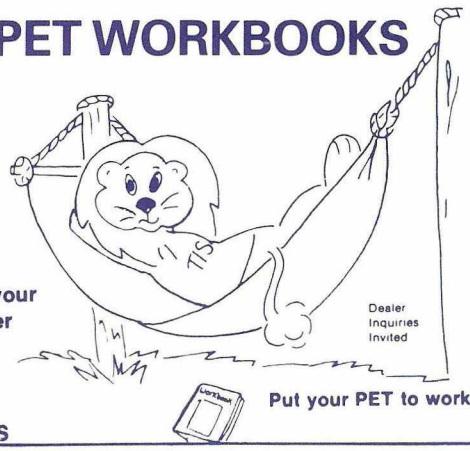

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CompuThink comments

A review of the CompuThink Disk system should inform readers that you *must* initialise the CompuThink variables F$, I$, R$ at least at the beginning of the program, and that as soon as you have read a string into R$, it is a good idea to say :X$=R$: and then do all manipulations on X$. Failure to do this with random-access hardware leads to self-corrupting programs. I have also had problems on my 8K PET and Expandamem – any program line that is passed over the join between the two memories (8192-3) during editing gets corrupted.

A. L. Minter

Take note, CompuThink users. The fault described concerning Expandamem memory does not happen on ours. Perhaps you have a hardware fault.

* * * *

PET printers

I have some questions on the new Commodore printers which I have been unable to get answers to – can you help?

1. How does the 3022 differ from the 2022?
2. Will the sprocket drive unit also take plain unsprocketed forms or pages (i.e. does it have an auxiliary rubber roller drive?)
3. Is the width of the sprocket drive adjustable to take forms less than 9½" wide?
4. Apparently it is not possible to use the 2023 (friction feed) model to reproduce VDU graphic displays since it has a fixed spacing of six lines to the inch. Is it possible with the 2022? Can dots be printed continuously both horizontally and vertically? Can all 8×8 dots be addressed? Will the print head stand up to printing reversed field for long?
5. On a different tack, how can I write in the lower right hand corner of the 25×40 screen without generating scroll-up? This would be very useful in forms layout and graphic displays.

Frank Chambers

Here goes:

1. **As far as we can ascertain – in cosmetic appearance only.**
2. **No – being a tractor feed, the paper advance mechanism is totally divorced from the print platten.**
3. **Yes, fully adjustable.**
4. **The 3022 has a programmable line feed which can be set to provide continuous vertical print. The head is a 6×7 matrix and the individual dots can be accessed by means of the programmable character. We shall be reviewing the 3022 in detail shortly.**
5. **The easiest way to put characters in the lower right hand corner is to poke the code for the character required into location 33767. If this is not possible then the following method will work:**

   Print the character desired for the corner, one position left of the corner. Print a CURSOR LEFT followed by CHR$(148) which is a programmed INSERT.

   This will move the character right to the corner, and you may then print the character for the blank space now to its left. Try it.

A Hitch-Hiker's Guide to the PET

A Hitch-Hiker's Guide to the PET is a new book written by C. Preston, containing descriptions of many useful memory-locations and ROM subroutines in the new PETs. The following extracts are typical and should prove useful to many readers. The book will shortly be marketed by Petsoft.

Introduction

This booklet is intended for those who want to do something a little out of the ordinary with their PET. It will be equally of use to BASIC or assembler programmers.

It is divided into three sections, two covering useful memory locations and subroutines, and a section on how to write and read files from an assembler program without using BASIC.

Where a pair of memory locations is described as an address or a pointer, the value is stored with the low order byte first, followed by the high order byte. To calculate the value, multiply the second byte by 256, then add the first.

If a number is written with a dollar sign ($) before it, e.g. $5C, this means that it is in hexadecimal notation.

$C191 BASIC error messages

This area contains the text for all the BASIC error messages, which are printed by subroutine $CA1C.

They are as follows:

$C191	NEXT WITHOUT FOR
$C1A2	SYNTAX
$C1A8	RETURN WITHOUT GOSUB
$C1BC	OUT OF DATA
$C1C7	ILLEGAL QUANTITY
$C1D7	OVERFLOW
$C1DF	OUT OF MEMORY
$C1EC	UNDEF'D STATEMENT
$C1FD	BAD SUBSCRIPT
$CD0A	REDIM'D ARRAY
$C217	DIVISION BY ZERO
$C227	ILLEGAL DIRECT
$C235	TYPE MISMATCH
$C242	STRING TOO LONG
$C251	FILE DATA ERROR
$C25A	FORMULA TOO COMPLEX
$C26D	CAN'T CONTINUE
$C27B	UNDEF'D FUNCTION
$C28C	ERROR IN
$C299	READY.

When BASIC detects an error, it prints one of these messages, then jumps to $C377, which resets the stack pointer to $FA, corrupts the pointer in $3B to prohibit a CONT, then prints "ERROR". It then checks to see if location $37 contains $FF, in which case the error occurred in a direct statement, whereupon the program jumps to $C389, which prints "READY." and waits for the next command.

If the error occurred during the execution of a program, the routine will print "IN", followed by the line number in $36-$37, before jumping to $C389.

This routine is useful if you are performing functions as machine-code subroutines and wish to pass error messages back to the user.

$F156 IEEE error messages

This routine prints one of the following error messages relating to the IEEE bus onto the screen.

The message is selected by the value in the Y-register as follows:

HEXADECIMAL VALUE	MESSAGE
0	TOO MANY FILES
6	FILE OPEN
17	FILE NOT OPEN
24	FILE NOT FOUND
32	SEARCHING FOR
41	PRESS PLAY AND RECORD ON TAPE
5F	LOAD
64	WRITING
6D	VERIFY
74	DEVICE NOT PRESENT
86	NOT INPUT FILE
94	NOT OUTPUT FILE
A3	FOUND
AA	OK
AE	READY.

Cursor position

Information describing the cursor location is stored in two parts.

1/ Locations 196-7/$C4-$C5 contain the address in screen memory of the start of the line containing the cursor.

2/ Location 198/$C6 contains the position of the cursor on the line, starting at 0.

So to calculate the address in screen memory under the cursor:

PEEK(196)+PEEK(198)+
PEEK(197)*256

Location 216/$D8 contains the line number (0-24) of the cursor.

94-99>$5E-$63 floating point accumulator

The floating point accumulator is used to pass a parameter between BASIC and a machine code subroutine via an I=USR(3), for example.

In machine code, values are converted to and from floating point by means of two subroutines in ROM: INTFLP and FLPINT. These are described more fully in their own sections.

$D09A FLPINT

This routine is used to convert a floating point number in the FAC, usually a value passed down by a USR(I) function, into unsigned integer format. The integer is left in locations $61 and $62. For example, if a machine-code subroutine is called by an I=USR(4), the location $62 will contain a 4, and location $63 a 0.

$D262 INTFLP

This routine is used to pass a value back to BASIC from a machine-code subroutine which has been called by an I=USR(0). It converts the integer value formed by the accumulator (more significant byte) and the Y-register (less significant byte) into floating point and store it in the FAC. For example, if A=2, and Y=3, then after a JSR INTFLP, the variable I above would contain 2*256+3=515.

Speech Synthesis – The PET That Talked Back

By Dr. P. Roach – University of Leeds

Speech synthesis, the generating by artificial means of an acoustic waveform approximating that of natural speech, has been around for quite a long time. An electronic speech synthesiser was demonstrated at the New York World Fair in 1939. Many different techniques and control systems have been tried out over the years, and not suprisingly the computer has played a large part in the development of modern speech synthesis techniques. There is a large literature on the subject: probably the best place to start for anyone interested in learning more about it is *Speech Synthesis* by J. N. Holmes (1972, Mills and Boon Ltd. M and B Monographs in Electrical Engineering).

Most conventional synthesis techniques work on the basis of a small number (usually between 8 and 20) of time-varying control parameters. Various synthesisers operating on parameter values supplied in digital form have been commercially available for some years, but the cost of these devices plus the cost of a suitable computer to control one has until recently been beyond the means of most university Phonetics laboratories. However, with the arrival of microprocessor technology this kind of equipment is no longer so prohibitively expensive. The system we have developed in our laboratory is based on a PET computer (approximately £500) and a Computalker speech synthesiser (approximately £400). How the system works is described below.

If we look at how speech researchers actually go about producing synthetic speech we find a number of different approaches. For example, a reasonably large computer (say at the upper end of the minicomputer range) can generate the entire waveform by software alone in reasonable time, and all that is needed is a D-to-A converter to translate the digital values into audible output. Some form of buffering is, of course, necessary in a time-sharing system.

Synthesis-by-rule

Synthesising speech is a very complex and time-consuming business, and in recent years the technique of *synthesis-by-rule* has been developed. Essentially, this is a technique which embodies in algorithmic form the information we need for synthesising sequences of speech sounds so that once the synthesis-by-rule system works the user needs to do little more than type in a sequence of characters representing the sequence of sounds (phonemes) required. If you have a requirement for synthetic speech output from a computer and you don't mind the sounds being generated by someone else's rules (or you are prepared to spend a very long time working out your own synthesis-by-rule system), this is the least laborious way of getting it. Computalker distribute their own synthesis-by-rule system (which produces American English), but this is not yet available in 6502 machine code, so we couldn't use it.

Another use is in teaching about speech acoustics and speech synthesis to students of Phonetics (other subjects sometimes do this too, notably some Psychology departments). Here the requirement is not for some ready-made package of rules, but for a 'hands-on' interactive synthesis facility that allows the user to set up, try out and modify the various parameters with immediate feedback about the resulting sounds. Ideally, students should not be required to know anything about computers. They should be able to use the synthesiser in the laboratory where they carry out acoustic analysis of speech. The operation of the system should be simple, backed up by good graphics and as nearly as possible foolproof. This was the requirement we had in mind in setting up our system.

