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Editor: Stuart Cooke
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 Origination: Elvora Typesetting
 Design: Angus Design Studio

Your Commodore incorporating Year 84 is a monthly magazine appearing on the first Friday of each month. Your Assign is published every second month within the pages of Your Commodore. Assign Newsletter Published from: Editorial & Advertisement Office, Your Commodore, No 1 Golden Square, London W1K 0AH. Telephone: 01-497 0626 Telex: 89 11 886.

Subscription rates upon application to Your Commodore Subscriptions Department, Instant Ltd, 5 River Park Estate, Northwood, Herts, HP8 1HL.



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DATA STATEMENTS


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Sport for All

Electronic Arts has recently released a whole host of sports games for the C64, so here's a quick run down of what's available.

Skate or Die is on C64 cassette (£9.95) and disk (£14.95). It's a skateboard simulation in which you have to compete in five different competitions. The contests are modelled on real championships and famous events like Ramp Freestyle, Downhill Race and Ramp Hill Jump.

Mini-Putt for the C64 cassette £9.95 and disk (£14.95) is a crazy golf game in which nothing is as it seems. A smooth green can suddenly come to life and gobble your golf ball!

Top Drive is a driving simulation which lets you experience the thrill of driving some of the world's top cars including a Ferrari Testarossa and a Lamborghini Countach. The simulation displays the interior of the

car and the road to give the feel of a real sea drive and the object of the game is to drive sections of the road within a given time limit.

Top Drive is available for the C64 at £9.95 cassette and £14.95 disk and is also out on the Amiga at £14.95.

Commodore has announced the release of an Amiga Sports Pack and Commodore 64 Sports Pack. Each pack contains an assortment of sports games, a full size carous bag and a "Win a day at Chelsea" competition.

Teleshop:
Electronic Arts, Loupley Business Centre, 11-19 Station Road, Loupley, or Slough, Berks, SL3 1YK. Tel: 0753 4642.

Commodore: Commodore House, The Switchback, Gardner Road, Maidenhead, Berks SL6 7EA. Tel: 0629 77898.

Television Tie-ins

There has been a sudden spurt of TV related titles in the last few weeks.

First, Music Publishing is launching *Top Prime Minister*, a game launched on one of the most popular comedy programs of recent years.

The player takes the part of Jim Hacker and must raise his standing in the polls during five days of turmoil and crises.

The game is available on C64 cassette at £14.95 and disk at £19.95.

TV games, Domark's new label, has announced the launch of three new titles for the C64. All based on popular television shows, the games are *Countdown*, *RedEye* and *Testamey First*, and all feature many of the familiar aspects of their counterparts on the box. All will cost £7.95.

Teleshop:

Healey Gately First, Smash Gately, Fundaybridge, Hertz 578 278. Tel: 0425 37663.

Domark: Domark House, 22 Mansfield Road, Westminster, London SW1W 7TA. Tel: 01 947 5622.



DATA STATEMENTS

Generally Speaking

The UK's first Technology Graduate Recruitment fair is to be held at the National Conference Centre, 4-6 January, 1988.

Chris Brown, of organisers Intra UK, said: "Some knowledge of the fair, we have been very pleased by the initial take up of stands." Companies committed to appearing include Barclays Bank, ICR, Dow Chemical, Thames Water Authority and Rank Xerox.

Exhibitors are hoping to attract graduates with technology and computing backgrounds at the specialist event.

Also relevant to those interested in computers, is the Data Protection Act 1984. The final elements of the Act came into force in November and will affect everyone in the UK.

For the first time, every man, woman and child has the legal right to see what is held on computer files about themselves and where appropriate to have the information corrected. It also gives individual the right to compensation under certain circumstances.

Lives can be seriously affected if inaccurate data is held about individuals. For instance, credit worthiness could be undermined or employment prospects blocked.

For further information about the Act and your rights under it, contact the Office of the Data Protection Registrar at the address in Touchline. Touchline:

John UK: Chris Paul House, Crays Pond Avenue, Ayles, Mid. Glos. Tel: 0494 551030

Office of the Data Protection Registrar: Springfield House, Water Lane, Wilmslow, Cheshire SK9 5AJ. Tel: 0625 53711

In the Arcade

Donark, always on the lookout for top licensing deals, has just released a C64 version of Star Wars. The game is a conversion from the original licensed Atari coin-op game and bears a close resemblance to it.