S-100 BUS

Our PET is the small-keyboard 8K machine, with the additional cassette machine and 24K Plessey memory expansion. The Computalker is on a single printed circuit board. This is an S-100 board, and we therefore had to find some way for the PET to talk to the Computalker. Computalker Consultants have announced plans to produce a cheap one-slot PET-to-S-100 converter specially for this purpose, but since this is not yet available we bought a BETSI converter (Forethought Products, Inc.) for around £85 which provides slots for four S-100 boards and a few sockets for PROM chips. We built a simple power supply to the design in the BETSI handbook and built a small cabinet round the power supply, BETSI and the Computalker. One snag was that both BETSI and our 24K RAM go on the PET's memory expansion port. We therefore wired up the connection to BETSI in such a way as to allow us to connect the RAM onto it in daisy-chain fashion. To complete the system we have a Ferrograph Logic 7 tape recorder for making the synthesiser output audible and for storing the finished versions of the synthetic speech. All functions on this recorder can be worked by remote control, so to automate its use and keep inter-item spacing constant we have it controlled by the PET via the User Port, using seven inverting amplifiers and relays. We use our printer to get hard copy of the parameter values and graph plots.

On first trying out the system we discovered a timing problem between the BETSI and the Computalker, which was overcome by inverting the address select pulse on the Computalker board.

Voicing, Aspiration and Frication!

The Computalker is controlled by nine parameters. It would take far too long to explain properly what these parameters are for, but briefly they are the following: AV (Amplitude of Voicing), FØ (Fundamental Frequency of Voicing, more commonly called 'pitch'), F1, F2, F3 (Formants 1, 2 and 3, used in producing different vowel qualities and synthesising consonants like *l, r* and *w*), AH (Amplitude of Aspiration, for *h* sounds), AF (Amplitude of Frication, for fricative sounds like *s, z*), FF (Frequency of Frication, to produce differences in fricative quality such as that between *s* and *sh*) and

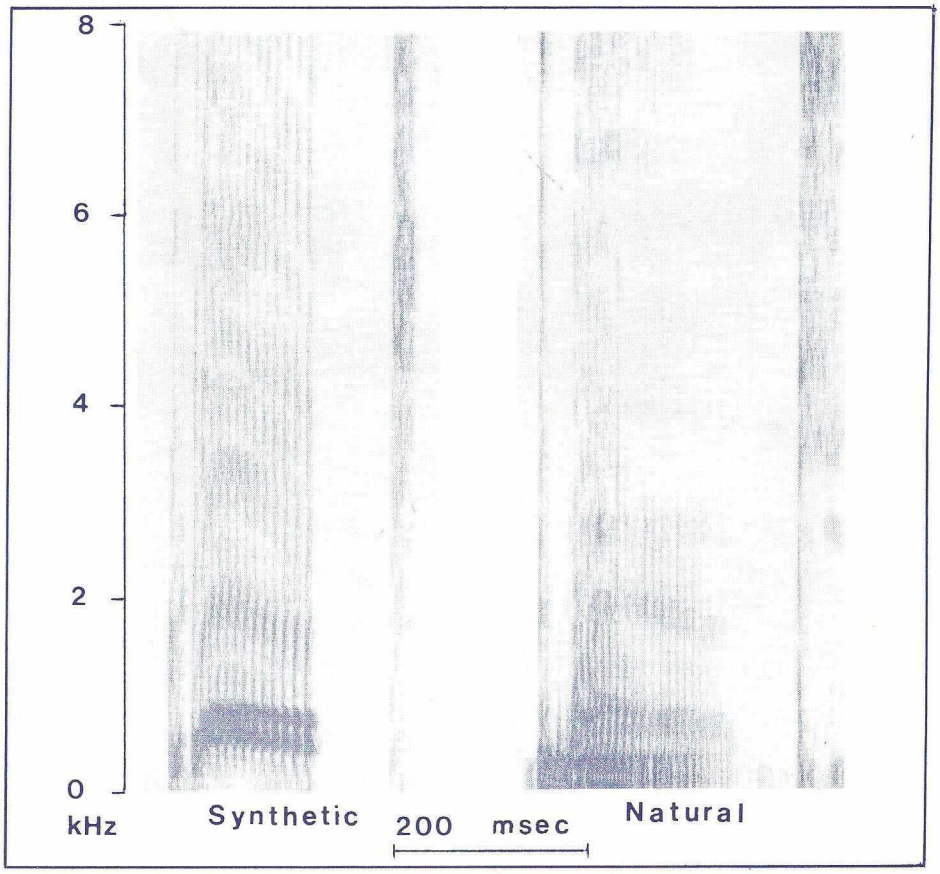


Figure 1: Spectograms of PET

AN (Amplitude of Nasal, used in producing sounds like *m* and *n*). For each of these parameters a byte has to be sent to the appropriate port at regular intervals. The usual update rate is 10 msec, though for the highest quality 5 msec is preferable. A 10 msec frame rate requires data output at 900 bytes per second, and it would obviously be too laborious to input all these values manually. In fact all that is necessary is to load frequency and amplitude values for the points in time at which spectral changes have to be brought about and let the program generate the data frames for the intervening time intervals. The high output rate and the large number of data bytes to be stored makes some machine code programming essential.

The key functions required of our program for synthesising speech are:

(a) To generate control parameter values for data frames and later output them to the ports of the synthesiser.

(b) To control the output rate of data frames.

Besides performing the above two functions, the program handles all the functions required before and after synthesis.

BASIC plus machine code

The program has been written in BASIC apart from a routine named 'PLAY', which has been written in machine code to achieve the required output rate. This routine resides in the second cassette buffer area.

In order to save space, data is accepted at discrete points which represent changes in speech pattern that necessitates non-gradual changes in parameter values. To do this it is necessary to specify the duration of each point as a tenth parameter. Then the intermediate data frames are created, converted to range 0-255 according to relations defined for the Computalker, and POKEd into the output area. The frame interval or output rate can be selected by the user.

The various commands accepted and the consequent actions taken are:

I - Input

Followed by K or T, specifies keyboard or tape unit to be the input device. A negative parameter value signifies that it has to remain constant during the duration of that particular point. Otherwise a straight line is interpolated between the values of consecutive points for each parameter.

M - Modify

Modifies one parameter at a time. The new value has to be preceded by point number and parameter name.

O - Overall shift

Shifts all the values of a parameter by percentage typed, preceded by parameter name to be shifted. This also allows change of frame interval.

L - List

Lists data for all points on printer.

D - Display

Followed by a block number, displays data from a six point block on VDU.

S - Save

Saves points data in digital form on tape.

C - Create

Creates the intermediate data frames. The rest of the commands are invalid until C has been executed.

G - Graph

Followed by parameter name, plots the graph of parameter against time on the printer.

V - VDU graph

Followed by parameter name and segment number, displays curve of parameter for 35 frames at a time.

P - Play

Plays the speech through the Ferrograph, preceded and followed by specified silent intervals.

R - Record

Turns the Ferrograph on in Record mode and records the synthesised speech.

The program occupies approximately 7K bytes.

PET's first utterance

The system described above has only recently been brought into use, so that it is not yet possible to report on how well it functions as a tool in teaching and simple experimental work. We are confident, though, that we have a system that will be very useful. We are pleased to report that the first thing the system said, after some preliminary test noises, was 'Pet'. The quality, as judged by several listeners experienced in listening to synthetic speech, was quite good. In this kind of work listeners tend to disagree about whether a particular synthetic utterance could have passed for a tape-recording of a human speaker. The highest quality synthetic speech can only be distinguished from taped natural speech by a few really expert acoustic phoneticians, and we obviously do not expect to get near that sort of standard.

We cannot, for obvious reasons, accompany this article with a tape-recording, but we have in acoustic phonetics a standard instrument for the visual representation of speech, the spectrograph. Fig. 1 shows a spectrogram of our system's pronunciation of 'Pet' and one of a human speaker (P.R.) saying the same thing. Fig. 2 shows printer graph plots for four of the nine parameters in the synthesis of 'Pet', in which frequency (in Hz) is plotted against time (calibrated in msec).

For the immediate future, our task is to teach our students to operate the system, after which it is hoped that we and the students will use it to produce synthetic speech stimuli for use in experiments on speech perception.

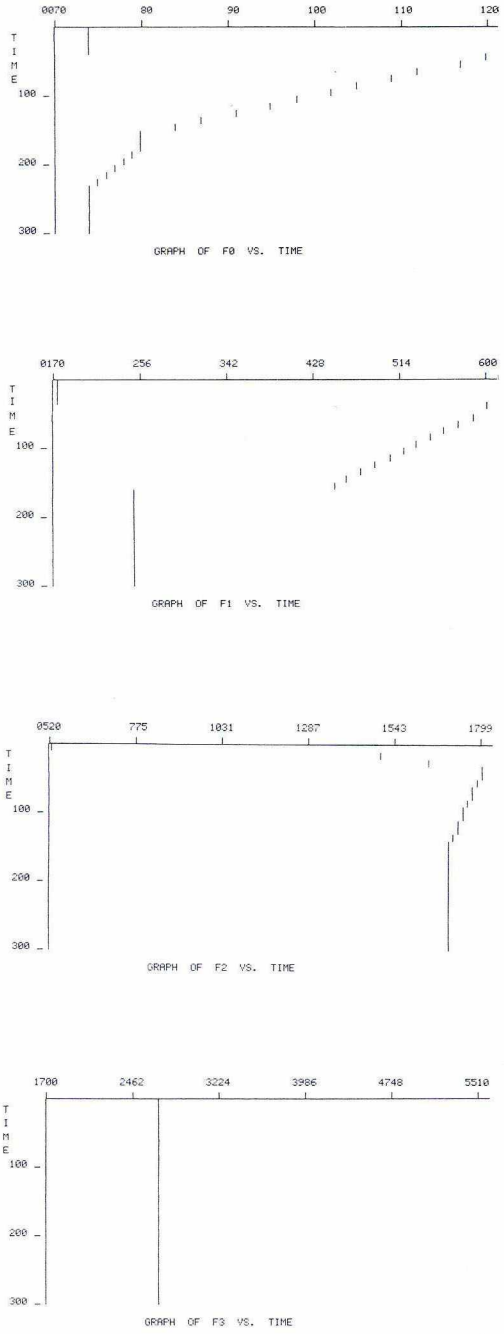


Figure 2: Parameter plots for PET

STOP PRESS: Commodore's Speech Synthesiser – See next issue.