You select your own difficulty level and then you're placed in charge of an X-wing fighter and are ready to fight the forces of the evil Darth Vader. The C64 cassette version is £9.95, and the disk version is £19.95.

Amiga News

The Amiga 500 has been reduced in price by Commodore to £499.99 including VAT. The announcement came recently after weeks of speculation over the pricing of the Amiga 500, the smallest machine in the Amiga range.

Boxed with the computer, and included in the price, are Deluxe Paint from Electronic Arts and The Fey First tutorial pack.

Tom Hart, National Sales Manager, Commodore Products Division, said: "We believe that £499.99 inclusive of VAT offers a significant incentive to the consumer during the Christmas period and the months ahead. This is the only price change both are for the remainder of 1987 and for the foreseeable future."

Software is still being launched thick and fast for the Amiga range, a large percentage coming from US companies. Electronic Arts is no exception, having recently announced the arrival of four new Amiga products.

Three of these are musical. *Amiga! Music!* (£24.95) allows even a novice to compose and play impressive sounding pieces. The program uses a non-standard form of musical notation which, it is claimed by EA, is exceptionally easy to read and a remarkable user interface to make creating music as easy as possible. *Not well Amiga Music!* even let the user play out of tune or out of rhythm.

The two other musical products are library disks to accompany *Amiga Music!*. These are: *A's Only Amiga's W Roll and W Roll and Cool Arts*. Both sell retail at £9.99.

The fourth EA Amiga release is *Earl Weaver Baseball*, a sports simulation rewritten by two top

baseball managers: Earl Weaver and Eddie Dierbeckson.

The arcade mode of the game is a challenging sophisticated simulation which features high resolution graphics and realistic digital sound-effects. However, there is a major strategic element to the game, in that players can step into the manager's shoes to set line-ups, trade and draft players, sack pitchers and outwit a variety of opponents including Earl Weaver himself. Players also get the chance to design their own baseball park. The game is priced at £24.95.

Sentinel Software has announced a price reduction for the *Word Perfect Amiga* word processor. Formerly £25, the program will now sell at £19.95.

Sentinel is also continuing its trade in offer to *Scrabble* owners. Anyone currently using *Scrabble* can obtain a C64 refund off the cost of *Word Perfect Amiga*. Simply send your old master disks and manual with a copy of your invoice for *Word Perfect Amiga* to Sentinel Software at the address in Touchline and you will get a C64 refund.

Touchline:

Commodore Consumer Home: The Telegraph Co., Grosvenor Road, Manchester, Greater M13 9PL. Tel: 0625 778000

Electronic Arts Computer Business Centre: 11-16 Station Road, London. Newburgh, North M13 9PL. Tel: 0753 46442

Sentinel Software: Wellington House, New Zealand Avenue, Hulton-in-Thames, Surrey KT11 1P1. Tel: 0932 251164





Richard Hanson, Managing Director of Superior Software gets to grips with *Bombcrasher*.

Denmark is also planning future games based on the films *The Empire Strikes Back* and *The Return of the Jedi*.

Octapolis is a new arcade game from English Software. Set in the year 2887 the small planet of Octapolis is faced with the sight of the Impetrium. Luckily a secret weapon is available, enormous mental power. No enemy ship could approach and expect its crew to remain sane and sensible.

However the Impetrium secret service has been trying to find a space pilot who would penetrate the zone around the planet and find a way through, so that Octapolis could be wiped out. Now a hero has been found and it's you.

Game features include split screen two way perspective scrolling, 40 detailed play a min and sound effects to match. It costs £9.99 for C84 cassette and £12.99 for the disk.

Imagine has released *Frodo Hobbit*, an arcade action game for the C84-£8.95 cassette and £12.95 disk. The game originated from Spanish software house Dinamic.

Frodo Hobbit is a counter-espionage agent, skilled in martial arts and laser weaponry. However, Frodo habitually drinks too much and one night manages to crash his space ship on a enemy planet. The only way to run escape is to fly back on enemy space ship without being killed by human-like mutants, immune to laser fire.