Professional Disk Drives: PART 2 – COMMODORE 3040

Ever since PET was first marketed in the U.K., Commodore have stated their intention to produce a range of peripherals that would enable PET to be used as an integrated business system. All did not proceed as smoothly as planned, however, with delays in production, re-designation of model numbers and long delivery times when the products finally arrived. The current situation is somewhat more stable with 3022 tractor-feed printers and 3040 floppy disk units being available in reasonable quantity.

Commodore's disk unit is undoubtedly the most sophisticated personal micro-computer peripheral on the market. Based around two Shugart 5¼" drives, it has its own internal microprocessor and RAM, and has the capability for handling up to six open channels simultaneously. Attached to the IEEE port of PET, commands can be sent to the disk's controller by means of straight-forward PRINT statements. In this way, PETs internal operating system is not affected and the unit will run on any new ROM PET. Owners of old ROM PETs will be supplied with a free set of the new ones on purchase of a disk unit though this means that all programs will have to be converted. Because the 3040 has its own RAM to implement the various buffers and pointers, none of PETs own RAM is used. An 8K PET will happily support the disk unit, though many business applications will require more than 8K for the program itself.

Design changes

When the disk was first made available (then called the 2040) it came in for heavy criticism from many users. Problems were encountered with head alignment, over-heating, and initialisation; the future did not look very rosy. Commodore made a few design changes, but discovered that many of the problems were due to poor documentation and hence misunderstanding of the operation procedures. PRINTOUT asked several users for their experiences and most recent purchasers reported that they had not come across any problems.

Turning to the operation of the 3040, several commands are available for file handling and maintenance. As with normal basic keywords, these can be abbreviated and the main commands are printed below:

PRINT # 1,"NØ:FILENAME,10"
News or formats a blank diskette.

PRINT # 1,"IØ"
Aligns the drive head with the first track on the diskette.

PRINT # 1,"VØ"
Verifies all data on the diskette.

PRINT # 1,"DØ=1"
Duplicates all files (both data and program one drive to the other).

PRINT # 1,"RØ:NEWFILE=Ø:OLDFIELD"
Renames a file on disk.

PRINT # 1,"SØ:FILENAME"
Deletes or scratches a file from disk.

Programs may be loaded and saved in the same manner as for cassette operations, or the directory of files on a disk may be loaded as an alternative. One very commendable point is the disk support software which Commodore provide with the 3040. 'DOS4.0' enables commands to be sent to the disk from the keyboard without the use of PRINT # , and DUM3.4 provides easy file maintenance without full knowledge of the command set.

Error messages

In addition to the conventional LEDs on each drive to indicate when they are active, the 3040 features an Error indicator which lights up whenever an error occurs. This might happen, for example, if one attempted to OPEN two files with the same name, or if the drive failed to initialise properly. Before operation can be continued, it is necessary to read the Error Message from the 3040's controller. There are 26 possible messages which can be printed on PET's screen, and this is undoubtedly useful when de-bugging software. Versatile as it is, though, this system can be tedious at times and it is annoying that there is no other way of clearing an error.

Although there is more software currently available for the CompuThink drives, Commodore are producing packages at an impressive rate. They currently have available through their Business Software dealers a Stock Control (£150), Word Processor (£75), Business Information System (£150) and Payroll (£150) and are working on a Sales and Purchase Ledger. Other companies also have packages for the 3040: Dataview – the powerful Wordcraft Word Processor, Micro Associates – software for heat loss and Petsoft – a Payroll (£50), Sales and Purchase Ledgers (£115 each) and Stock Control (£50).

Sequential files

Having good software available is obviously important if you intend to use the system for an 'off-the-shelf' application. However, for many users, the most important question is: "How easy is the system to use?" In order to answer this question, with particular reference to business programming, it is necessary to distinguish between the two types of data file available to the disk user. All files are listed on the directory and may be read after an OPEN"FILENAME" type statement; the file is automatically located without having to specify its physical location on the disk. The file might contain, for example, a hundred names and addresses. With a SEQUENTIAL file, it is only possible to read the records in the order in which they were written, one cannot read address number 60 without having read addresses 1-59 first. If address number 30 is required, the file must be closed and re-opened and addresses 1-30 input to PET. If a business system contains many data items, then the disadvantage of this type of file is obvious. However, creating and using a sequential file is relatively easy and the method is well documented in the handbook. A sequential file is very similar to a cassette file, being accessed with PRINT # , INPUT # and GET # , though it is many times faster than a cassette.

Random-access

RANDOM-ACCESS files use memory pointers to locate a particular record on the disk in terms of its track number, sector number and position in the 256 byte block specified by the former two. This means that records can be located and changed in a faster and more efficient way, but requires much more programming by the user. Unfortunately, Random-Access file manipulation is not at all well documented in the handbook for the 3040. After a brief description of the relevant commands (BLOCK READ, BUFFER POINTER, etc.) there is a listing of an example Random-Access program and then nothing else. We asked Commodore to explain this lack of documentation and they replied: "We don't deny that Random Access is a complex procedure, but we feel that most business users will be buying ready-written packages or will write their own simpler sequential programs. For those programmers who want to write their own high-key software, we run a training course which teaches the use of Random Access techniques."

In conclusion then, at £795 plus VAT, the Commodore 3040 disk unit represents good value for money and a very advanced specification. The initial problems with overheating and system bugs have been cured; the 3040 now has a good reputation for reliability. Software packages are appearing rapidly and seem to be well-written. If you intend to use the system for off-the-shelf programs or simple business applications then there is sufficient documentation available. If you want to write your own large business package, you must consider spending an extra £150 on a Commodore training course.

PET Games:
The Good, The Bad and the Truly Terrible!

When the PET first appeared in this country two years ago, the only programs immediately available were games. Despite the wealth of utilities and business packages released since, the PET remains in many minds, primarily a games computer.

Whilst we believe that PET is much more than this, there can be little doubt that the PET is a superb vehicle for games.

PRINTOUT looked at over a hundred games in compiling this guide to the Good, the Bad and the Truly Terrible. For the benefit of readers we concentrated on the first category. Unfortunately, software from Databank and Supersoft did not reach us in time to be included in the survey.

Types of games

Broadly speaking PET games fall into six main categories:

maze games, 'intelligent' board games, military/economic simulations, interactive conversational programs, fantasy simulations and space games.

It was the last mentioned that first became established as a classic computer game. Originally played on mainframes, Space War was estimated by one authority to have cost the United States over $20 billion in lost computer time during 1970 and 1971.

On the other hand, many interactive techniques now in common use were first developed as improvements to Space War. Stuart Brand in his book, *Cybernetic Frontiers* reports that IBM banned playing of the game. After six months of low morale and lower productivity, the order had to be rescinded. Today the game is known as Startrek, and most commercial software publishers have a version. Usually you control warp and impulse engines, shields, photon torpedoes and phaser weapons with which to battle the evil Klingons. Of the versions we examined, three 'real time' programs did particularly well; these were Commodore's Startrek (Treasure Trove No. 7 £10), Petsoft's Wartrek (£8) and Personal Software's Timetrek (£8).

A family of space games with which we were less impressed was the missile game, in which one or more space craft are manoeuvred round the screen exchanging fire. Commodore's Galaxy Games, Petsoft's ST*RW*RS and Instant Software's Arcade II (£5.75) came into this category. The graphics were on the whole no better and no worse than those of the arcade games from which they are so unimaginatively poached.

One of the first programs sold here was Commodore's Lunar Lander. You control thrust, and in some versions altitude, to land the Lunar Expeditionary Module on the surface of the moon. Digital displays show altitude, rate of descent, fuel level, etc. We rated Commodore's program (TT1 £10) best for graphics. Petsoft's LEM Landing (£8) is said to have been written by a NASA scientist and the orbital equations are claimed to be authentic. It was the most complex and challenging of the Lander games we tried. However, it is doubtful whether anyone would wish to play any of these games very often. Incidentally, we were surprised to note that the NEECO program appeared to use Commodore's graphics.

An honourable mention to Petsoft's Deathworld V (£5) and a wooden spoon to CBM's Glider.

Board games

The better board games sustained interest over repeated runs. This was due to the fact that each game was potentially different in tactics and result. Most companies offered Tic Tac Toe (Noughts and Crosses); all were well implemented, but this is hardly the best way to enjoy your PET. Three dimensional Tic Tac Toe,available as part of Commodore's TT No. 1 (£10), was somewhat more complex, but we think the game would be even better played with pencil and paper!

Othello is a strategy game played on an 8×8 board where the object is to surround the enemy. Good implementations by Commodore (TT5 £10), Petsoft (£7) and Microware (£7.50). Another game we liked was Backgammon. None of the games we tested would stand up to a strong human player. Petsoft's version (£8) had the best graphics, but the Commodore program was supplied with slightly better instructions (£10). Strategies were of comparable standard.

Undoubtedly the best board game was Personal Software's Microchess 2.0 (£14). Over 50,000 copies have been sold and deservedly so. This program is a must for all PET owners. Obtainable from Petsoft and virtually all PET dealers.

An honourable mention goes to Commodore's Wrap Trap (TT3 £10), which can be quite addictive.

The A.I. simulations were poor with the exception of Petsoft's Eliza (£8), which simulates a conversation with a psychiatrist. Earlier this year we found some bugs in the program. The copy supplied for review had been improved and anglicised somewhat.

Brian Reffin-Smith's more ambitious 'General Conversation' was a disappointment. Sample conversation:

Q: "DO YOU LIKE COMPUTERS?"

A: "SUPPOSE ONE MIGHT ENVISAGE LOVING EXPERIENCE FOR FUN"...

In the same package from Commodore (£10) was 'Abuse' which starts off promisingly enough: "WELCOME TO ABUSE – THE LAST FRIENDLY WORDS YOU WILL HEAR. INSTRUCTIONS ? – YOU MUST BE JOKING". What follows is quite unprintable.

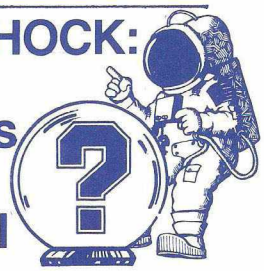
Far too many of the programs on sale are simply word or letter guessing games, like Hangman, which can easily be written from scratch with the most elementary knowledge of BASIC. We propose to pass over these without further comment.

Simulations of the economy of a Far Eastern state (Porasing in one implementation) are popular. Petsoft's El Presidente (£7) was particularly well presented. QSoft have an interesting simulation of the English 'Civil War' (£8), in which Scouts and Cavalry are manoeuvred from county to county prior to a battle. We also liked HB Computer's 'Micropoly' (£12), a computerised version of the famous property game 'Monopoly'.

The subject of fantasy simulations is dealt with at length in a forthcoming article. However, recommended programs include Mike Richter's 'Hunt' (Petsoft £10), where you define the names and natures of the players, and their quest, and Instant Software's 'Dungeon of Death' (£5.75) which involves demons, spells and search for the Holy Grail.

Preliminary returns from PRINTOUT's PET User Questionnaire suggest that even business users enjoy playing games. With such variations in quality our advice is to try a games program out at your local dealer, prior to purchase. If you are disappointed by a mail order purchase, most companies will be happy to exchange the program for another.

FUTURE SHOCK:
Revelations from a Crystal Ball



PRINTOUT asked leading PET experts on both sides of the Atlantic to gaze into their crystal balls. Here are their predictions of the way PET is likely to develop over the next three years:

1980 March

Revised Disk Operating System. High resolution graphics board on sale. Database software package released.

April

Battery powered hand held Mini PET with 4K BASIC on sale in US. PET advertised on TV. Personal Software's Toolkit launched.

May

Petsoft offer plug-in Assembler chip. Colour graphics board on sale. 8K PET reduced to £400.

June

Sound added to PETs. Commodore apply for GPO approval of PET Modem. Digitizer tablet on sale for £50.

July

Commodore thermal printer on sale. Petsoft release PASCAL for PET. Chuck Peddle joins Apple again.

August

CompuThink 2.4Mbyte 8'' floppies arrive. Commodore produce revised ROM set. Chuck Peddle goes back to CBM.

September

Speach Synthesizer. Kit Spencer promoted to International Marketing director based in Santa Clara. PET FORTRAN released.

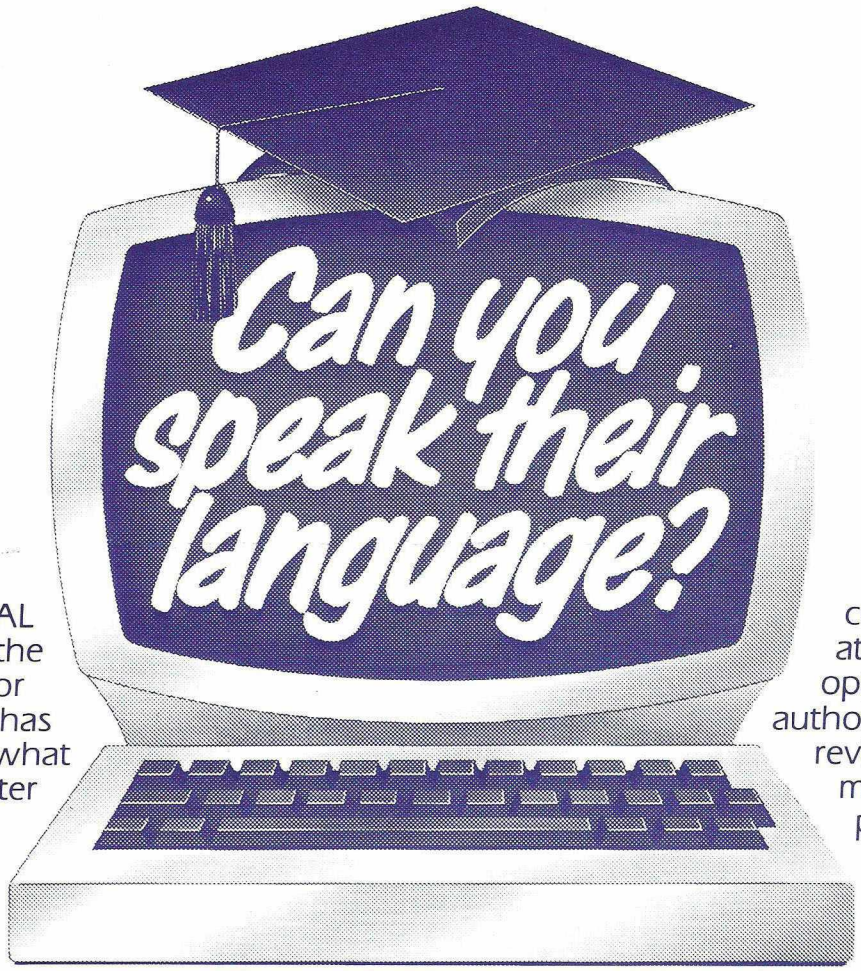
October

11Mbyte hard disk by Corvus on sale. Commodore Toolkit arrives. ALGOL package launched.

November

2Mbyte SUPERPET with 64K RAM + 12'' 80 column monitor. Chuck Peddle joins Atari. David Levy's chess program smashes Microchess.

(Continued)



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(Continued)

December
Daiseywheel printers below £750. Chuck Peddle goes back to Commodore. BASIC compiler released.

1981 January

ROBOT Artificial Intelligence language for PET. 8K PET reduced to £200.
February
Voice Recognition peripheral on sale. Volume 2 No. 4 PET User Club Newsletter printed.
March
Colour PET with high density graphics. ACT publish complete business suite in ROM.
April
30Mbyte hard disk offered by Commodore. PRINTOUT circulation overtakes Practical Computing.
May
Petsoft publish 30Mbyte Startrek. Richard Pawson heads ICL Micro division.
June
Kit Spencer returns to UK to head High Street multiple.
July
Chuck Peddle joins IBM.
August
8K PET reduced to £100. Chuck Peddle rejoins Commodore.
September
IBM announce $1000 Micro.
October
Currys open 1000th micro-computer shop.
November
16bit 12Mb disk based time sharing PET with 256K RAM.
December
Nick Green receives promotion.

1982 January

Chuck Peddle joins the Foreign Legion.
February
Read/Write video disk storage. PRINTOUT circulation overtakes The Times.
March
Kit Spencer knighted.
April
Commodore sales exceed $250m; gross profit $50m.
May
Jack Tramiel retires.
June
Commodore taken over by Bank consortia.
July
ICL drop mainframes.
August
Commodore publish debugged handbook.
September
Jim Butterfield elected Pope.
October
AUTO PROGRAM 1. Super high level language released.
November
Robin Bradbeer finally gets CompuThink disk drive working.
December
GPO approve Commodore Modem.

1983 January

24bit micro-based PET mini mainframe.
February
Currys take over ICL.
March
Laser printer for PET.
April
Commodore sales exceed $400m.
May
Greg Yob completes PET Handbook.

ADVANCED PROGRAMMING:
A New Approach to Subroutines: Part 1

The subroutine is one of the simplest but most powerful concepts in programming; though they are now commonplace, subroutines first appeared relatively late in the development of computer languages. In essence, a subroutine is a self contained block of code which can be accessed from any position in the main program. Upon completion of the routine, control is returned to the place in the program from where the subroutine had been requested.

This 'Position Free' property has meant that standard subroutines (for example to evaluate a mathematical function) can be written – and later incorporated into any program needing that function. Furthermore, one can build up a whole business suite simply by concatenating several such routines, selected from a large and versatile list, and the addition of a few lines of bespoke programming to tie the system together. This approach is widespread among the software houses for large computer systems.

The PET, powerful as it is, was not designed for this type of programming; limitations exist in both hardware and software. However, the collective work of many experienced programmers has resulted in removal of many such restrictions – lending PET more credibility as a professional system. Re-numbering routines have been developed to circumvent the problem of relocating a BASIC routine (unlike the true subroutine-based languages such as FORTRAN, BASIC requires that each line has a uniquely defined reference number). Perhaps the most significant development to date is the Butterfield Merge, enabling subroutines on tape to be merged into RAM, without retyping. More recently, the Programmers Toolkit features an APPEND function which simplifies the process even further.

by Richard Pawson

Nevertheless, there still exists one major restriction which prevents PET being used for true subroutine-based development work. PET BASIC has no parameter passing. In FORTRAN each subroutine contains a list of the parameters or variables which need to be entered into it, and the ones which are output from it. Wherever the subroutine is called from the main program, there is another list (similar in structure) of the variables which the program wishes to pass to and from the subroutine. The variable names in the two lists need not be the same, and the compiler will arange for all the parameters to be 'passed' correctly. A simple example would be a subroutine to compute the cube root of variable x. If the program at some stage needed the cube root of variable y then 'y' is simply put in the parameter list on calling the subroutine; there is no need for the statement x=y. As this can be used to pass many parameters, including dimensioned variables, considerable time and program space is saved. Because the subroutines are 'Variable Free' as well as 'Position Free', they can be strung together in a most versatile manner.