Microsoft has released a new Tony Crowther game for the C84 on disk (£12.99) and tape (£9.99). The game is called *Zig Zag* and is set in the twelfth dimension. As a trainee space pilot, you must face the ultimate challenge, the Matrix of *Zog*. Chased to find the supreme space pilot, it has yet to fulfil

its purpose. Your aim is to find the eight crystals of *Zog* and escape to what lies beyond the Matrix.

As an incentive to would-be superpilot, Microsoft is offering a photo-illustration signed by Tony Crowther to the



first five players who finish and discover the code on the hi-score table.

Superior Software is also offering prizes to accomplished games players. *Bombcrasher* is Superior's new arcade adventure for the C84-£9.99 cassette and £12.95 disk and the Amiga (£14.95). Bono is a baby dragon who runs a bath house in the depths of the sea for monsters fed up of stagnant water. Unfortunately, the bath attract some undesirable who love to eat baby dragons most.

The competition can be won by anyone who finished the game. Each player who completes *Bombcrasher* successfully can claim a portable radio-complete with headphones, a Bono badge and a winner's certificate.

In the *of the World*, on the Rediker label, you (Chuck Harrison) and your C64 (an R79-46 fighter jet) find yourselves in *The Other World* and have to negotiate eight levels, seven bonus levels and hostile enemy ships in order to make the reverse rendezvous. The game is available on cassette and disk at £9.99 and £12.99.

Electronic Arts has launched *Demon Slayer*, a one or two player arcade game for the C84.

Demon Slayer contains 99 levels of amazing mazes, all with different goals, messages, monsters and magic. And level 100 contains *Clairat* the Demon, ready to battle with unarmoured intruders. On each level are many useful items but you have no way of knowing if they are good or evil as he prepared to take risks. The cassette version of the game is £9.95 and the disk version costs £14.95.

Touchline:
Denmark: Denmark House, 21 Marlfield Road, Wimbledon, London SW19 1JA. Tel: 01-667 5822

English Software, 1 North Parade, Forthampton Gardens, Manchester M3 2JM. Tel: 061 823 1588.

Imagine: 6 Central Street, Manchester M2 2NS. Tel: 061 824 3818

Mitrosoft: Altona House, 60/71 Silver Lane, London EC4P 4AB. Tel: 01 377 4673.

Superior Software: Regent House, Silver Lane, Leeds, LS7 1AB. Tel: 011 289413.

Rediker: 8 Danwell Road, Pinner, London SW17 2DM. Tel: 81-785 4281.

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Solid Gold

Go for gold in the latest in game compilations.

By Tony Hetherington

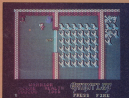
Compilations come and go and offer you a gaggle of goodies for the price of one game. They usually consist of one short tapper, two also rans and a few lions. So the usual advice from reviewers is to buy it if you haven't already got the good game. Now US Gold has changed all that with Solid Gold, a compilation of five

great games. Now the advice is simple - buy it!

Gameset leads the impressive line-up that also includes the combat flight simulator Ace of Aces, the original version of Lander Board, the best of the "event" sports games, Winter Games, and Inflitraz which is a slight simulation, command game and

arcade adventure all rolled into one.

Gameset took the crowded Christmas market one spot and is the successor of the classic coin-op machine that was so popular that a dot for 50 coins was specially fitted so no players could cheat in their money. The C64 version captured the excitement of the battles of a warrior,





wind, if not submerging it at times against ghosts, grunts, robbers, savvies and the aptly named deathies as they bravely delve deeper into the swamp.

A staggering 512 levels packed with monsters and monsters lay ahead as they search for treasure, keys to open doors, magic potions, amulets of invisibility and food to top up their health points. As monsters maul you and poisons drain you then the health points are lost. Run out of health points and you run out of game.

Castles is a fast and furious game that's played in a state of semi-controlled panic by players that once bitten, are hooked for hours and hours. Unbelievably, the pick of the coin-op conversions.

Age of Aces takes you to the skies as the pilot seat of a Mustang fighter bomber. The game begins in the briefing room where you can choose to bomb a POW train carrying prisoners to Berlin, attack submarines before they escape to the open sea, defend VI rockets from their deadly course to London or delight with a squadron of 10Fs. If you want to become the Ace of Aces you will have to attempt all but at once!