The aim of this series of articles is to develop a parameter passing capability for PET without the need for hardware or language modification.

First, let us examine the present system by means of an example – the addition of two matrixes, i.e. matrix A=matrix B+matrix C (this is written A=B+C by mathematicians). Assuming that the dimensions of each are M×N, a subroutine to perform the matrix addition would be:

```
1000 REM MATRIX ADDITION SUBROUTINE
1010 FOR I=1 TO M
1020 FOR J=1 TO N
1030 A(I,J)=B(I,J)+C(I,J)
1040 NEXT J
1050 NEXT I
1060 RETURN
```

This is fine if we only wish to perform the addition on the variables A, B and C as indicated. If the matrix sum D=E+F is to be done in the program using the same subroutine, then before GOSUB 1000, each element of B must be made equal to the corresponding element of E, and similarly C with F. After returning from the subroutine the process must be repeated to convert A to D. The whole process will be so laborious, involving several FOR-NEXT loops, that it would be quicker not to use a subroutine, but to write some code for D=E+F directly.

Isn't there a more efficient way? Switch off your PET and enter the following program exactly as it is written:

```
10 REM DIMENSION & ENTER MATRIXES
20 DIM D(3,3),E(3,3),F(3,3)
30 FORI=1TO3:FORJ=1TO3
40 PRINT"ENTER VALUE OF E("I","J") ";
50 INPUT E(I,J)
60 NEXTJ:NEXTI
65 PRINT"■"
70 FORI=1TO3:FORJ=1TO3
80 PRINT"ENTER VALUE OF F("I","J") ";
90 INPUT F(I,J)
100 NEXTJ:NEXTI
110 PP=1
```

(Listing Continued)

```
200 REM PASS PARAMETERS
210 PP=PEEK(126)+256*PEEK(127)
220 POKEPP,65:POKEPP+89,66:POKEPP+178,67
230 GOSUB1000
240 POKEPP,68:POKEPP+89,69:POKEPP+178,70
300 REM OUTPUT MATRIX
305 PRINT"J"
310 FORI=1TO3:FORJ=1TO3
320 PRINTD(I,J),
330 NEXTJ
340 PRINT:NEXTI
350 END
1000 REM MATRIX ADDITION SUBROUTINE
1010 FORI=1TO3
1020 FORJ=1TO3
1030 A(I,J)=B(I,J)+C(I,J)
1040 NEXTJ
1050 NEXTI
1060 RETURN
```

On running, you will be asked to enter the elements of two 3×3 matrices, after which the program will return the matrix representing the sum. Turning to the listing, lines 210 and 220 perform the parameter passing which enables the subroutine to work on different variables; line 240 performs the reverse procedure. What these lines actually do is to change the name of a variable internally, so that the character D (ASCII 68) which is found in location PP is replaced by character A (ASCII 65). Similarly E becomes B and F – C. The subroutine is then called, and on completion the variable names converted back – the main program then being unaware of any change except the evaluation of D = E + F. It should be noted that this is not the way true parameter passing is achieved, but imitates the effect.

This example only worked because the positions of the three variable names were known: PP, PP + 89 and PP + 178. In the next article, PETs variable storage structure will be discussed in more detail and a general routine for finding and changing the name of a variable developed. Later on, parts of the system will be made more efficient with the use of machine code programming.

Notes:

1. For new ROM PET owners, line 210 should be:

   210 PP=PEEK(44)+256*PEEK(45)

2. 3×3 matrices have been used throughout the example for simplicity. Though these dimensions have been put in the program as constants, they could be variables and also passed into the subroutine.

TOKENS – By Nigel West

A funny thing happened to Gavin Sanders (PRINTOUT No. 2, Pets & Pieces) when he used a shifted character following a REM statement. When listed, the shifted character – a thick white line – turned into NEWNEWNEW. Interesting – concluded Gavin, before going on to generate other BASIC keywords in the same way.

The explanation has to do with Tokens. To save memory space BASIC stores keywords like NEW, POKE, RIGHT$ as a single 8-bit character. In the case of NEW the character has the decimal value of 162. In PET's BASIC there are a total of 75 such characters or tokens, listed here with their decimal values:

128 END	153 PRINT	178 =
129 FOR	154 CONT	179 <
130 NEXT	155 LIST	180 SGN
131 DATA	156 CLR	181 INT
132 INPUT	157 CMD	182 ABS
133 INPUT	158 SYS	183 USR
134 DIM	159 OPEN	184 FRE
135 READ	160 CLOSE	185 POS
136 LET	161 GET	186 SQR
137 GOTO	162 NEW	187 RND
138 RUN	163 TAB(	188 LOG
139 IF	164 TO	189 EXP
140 RESTORE	165 FN	190 COS
141 GOSUB	166 SPC(	191 SIN
142 RETURN	167 THEN	192 TAN
143 REM	168 NOT	193 ATN
144 STOP	169 STEP	194 PEEK
145 ON	170 +	195 LEN
146 WAIT	171 –	196 STR$
147 LOAD	172 *	197 VAL
148 SAVE	173 /	198 ASC
149 VERIFY	174	199 CHR$
150 DEF	175 AND	200 LEFT$
151 POKE	176 OR	201 RIGHT$
152 PRINT	177 >	202 MID$

As well as saving storage space, the use of tokens speeds up program run-time. To identify a token BASIC simply tests to see if the most significant Bit has been set.

Knowledge of token values is useful in many applications. RENUMBER and PEEK/POKE conversion to revised ROM sets are two possibilities. Readers are invited to submit a routine making use of Tokens. We will publish the most useful entries and there will be £20 worth of software for the winner.

PETAID
The DIY Business Package

Traditionally, there are three methods of obtaining a program for your business application. First, one can buy an off-the-shelf package from a computer dealer or software house. This has the advantage of low cost, due to mass marketing, but lacks flexibility – you may have to change your business systems to suit the program. Secondly, the businessman may write a program specifically to cater for his own needs. This way the program is a perfect fit, but long development times mean high costs and the coding may be inefficient. The third traditional method is to contract the requirement out to a professional software house. This guarantees that the program will be accurate and suit your needs, though typical costs are £15 per hour. The off-the-shelf approach is quite satisfactory for applications which vary little from company to company, such as Payroll. Many functions, however, are non-standard, particularly in the small business.

Cheaper alternative

If personal computing is to catch on in this area then there must be a cheaper alternative for writing software that is relevant to a particular business. Ideally, what is wanted is a program that will write a package to any user specification. Computer scientists have long-winded proofs that such a program cannot exist – and it is not hard to see why. What is possible is to identify the common elements of business applications and write a program that will handle these elements in a general way. PETAID is such a program, written specifically to operate on the PET.

The concept of PETAID was developed by Neil Hewitt of STAGE ONE COMPUTERS, who now market the program in various forms, starting at £46 for cassette operation. Hewitt, whose background was large computer systems and bureau consultancies, argued that most business applications are based around information retrieval – either directly as in cataloguing, or indirectly in things like stock control. Over a period of many months PETAID was specified to provide a general form of information retrieval which could be adapted for many purposes.

Information fields

PETAID handles a large number of records on tape or disk, where each record might contain details of a particular stockline, employee or customer account, etc. Records contain a key field such as the account number or stock number, and several information fields holding both alpha and numeric data. PETAID will search through all its records (typically up to 650 per diskette) and list all the records which conform to the user-specified search criteria. One could request the names of all stock items where the number in stock is less than the minimum stock level, or the details of all invoices issued between 8/9/

79 and 13/11/79 with value greater than £1,000, and so on.

In their advertisements, STAGE ONE claim that PETAID will reduce program development time from days to hours. We decided to put this to the test with an application dear to our hearts – subscription handling! The first stage was to read the documentation and become familiar with the operation of PETAID, which is comprised of several programs. The documentation is adequate, though we felt that it could have done with more of an introduction and explanation of the concept. Still, one hour later we were ready to proceed.

Half an hour

Next a grid of 40 columns by 25 lines was drawn to represent the screen and identify the positions of various data fields. In the top left corner we put the key field (subscription number). Below that was the name and three lines of address. Other fields positioned around the screen included the date of joining, and a special 'category field' to indicate an overseas subscription or PET dealer. This form was transferred to PET's screen by specifying the column, row and heading for each field. Time taken for specifying and entering the record structure was only half an hour.

After the program had created a blank random-access file on the 3040 disk, we were ready to enter the details of each subscriber. This is probably the most time-consuming exercise, but would be unavoidable on any program. We entered details of only half a dozen records to save time, with the end result that our application (albeit a rather simple one) was up and running in less than two hours after opening the envelope!

Search criteria

To test out the search and print facilities, we requested details of everyone who subscribed in December, followed by all dealers in London, and the system responded admirably. Using the special AND, OR and NOT functions it is possible to specify some quite complex search criteria. Numbers can be compared using <, =, > and whole strings or parts of strings tested. One criticism was that it was not possible to test if a string was greater or less than another; we could not, for example, ask for all subscribers with surnames between M and S. This was no great disadvantage to us, but could be important in another situation. Phoning Hewitt, we were told that: "The development of PETAID is still in progress – in a few months time we will have several more powerful versions selling at a higher cost. Meanwhile, the present specification is quite powerful enough to handle most business functions, and feedback from customers has confirmed this."

Certainly we were impressed with the versatility of PETAID, and the speed with which a program could be developed. It is not possible to indicate the true capabilities of a system like this in a short article. STAGE ONE will gladly provide more details to any interested users. Their address is: 6 Criterion Arcade, Old Christchurch Road, Bournemouth.

PEEKS and POKES

by Inside Trader

Gossip Rumours and other distortions

Commodore's dealer shakeout continues with uneven results. Latest to be refused a dealership is Tim Moore of Newbear Computer Store who probably knows more about personal computing than any other man in Britain . . . . . Fireworks at the Computer Retailers Association AGM. Paid-up members were virtually outnumbered by PCW staff in mufti, including 'Desperate' Dave Tebbutt, computing's Best Dressed Man. Even the normally placid Jeff Orr stormed out . . . . . Greatly enjoyed the latest issue of the Commodore's User Club Newsletter, 80% of which was written by the redoubtable Jim Butterfield. Unfortunately, Jim sends the same material to over 40 PET oriented publications . . . . . Before rushing out to buy an 11 megabyte hard disk, wouldn't it be worth investigating Courtest's 8 megabyte cartridge drive at half the price. Big brother offers 128 megabytes! . . . . . PET makes its television debut in an upcoming commercial for HB Computers. Has no one warned Colin Stanley about the hazards of appearing with children and animals? . . . . . No more winning smiles in Commodore advertisements for a while. Kit Spencer broke two front teeth playing squash. Now dealers are passing the hat round for a shiny new set of snappers . . . . . After dancing in Leicester Square for Computing magazine, and at North London Poly's micro disco, aging PET pundit, Robin Bradbeer, is nursing a double hernia . . . . . Proletarian PET types keep asking me whether Commodore's PR lady, the nubile Ilona von Uhl is really a baroness . . . . . At least three PET related companies made offers when the Byte shop went down recently . . . . . Amazing scenes at Practical Computing's annual party, when the host went completely unrecognised. No one had ever seen Peter Laurie in a suit before . . . . . Why was one of our leading PET dealers wearing a false beard at the Computer Retailers Association AGM? Wouldn't it be cheaper to pay the subscription like everybody else? . . . . . Commodore's PET Information Centre continues to entertain the trade. When a VIP visited the Euston Road office to inspect the wonder computer, there wasn't a single PET on the premises . . . . . In an unwonted bout of generosity Commodore flew my friend Jim Butterfield to Las Vegas, all expenses paid. According to Jim, roulette losses are tax deductible . . . . .

Hugely enjoyed Thames Television's Money Go Round programme in which they attempted to portray the household of the nineteen-nineties. The nerve centre of this futuristic dwelling was an old ROM Pet circa 1978, printing merrily away on a refurbished IBM golfball of distinctly sixties vintage . . . . . Spare a thought for Petsoft who have carelessly mislaid technical bod, Michael Woolfe, last seen heading for South West Africa. If anyone finds him, will they please return him to Birmingham . . . . . The Curse of the Commodore attends all who attempt to review Petaid. Our first evaluation copy was sat on by Richard Pawson's pet Alligator; No. 2 got wiped because our beloved editor can't bear reading instructions. The third diskette was delivered helpfully bent in half by the postman. Perhaps Richard should have been more generous with his Christmas box . . . . . Money Where Your Mouth is Dept: Petsoft use an ICL 1900 to process their accounts. Now I learn that Commodore have taken delivery of a spanking new Honeywell computer . . . . . Consumer Electronics Fair visitors witnessed an amazing altercation between Julian Allason and the management of one Las Vegas casino. The use of programmable calculators at the blackjack table is apparently considered unsporting. Allason made a rapid exit assisted by two men in dark glasses . . . . . Poor old Commodore; they can't use the name PET in Germany for copyright reasons, and now someone has helpfully pointed out that it means 'fart' in French . . . . .

GREMLINS

Several keen-eyed readers queried the photograph on page 13 of the last issue. We must apologise to Commodore for leaking one of their best-kept secrets – the new Australian PET, due to be launched on 1/4/80.

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PETS AND PIECES

by GAVIN SANDERS

Off with the old

Gracious, it was only in the last issue that I was talking about my 8K PET, and now here I am, up-graded to 32K, lovely green screen, big keyboard, memory running out of my ears, and an old ROM/new ROM conversion chart permanently to hand.

The change was virtually an overnight decision, and the wife hasn't really realised it yet. She did remark on the new green display ("oh, that's pretty . . . I've always wanted a dress in that shade") but I airily told her it was due to a special POKE instruction. "Heavens!" she said, and went back to the TV.

There isn't too much to say about the big PET that hasn't been said already, excepting one thing maybe. New users, watch out for the Shift Lock key. It holds down with a satisfying little click, and that's a great advantage, of course.

What isn't quite so good, if you're used to normal typewriter keyboards, is the fact that it doesn't pop up again when you press Shift later on. This means that you can be in Shift and not realise it; even power-down for the night and leave it locked in Shift.

The subsequent effect is disconcerting, if you forget. Nothing happens as it should (not surprisingly), and you *can* get to the stage of fretting about the works of your lovely new machine.

So, keep it in mind . . . if curious things seem to be happening, try a little press on the Shift Lock. Chances are you forgot it was down.

Psst! The word is . . .

I was talking to someone in the trade a few weeks ago about the Commodore floppy disk unit. I'd give the model number, but we seem to be in a sort of transitory phase at the moment – have you noticed? The 2040 fades gently from sight, as the 3040 comes over the horizon. No dramatic differences apparently (excepting 'cosmetic', to use CBM's Estee Lauder word), but I wonder.

My trade friend was saying that despite the recent famine of CBM dual floppies, their Slough warehouse was piled high with the things. So why weren't they on sale, I asked.

He said the word was that Commodore reckoned they'd saturated the hobby market, and that small businesses were the future Eldorado. Nothing terribly unusual in that as a theory, but then came the interesting bit. Hobbyists, said my friend, would put up with almost any operating problem, so long as they had a unit that worked for some of the time . . . business people were different.

That's why gentlemen with white coats were busy putting little secret mods in all the disk units, and until they'd finished there wouldn't be too many available for sale, despite the hundreds that CBM had in stock. The same goes for the user manual, he said. Hobbyists actually *enjoy* decoding opaque cypher-like instructions; businessmen don't. The whole thing will be reworked to make it understandable and readable.

And, do you know, the 3040s now on sale seem to have few if any problems, while the user manual that comes with them is really quite helpful. Surprise?

And ore . . .

Oliver Bulmer is a man with a problem right now. He has a cassette from Petsoft that simply won't load, no matter what.

Not that Oliver is without experience. Indeed, he's not only PET-orientated like the rest of usd, but is a very creative programmer in his own right. In fact, quite a few of the titles in the Petsoft catalogue are a product of his inventive mind.

Strangely enough, when Oliver got the cassette he didn't immediately make for his machine to try it out. Why not? Because as soon as he saw it, he had a shrewd suspicion it was going to give him problems. Apart from anything else, it was gold and in a frame.

It turns out the answer was simple enough, though I doubt that Mr Bulmer's surprise and pleasure were diluted by the straightforward reason. It so happened that the 50,000th cassette sold by Petsoft just recently contained one of Oliver's programs; 'Mailing List' to be precise. To celebrate the occasion, Petsoft decided to follow the music world's example, and present Oliver with a gold cassette.

Having chosen gold for the 50,000th, there are apparently furrowed brows up there at Petsoft's HQ. It's the knotty problem of something suitable to mark the 100,000th that's exercising their collective creativity.

All would have been different had they used some foresight and flicked a glance at the sales graph. Doubtless then the 50,000th would have been coated in some baser material. Iron oxide, say.

That way they could have worked gently up through chrome dioxide and the ferric chrome compounds, only reaching gold at about the 1,000,000 mark. Mr Bulmer wouldn't have minded (well, perhaps he would, but it's the greater good we have to think about, isn't it?).

As it is, with a gold cassette behind them at 50,000 sales, what *will* Petsoft do for the 100,000th? Better still, what *should* they do?

Suggestions (printable, of course) to me please at PRINTOUT, in the next couple of weeks. I'll run the best on this page, send them all to Petsoft, and the most original gets Petsoft programs of his or her choice, to a value of £25.

Find without looking

I can't leave this month's column without briefly mentioning the now widely-known Programmer's Toolkit. That's the plug-in chip for PET that adds quite a few new commands to those PET gives you anyway.

The commands, and what they do, have been so widely described I won't mention them all again, but it's worth underlining a special value that one of them has, and that's the FIND command.

With Toolkit installed, FIND zips through a program, listing on-screen every line that contains *any* specified item, whether it be a string, a bit of a string, a variable, or whatever.

Hold that in memory store for a moment, and think instead of one thing that stops some people upgrading to new ROMs, whether in their existing machine, or in a bigger one.

What is it? The anticipated hassle of changing all those carefully acquired old-ROM programs, with all their PEEK and POKE commands that won't work with new ROMs.

That's one place that FIND is invaluable. The rest is obvious. Simply load the program, enter FIND PEEK, and there are all the lines that need changing (which you can do then and there). Do the same with FIND POKE, and you have a program that your new-ROM PET will lovingly embrace.

Put like this it all sounds rather obvious, but it didn't occur to me until after I'd had Toolkit for some days. Once inspiration had struck though, I'd modified all my programs (nearly 200 of them) in a couple of evenings.