Once airborne you certainly have your work cut out as you have to plot your course to the target, control both engines, select between guns, rockets and bomb weapons and fight off attacking MiG 10Fs.

Leader Board was the first of a series of four golf games from Access, the people who brought you subtle games such as the upcoming Beach Head II and Road over Moscow. Despite the lack of shots and telling (the normal Access trademark) the Leader Board courses can be vicious particularly to novice golfers.



Unlike other golf simulations that postulate over clubselection and fine angles Leader Board is a LOAD and go game.

Hit and Hope tactics seem to work as well as any other which makes it a real games players game which probably explains why it shot straight into the number spot in the charts.

The courses are a bit limited and consist of islands set in a massive lake so if you manage to stay out of the drink you'll probably get a good score. If you enjoy Leader Board then it's probably worth investing in one of its three sequels. Leader Board Tournament added four new but equally wet courses, the Executive version dried out the course and added trees and bunkers and finally World Class Leader Board is the definitive version complete with a topdown map of each hole.

Winter Games was the third in the Epic's "Games" series that began with Summer Games 1 and 2 and has since continued with World Games and recently California Games. Winter Games, another chart topper, is still my favorite.

Overlaid events push joystick addicts to their limits as they go for gold in the ice and snow.

Superb graphics form the



backdrop for events such as the ski jump and bobsled as well as the curious Hot Dog Arch in which contenders must perform acrobatics while leaping off a ski slope! Skating comes in the three varieties of speed, figure and free but the most grueling event has got to be the bobsled. This is a cross country race against time in which you must also shoot targets to get a good score and a chance of a medal. After the bobsled, the 1500m will be easy.

Last but no means least **Infiltrator** casts you as Johnny "Beetle-Baby" McCarbren as you set off in your super helicopter to save the world once again. This time the Mad Leader is up to his old tricks again and you must stop him.

In the first of three missions you must fly your Whirlwind Enterprises Glens Attack helicopter through enemy airspace then land and infiltrate the enemies base. With only your usual toolkit of sleeping gas, fake papers and gas grenades you must search the base and photograph the Mad Leader's plans and then escape back to base. This mission leads you through a combat simulator to a commando style evade adventure and back again in one amazing game.

Each of these games is a classic in its right but together for only £5.99 they are pure solid gold.

Finality:

Title: Solid Gold. **Supplier:** US Gold, 127 Hollywood Way, Bedford, Buckinghamshire MK43 0JL. Tel: 029-334 1285. **Machine:** C64. **Price:** £5.99. **min/14/89 date.** **Originality:** 4/10. **Playability:** 10/10. **Graphics:** 8/10. **Value:** 10/10.

Byting into the 6510

This month we continue our typewriter program in machine code by adding an interrupt driven cursor and find out more about the machine stack.

By Burghard-Henry Lehman

Personally, I consider the most exciting thing about computers is their tremendous flexibility. Even though they are only machines, they are the most versatile kind ever invented. This opens the way for unlimited creativity, and at the end of the day, a computer is as good as what you make of it.

For example, you may be forgiven for thinking that since you bought yourself a Commodore 64 you are lumbered with a slow and pretty limited Basic for ever. But the moment you learn something about how flexible the machine really is, you'll find that this is only the tip of the iceberg. The deeper you get into the 654, the more you will discover that it has been designed in ways which literally beg you to make more out of it. In the end you could change your computer so completely that you could have a brand new computer every week! And this is not really as difficult as you might think. In fact, the designers of the 654 made sure of that in several ways.

In the following article we will discover a powerful way of changing your 654 considering the use of vectors.

Vectors

In the last article in this series I told you a little about the maskable interrupt which is called upon every 40th of a second and enables the computer to read the keyboard and print the flashing cursor. Now we want to use this knowledge and create our own cursor.

First of all, let's look at exactly what happens every 40th of a second.

Each time the interrupt is called the microprocessor is made to jump to the last location of the 654 which is hex FF4E or decimal 65535. Actually, it's not really jumping to this address, but using this uppermost location to find out where to jump to next. (You might like to know that all processors of the 6502 family, to which the 6510 belongs, are programmed to read the vector at 3F4F4E. But from there all machines take different routes).