Oliver Bulmer receiving his Gold Cassette

"If you want what's best for your PET, choose Commodore software."

Kit Spencer
General Manager
of Commodore Systems
360 Euston Road
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The Commodore PET is Britain's best selling micro-computer, with over 10,000 already installed in a wide range of fields, including Education, Business, Science and Industry.

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ANALOGUE TO DIGITAL: A Review of the AIM161

In the early days of computing, Analogue computers (which solved equations by analogy with electrical circuits) had an equal footing with Digital computers. Whereas the former needed to be wired into the correct configuration for a particular problem, the latter could be programmed with a set of sequential commands which operated on numbers or digits as opposed to voltages. Digital computers were far more difficult to design, but were many times more accurate and versatile than their counterparts. With the standardisation of designs and decreasing costs of microelectronic components, the digital computer has engulfed the market, leaving the Analogue with just a few specialist applications.

Physical parameters

More and more devices are being made to function digitally and can be linked directly to a computer. Automatic control and measurement systems are widespread. Yet there remain two major difficulties which prevent more rapid progress. First, most physical parameters such as heat, light and force, do not exist in digital form in the real world. Secondly, devices which can read such a physical quantity directly into digital form are expensive; but most parameters can be converted to a voltage with a simple transducer. If, then, a computer is to measure some physical quantity, it would be useful to have a standard device which could convert continuous voltages into quantized digits. Such a unit is termed an Analogue to Digital converter (A to D). The name is a hangover from the early days of computing and a more correct one would be Continuous to Discrete.

Conversely, a Digital to Analogue converter is used on the output side of computer control to produce physical quantities from numerical representations.

The AIM161 is a 16-channel A to D converter designed specifically for microcomputers such as PET and Apple. This means that the programmer can read the voltage on any of 16 lines independently and process this information in the computer. The unit is imported by Kingston Computers and the main retail outlet is Stack Computers who market the AIM161 at £130 and PETSET1 at £166. The latter includes all the connecting boards and cables necessary for operation on the PET, and this is what we actually evaluated. Both are apparently available from stock.

Quality of construction

The configuration consists of PETMOD (2 componentless PCBs which extend PET's IEEE and User Ports with a separate output for AIM), the AIM161 A to D converter, a 16-way screw terminal board for connection to the measurement apparatus, and a power supply. On quality of construction, it is best said that what there is is well made, but with the bare PCBs (on stand-off pillars) spread over the worktop, it is evident that PETSET is designed for the experimenter's laboratory and not the showroom.!

To use the converter, the voltage source must be connected to one of the input channels and to common earth. The voltage must lie in the range 0 to +5.12 volts on all channels. Additional amplifiers, resistors or limiters are needed to handle other ranges; considerable care must be taken since there is no overload protection on the AIM.

Reading the voltages into the PET can be done from BASIC using PEEKs and POKEs. It is a pity that (being partly connected to the IEEE port) INPUT # is not the method chosen. The coding required, however, is very simple – the following program will print the voltages at each channel on the screen:

```
10 PRINT "     CH.NO.","VOLTS"
20 FOR N=Ø TO 15
30 POKE 59426,N:POKE 59426,255
40 PRINT N,PEEK(59471)*5.12/255
50 NEXT N
```

Accuracy and speed

The channel number is output on the IEEE bus with two POKEs and the voltage read from the User Port, with a PEEK. The input number is in the range 0-255 representing the voltage range 0-5.12v; this gives a discrimination of 1/50th of a volt – adequate for many purposes but not a 'precision' instrument. In terms of speed, the conversion is certainly fast enough to be read from BASIC without delays, though we did not attempt machine code. A full technical specification can be obtained from Stack.

To test the accuracy and stability of readings obtained we connected a simple potentiometer to one input. A 5.12v rail is available so that pots, strain gauges, thermisters and other non-voltage generating devices can be operated. The first noticeable effect was that all 15 unconnected channels floated around in value; a disconcerting effect which was cured by shorting the lines to ground. When the potentiometer was set at random, most voltage readings on the PET were stable. It was possible to adjust the pot. so that the reading fluctuated between two adjacent values, but this may have been due to mains interference.

Half way through our evaluation, however, erroneous values started to appear at irregular intervals on several channels. The cause was found to be the old enemy – static electricity – which was demonstrated and eliminated with the aid of a Zerostat pistol (not a method to be recommended!). We contacted the suppliers who said that this was not normally a problem and hence chalked up the effect to faulty equipment. Be warned though – if your environment is static-prone, surround the electronics with a proper metal case.

Joysticks

The ease with which a potentiometer could be connected prompted us with the idea of a joystick input. A standard component joystick was obtained and two perpendicular pots connected to two input lines. With a little bit of programming, some quite spectacular results were obtained. Menu selections, games and a useful 'drawing' program using our double density plot routine (PRINTOUT Issue 1) were devised. By the time we had rigged a third control for speed setting, we were getting quite carried away. . . .

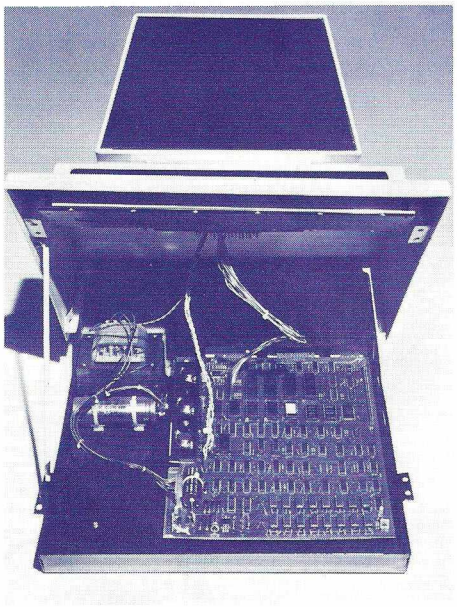
We have established, then, that the AIM161 is great fun for playing with if you are the electronics-experimenter type (irreverently referred to as "soldering iron and braces men" by software specialists), but at £166 you would think more than once about buying one without a specific application in mind. Leaflets accompanying the equipment (the standard of documentation is poor, but helpful advice can be obtained from the supplier) portray computerised homes with PET monitoring everything from the hot water tank to the moisture in the plant pots – all very likeable but not very likely. What then are the real applications of a 16-channel A to D converter?

The answer lies in industry – specifically in the Research and Development departments. Stack say they have sold PETSETs to a large number of big companies as well as Universities and research laboratories. Projects known to be in progress include monitoring industrial furnace temperatures, and controlling rates of fungus fermentation! "PETSET' is not designed for finished-product application, though with a proper casing it could be incorporated into a commercial system, but for development of control or measurement systems it is ideal." Using appropriate transducers it would be possible to measure tolerances on a machined part, record voltages from 16 points on a manufactured PCB or measure the strain in a steel structure.

In conclusion, for the development department PETSET represents an adaptable, experimental unit that is excellent value for money. For the hobbyist it represents an expensive but interesting extension to PET's interfaces. What the set lacks in documentation and cosmetic finery, it makes up for in ease of use and versatility.

HOW PET WORKS:

PART 2 – The Keyboard



The keyboard on a PET is one of the most simple yet heavily used of all input devices. Both the old and the new models have stood up to heavy punishment – both from users' fingers and the pundits' criticisms! Yet one seldom hears of a faulty PET keyboard – either 'hard' faults, for example sticking keys, or 'soft' faults such as double keying.

The hardware involved is extremely simple – consisting entirely of 'dumb' switches wired together with no additional electronics. Because the keyboard completely lacks 'Intelligence', all the key code interpretation and buffering must be done with software by PET's central processor. In contrast to the more conventional ASCII-producing intelligent keyboards, the PET approach is less efficient but considerably cheaper to implement.

To avoid the need for 73 different lines between the keyboard and main logic PCB in PET, the keys are hardwired into a matrix with 10 input lines and 8 output lines. Depressing a key shorts one of the input lines to an output line. Theoretically, another 7 keys could be added to make up the 80 distinct positions, but in practice it would be difficult to interpret these without some extra machine code in the operating system.

Turning to the software, PET's keyboard is interrupt driven rather than keystroke driven. 60 times every second, an interrupt is generated in hardware which directs the processor to a special service routine in ROM. As well as other functions, such as updating the jiffy clock, this routine scans the keyboard and manages the code conversions and buffering.

The first task is to find which key is depressed, if any, at that particular time. The keyboard is interfaced to PET's 6502 processor by means of a 6520 peripheral chip. The 6520 PIA (Peripheral Interface Adaptor) contains two 8-bit ports which may be addressed as memory positions. In addition, the individual lines of each port may be programmed as Inputs or Outputs, and two 'handshake' control lines are available for each. The keyboard, being an unsophisticated device, uses only part of one 6520, the rest of which is devoted to the cassette operation.

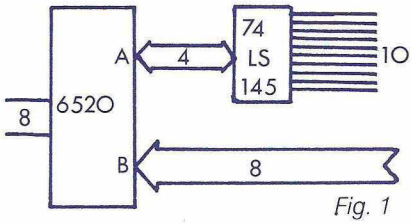


Fig. 1

Figure 1 shows the arrangements for addressing the keyboard, in schematic form. The numbers 0 to 10 are sent sequentially (in binary) to the PIA, which directs them onto bits 0-3 of its A port, which have already been set to output-mode. A standard decoder chip (74LS145) sends a pulse onto one of 10 output lines, according to the input binary code. For each line in turn, the processor reads the 8 return lines from the keyboard via the B port on the 6520, set to input mode. When a return pulse is detected, the values on the A port and B port are combined to give a unique code for the key pressed. This 8-bit code is stored in location 515 (151 New ROMs); if the shift key is detected, then location 516 (152 New ROMs) is set from 0 to 1 and 515 contains the code for any other key depressed. Try depressing several keys after running this one-line program demonstrating the process:

```
10 PRINT " ♥ " PEEK(515),PEEK(516):
   GOTO 10
```

You will notice that the keycodes obtained do not correspond to the ASCII or PEEK/POKE codes for the character pressed. For example A is 48, compared with 65 in ASCII and 1 for PEEK/POKE. Figure 2 shows a code evaluation matrix for the keyboard; simply add the row and column values for the key desired. Location 515 contains 255 if no keys are down.