So this is what a "vector" is all about. It is very similar to what we have already learned when dealing with indirect addressing—the contents of two locations point the microprocessor to the address of another location.

The vector at the top of the 654 tells the 6510 to jump to a routine at hex FF4E, decimal 65535. This is the start of the interrupt routine and begins with the 6510 saving the contents of all its registers and so afterwards, it can continue with whatever it was doing before. It is then made to jump via another vector.

This vector is located in RAM, at hex 8214 or decimal 782, and is the one which interests us most. Because it is located in RAM we can change it and thus make the 6510 jump to our routine, instead of the usual routine in ROM.

Driving a Wedge

Vectors are very useful because they provide flexibility in the design of a micro. When a computer first comes onto the market the operating system is seldom as fully developed as hoped. There are very often bugs present in the

people who program the operating system are just as fallible as the rest of us... It is also very likely that the designer comes up with ideas for improved facilities.

Without vectors these changes in the operating system would mean that the whole program would have to be re-written completely. It would also mean that some of the hardware of the computer might have to be re-designed and this would result in a lot of very unhappy people who have spent their hard-earned money on a brand new micro, only to find themselves with a very short time lamered with a machine which is hopelessly out of date. This problem can be solved by using vectors which are fixed locations, either in RAM or in ROM. All that has to be changed now is the contents of the vector location, which makes the microprocessor jump to the new or modified routine.

Vectors are also very useful to the hardware programmer. If a vector is in RAM, he can change it and make the microprocessor jump to his routine instead of the one in the operating system. This is called "driving a wedge", and is used by all the extended Basic programs available for the 654.

We will also use this method, for programming our own cursor.

Turning the Cursor On

The interrupt routine which I have run into a separate source file (located at 50000 — see listing 2) consists of three routines:

- ◆ the routine, which turns our cursor on.
- ◆ the routine, which turns it off.

the interrupt routine itself, which is called upon every 60th of a second via the vector at 8014.

"Turning the cursor on" could sound a little misleading, as we don't really turn anything on or off. All we do is change the vector at 8014. But for our purpose this means, that from then on our cursor is "turned on", in the sense that the computer will now jump to our routine instead of the one in Kernel-ROM which is located at 80A1.

Later on, when we "turn the cursor off", we will do the opposite, i.e. change the vector back to normal.

As you can see from lines 158 and 160 (and 158 and 168, respectively), I have introduced two new op-code mnemonics "SEI" and "CLI". You may remember that in the last article I said that we are dealing with a "maskable interrupt", that is an interrupt which can be turned on and off by software.

This is exactly what "SEI" and "CLI" do: "SEI", which stands for "Set Interrupt flag", disables the interrupt. "CLI", which stands for "Clear Interrupt flag", enables it. The interrupt flag is bit 0 of the flag register of the 6502. If this flag is clear (0), the microprocessor associates the interrupt every 60th of a second. If it is set (1), it doesn't.

It is very important to disable the interrupt while we make the 6510 change the vector. Remember, in the time which it takes you to read lines 160 to 168 in our program listing, the 6510 will have called the interrupt at least sixty times! So it could easily change part of the vector at 8014 and then jump to the interrupt, using the same vector which it has just partially changed. This would result of course in it jumping to somewhere quite non-sensical! And this, in all likelihood, will mean a complete crash!

So we have to prevent the 6510 from following the interrupt while it is changing the vector.

In lines 230 to 238 I zero the two variables ("CURSPFLAG" and "COUNT"), which will be used in the interrupt routine itself. More about this in a minute.

Flashing the Cursor

What does "flashing the cursor" mean? Just I am not thinking of the possible roughly connotations...

In short notation it means that there are two states in which a certain

position on the screen can be: in the normal C64 mode you either have the character at that position printed normally or in reverse. The flashing effect comes from the machine alternating between these two states.

What happens is very simple - some of the time the interrupt is called, it prints the character in normal, while the rest of the time it prints it in reverse.

If it alternated between these two every 60th of a second, it would happen so quickly that you wouldn't be able to see the reverse. All you would get at that position is a bad case of flicker.

Therefore we have to introduce a timing device to make it alternate about once a second. This is what the variable "COUNT" is all about, which I introduced in lines 240-248. Of course, by changing the value in "COUNT" you could easily change the timespan to suit your taste!

It starts off with "COUNT" = 0. And every time the interrupt is called, this is bumped up by one (line 260). Then it is loaded into the accumulator and compared with 20 (lines 268-270). If it doesn't equal 20, the program continues straight away to line 280 (JMP \$E7A8). If it does equal 20, the rest of the normal interrupt routine in the Kernel, which makes it read the keyboard as usual.

If it reaches 20, first, "COUNT" is reset to zero (lines 650-660), ready for the next go. Then it tests a variable which I have called "CURSPFLAG". This contains either 0 or 1.

If "CURSPFLAG" contains zero, the character "under the cursor" is reversed, by adding 128 to it (lines 740-800).

If "CURSPFLAG" contains one, the character is put back to normal by subtracting 128 (lines 840-900). (I hope that you are aware, that you can do this with all screen codes, simply by adding or subtracting 128 to it...)

This is all there is to our cursor routine, except that every time "CURSPFLAG" is zero, we clear or reset it. Don't think me too pedantic mentioning this little matter, because if you overlook it I can assure you the computer won't! And this will result in the cursor being off most of the time, which means you won't have a cursor!

Turning the Cursor Off

As I've said already, lines 110-168 turn our cursor off, by changing the vector at 8014 back to normal.

I mention this specifically, because, if you do your own interrupt routine you should always turn it off, when you don't need it any more!

The final reason for this is that your interrupt routine might slow other operations down, such as loading or saving to disk or tape, especially if your interrupt routine is longer than the one in ROM.

Secondly, it is easy to forget that your routine will indeed be executed every 60th of a second! Therefore, some of the variables which you use in the interrupt routine might be used by the operating system or by the program you are running in the meantime.

For example, if you use my "Speedy Assembler" routine (locate the table plug!), you should always turn off any interrupt routines you are experimenting with, before reassembling them. And above all, take care to reset all vectors as they were before "Speedy Assembler". Like many other programs of this kind, changes some of the vectors for its own purposes. If you want to be safe, exit from the assembler, run your program and then re-enter "Speedy Assembler" by typing "SAS 22023".

Introducing a Textfile

Having created our very own cursor (and I hope you will feel free to experiment with different versions) we now want to expand our (typewriter) routine in order to see our cursor working in all its aspects.

Figure 1

SEI=SEI Interrupt flag
 CLI=CLEAR Interrupt flag
 PIA=PortA contents of the Accumulator
 PIR=PortA contents of the Processor status register
 PLA=PortA contents of the Accumulator
 PLR=PortA contents of the Processor status register

The main program in Listing 1 is similar to my last one, apart from the fact that I've added quite a few facilities to it, which makes our program more like a wordprocessor.

First of all, I have introduced a textfile which is useful for saving the text we have written and also loading it

to the printer later on. A textfile is an area in memory 00 or one page starting from 0000 but you can change this to any location which suits you which stores the printable characters you have typed. In lines 144-170, "TEXTFILE" is initiated, and in line 790-799 the ASCII-character which results from the keypress is put into "TEXTFILE".

The accepted way to store characters with microprocessors is in ASCII and not in the Commodore screen codes. Printers, including the Commodore printers, know nothing about screen codes, and later on you might even want to send a textfile down the line to another computer. ASCII is the standard and Commodore screen codes aren't!

Having introduced a textfile we have all wanted to take other routines into account! In other words, we are now dealing with two "current positions"; one on the screen and one in the textfile! Both have to be updated in concert.

CRSR Left and Right

Since we have now got a cursor, we naturally need to move it! To this purpose I have built a cursor left and right facility into the program. And here I have been more clever than usual! Instead of writing two separate routines I have built both facilities neatly into the existing routine.

The idea is simple. If you move the cursor to the right, it is the same as if you enter letters - only without the letters, if you get my drift...

On the other hand, if you move the cursor to the left, it is like deleting characters - only without actually deleting anything.

Therefore, cursor right fits neatly into the normal writing routine, while cursor left goes into the deletion routine.