To convert these codes to ASCII, PET uses a keyboard encoding table in ROM. Starting at location 59228 (59128 New ROMs) the ASCII codes for characters are listed *in numerical order of keyboard code,* thus:

Location	*Contents*	*Keycode*	*Character*
59228	61	1	=
59229	46	2	.
59230	255	3	No Key
59231	3	4	RUN STOP
59232	60	5	<

The ASCII code for a shifted character is simply 128 + the ASCII code for the unshifted character on the same key. The keycodes may thus be converted to ASCII with the following routine. Try it as before:

```
10 P=PEEK(515):A=PEEK(59227+P)+
   128*PEEK(516)
20 PRINT " ♥ " A:GOTO 10
```

If your program was not expecting a keystroke at the exact time of the interrupt which noted it (as frequently happens when using GET), then the key entry would be lost. Some sort of buffering is necessary. This is provided in a section of RAM from 527 to 536 (623 to 632 New ROMs) with byte 525 (158) providing a constant count of the number of characters waiting in the buffer.

Every interrupt, the routine checks to see if the contents of 515 have changed to a valid keycode different from the last entry. If so, the ASCII value is found and placed in location (527+PEEK(525)). The buffer pointer (525) is then incremented by one. Whenever BASIC reads a character from the buffer, the pointer is decremented by one.

Does all this esoteric information have any practical use? By monitoring 515 and converting the keycodes, it is possible to implement special functions, such as a repeat key. The more advanced machine code programmer can also make his system more efficient. For example, if you are waiting for a particular key to be pressed, there is no need to scan the whole keyboard when the PIA can be programmed directly by the user. If any readers have done something interesting with the keyboard we would be interested to hear from them.

	8	7	6	5	4	(3)	2	1
64	!	"	#	$	%	'	&	\	(	)	←
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Fig. 2.

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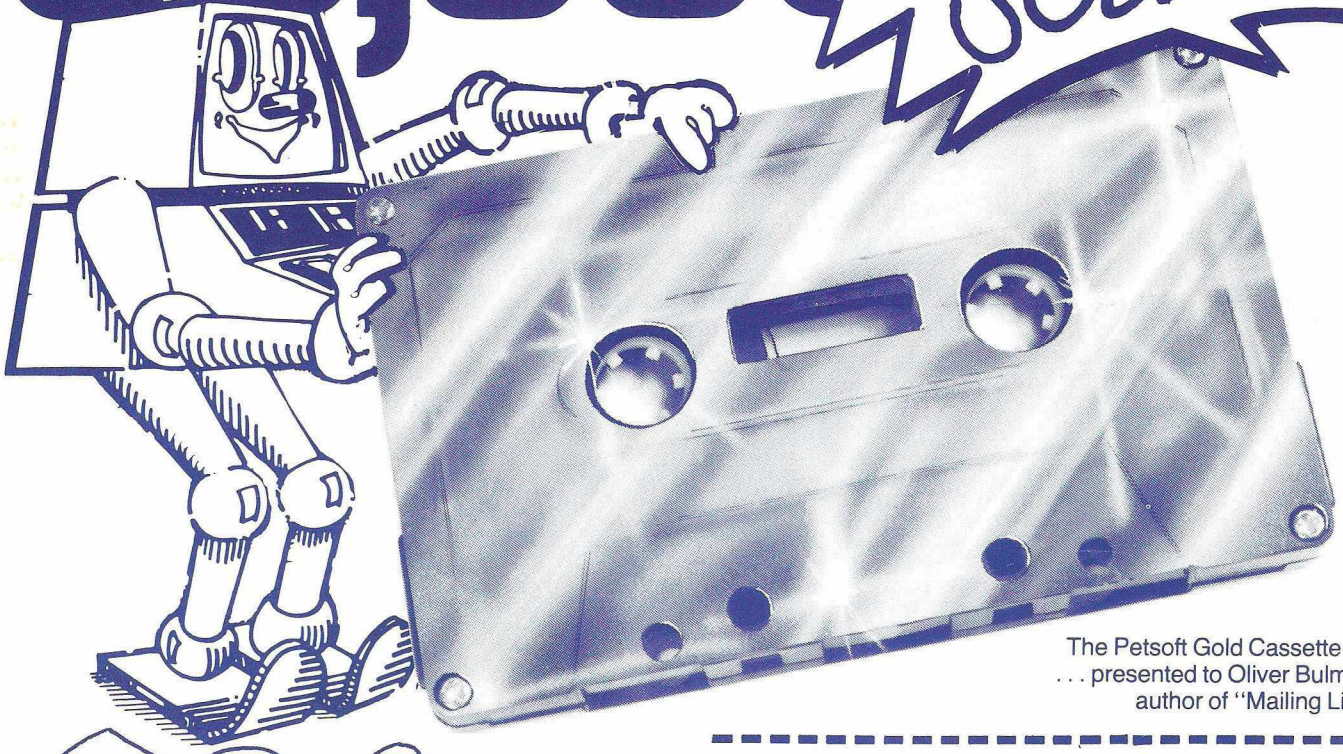

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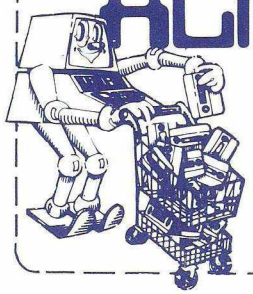

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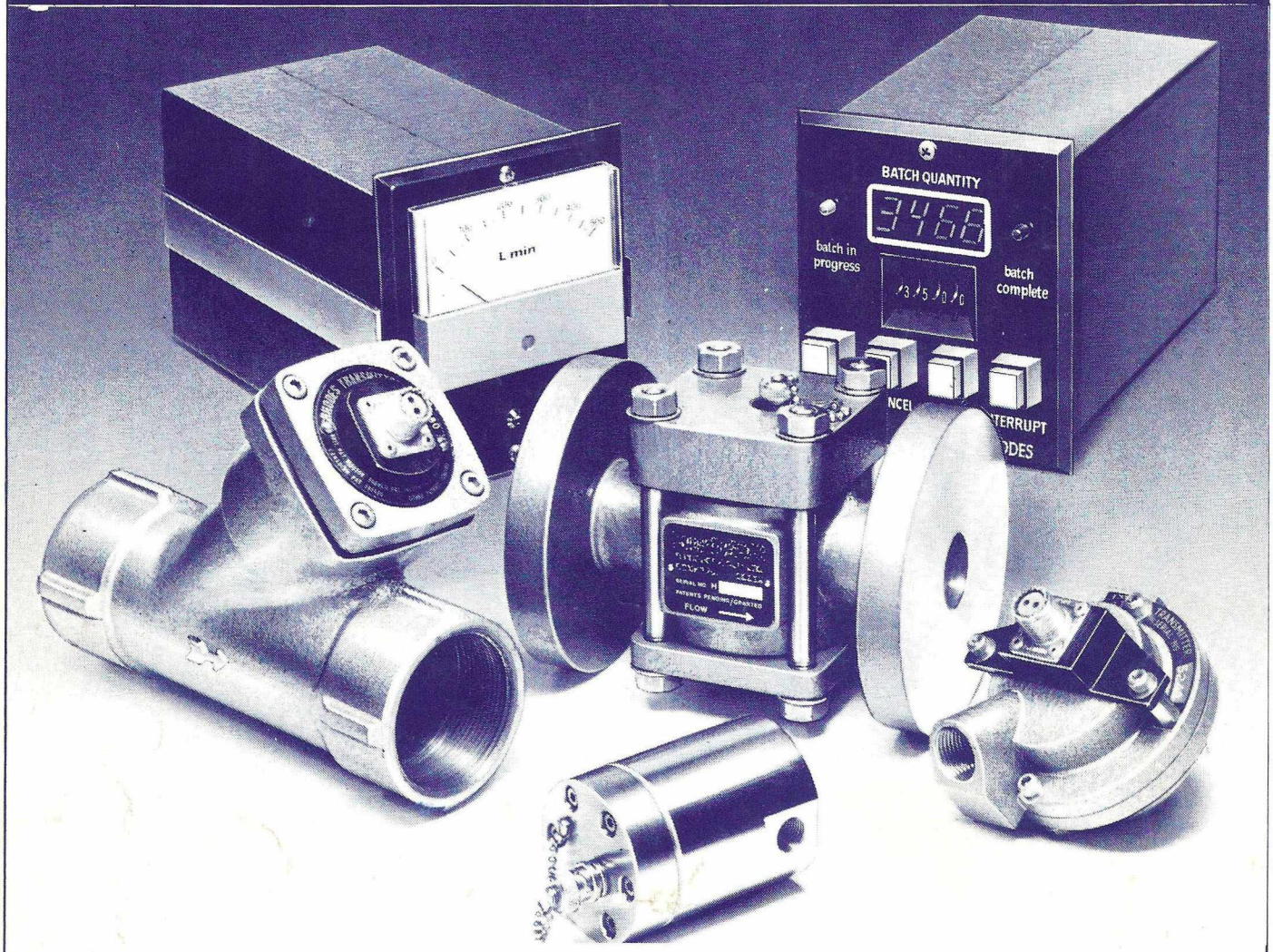

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