With the cursor routine, the only important thing is, that I don't want the cursor right ASCII-character, which is 26, to be printed on the screen, because this would give me "Z", as it happens. So whenever CRSR right is pressed, the program jumps straight to line 0580 where the print position (both on screen and in the textfile) is updated.

For cursor left I had to do some modifications to the deletion routine:

First of all, in lines 1340-1360 I used the X-register instead of the accumulator to test for the beginning of the screen. This is because I do not want to corrupt the contents of the

accumulator, which at this point contains the result of the last keypress.

Then I used the contents in the accumulator by pushing it onto the machine stack (line 1450). (Mind about this in a minute). This allows me to document the print position one to the left, as usual. It suits me that it moves the character to the right too, because in this way I get rid of the cursor!

Afterwards I pull the contents of the accumulator from the machine stack (line 1560) and give it another test. If it contains 20, that is in the deletion routine, if it contains 027, that is in cursor left, which means that no further action needs to be taken. It jumps straight to the exit in line 0380.

Pushing and Pulling

In the first article of this series I briefly mentioned the existence of the so-called machine stack.

The trouble with the machine stack is that, like so many others in computing, it is thought of as mysterious, and difficult. In reality it is nothing more than another area in the computer-RAM (starting at 0000 or decimal 256 - the next page after zero-page) which is used for storing data.

These data-bytes are simply piled on top of the other. It has the effect that the machine stack grows to the east. (Where should it grow, if you pile things on it). With heaps like this it would of course, not be a very good idea to retrieve items by pulling them from the bottom or the middle. If you do this with a pile of books, you might easily have a nasty accident. Nothing like this happens with the machine stack, but the data-byte you pull is meaningless to the computer.

So, you "push" things onto the top of the stack and you "pull" them back from the top again. The secret of the whole thing lies in the sequence in which you do all your pushing and pulling:

If you push A, B, and then C, and you want then to start pulling things again, the first thing you get is C, B, and finally A. The whole secret of using the machine stack lies in pulling first what you pushed last, and pulling last what you pushed first.

The 6502 actually has a special register - the "stack pointer", which you can program and therefore change the top of the stack, as it is perceived by the computer. But this is something for commission and kamikaze pilots. You also always have to bear in mind

the machine stack, and whether its proper functioning is vital to the proper functioning of the computer as a whole!

Because every time the 6502 jumps to a subroutine it pushes the return address onto the stack. If, at the end of that subroutine, it can't retrieve the proper address back from the stack, it is well and truly lumbered!

So, if you push something onto the stack, always be sure to pull it before you leave the subroutine you are in!

The advantage of using the stack to store things, is that it is convenient and cheap in memory. "PMA" and "PLA" together use only two bytes, and that's half the length you need if you store in a zero-page variable. The disadvantage arises if you are not quite certain whether you will have pulled before you exit.

For example, at the beginning of our deletion routine I could have pushed temporarily the contents of the accumulator onto the stack before I tested the screen position in lines 1340-1360. But this would result in the stack getting out of order every time the user presses the deletion key at the beginning of the screen. Because it would then jump straight to the exit in line 0380 and this would mean that there would be no equivalent pull from the stack! This would have created the type of classic machine code bug that usually takes days to find!

Unlike other microprocessors, the 6502 allows you to push only two registers onto the stack: the accumulator and the flag register. "PMA" stands for "Push the Accumulator onto the stack", while "PLA" stands for "Pull the Accumulator from the stack". To push and pull the flag register use "PHF" and "PLF" respectively.

And Finally

Everything else in Listing 1 is very much the same as it was last time, it would like to give a special mention to lines 430 and 1900 which turn our cursor on and off and thus activate and deactivate our interrupt routine in listing 2.

I'll leave you with a little something to try for yourself. What about adding a CRSR up and down routine to our program? Here comes the only hint I am willing to give you - you have to add 40 to the screen (and textfile) position for CRSR down and subtract 40 for CRSR up. 71

See *Things* on page 37.

80 Character Print Out

Improve the printing powers of your C64 to produce 80 characters per line with this handy program.

By Jens Meyer

This program enables the Commodore 64 to print 80 characters per line instead of the usual 40. It does this by using the graphics screen, and not the text screen. All inputs are directed to the graphics screen, where the letters are printed to half their normal width. Despite the fact that they are much thinner than normal letters, they are still clear and can be read easily.

The program is written entirely in machine code, but can be loaded normally and started using "RUN".

After loading you will be asked if you want the Epsom version - type 'N' for no and 'Y' for yes. If you select yes, a new version of the program starting at \$3000 will be saved to disk, enabling the user to program an Epsom with it later on, if you have the necessary equipment. The Epsom has several advantages to the normal version. It is much more compatible with other programs, as it is "Hidden Away" under the ROM and not stored in the basic memory.

However, most users will select "NO". This will start the program immediately and means that you can simply save it to disk or tape with no need to program an Epsom, as this

version creates the 80 column display.

The Epsom option merely exists for a very small minority of people.

When the program is started, the following restrictions and changes occur:

- As the program uses the Hi-Res mode, only one colour can be used at any one time.
- The screen memory map is twice as big as usual because there are twice as many characters, and goes from \$CFCF.
- It is possible to mix upper and lower case letters and graphics because the

graphics mode is being used, and letters which are already on the screen will not be changed, even if, for example (SHIFT)+V(COMMODORE) are pressed. The new character set is created by using bits 0,1,4 and 8 of the letters of the old character set.

Also, there is a routine in the memory which scrolls up everything on the graphics screen by 8 pixels (one line) to imitate the scrolling upwards in the text mode.

The characters are stored in both the screen memory map and the graphics bit map.

The following table shows the use of the memory by ROM 80:	
\$C400-\$C7FF	NEW CHARACTER SET
\$C800-\$CFCF	SCREEN MEMORY MAP
\$CFF0-\$CFFF	ROUTINE FOR SCROLLING GRAPHICS
\$DFFE	PRESENT FORE - AND BACK-GROUND COLOUR
\$E000-\$E7FF	(\$C000-\$E7FF IN RAM VERSION) COLOUR
\$E800-\$EFFE	(\$8000-\$EFFE IN RAM VERSION) GRAPHICS BIT MAP

But enough of all the technical details. If you want your Commodore 64 to have an 80 column display, just

use "ROM 80".

See listings on page 77.

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Controlling the 80 column video display

If you own a C128 and you're eager to learn more about the capabilities and limitations of VDC, then read

on

By Leigh Brown

It is useful to have a rudimentary knowledge of Machine Code as some of the operations that the 128 can perform are not possible in BASIC. Also, it is important to remember that a monitor is needed for 80 columns and some people may not be able to afford the expensive Commodore monitor. I would advise those people to use a standard monochrome monitor.

The VDC has been designed to cater for most of the programmers' needs. For example, it has its own cursor and draws 16K bytes of RAM. However, it has a few drawbacks, but you should get used to these after using the VDC for a while. The first of these is the addressing of the VDC. All the 32 registers are accessed to two locations, in the Input/Output area of the computer. These locations are \$D900 and \$D901 and act as a simple Input/Output port. For example, to store 15 in register 11 you store 11 in location \$D900 and then store 15 at \$D901. And to read from register 11 you store 11 in location \$D900 and then read the value from \$D901.

Figure 1

7	6	5	4	3	2	1	0
ALT	HVS	UND	FLA	RED	GRE	BLU	INT

Figure 2

\$D900: Read: --- << 8 bits register select >>
Write/Write: none Upon Blank: ---
\$D901: Both: << 8 bits for reading and writing data >>

Figure 3

Reading to and writing from registers: Using these routines, X is the register and Accumulator holds data.

write	STX \$D900	/*Write register	
wait1	BIT \$D900	/*is VDC busy?	ROM COPY
	BPL wait1	/*yes, then wait	AT \$D900
	STA \$D901		
	RTS		
read	STX \$D900	/*Write register	
wait 2	BIT \$D900	/*is VDC busy?	ROM COPY
	BPL wait2	/*yes, then wait	AT \$D901
	LDA \$D901		

Location \$D600 also has some other uses when read. Bit 7 returns the status of the VDC, in other words whether it is busy or not, as some operations take some time. Bit 6 is used for the light pen, which doesn't concern us. Bit 5 is the vertical flyback bit, so you can synchronize events to the monitor or alter the screen without flickering occurring.

The 14k RAM of VDC

As mentioned before the VDC 'owns' its very own RAM, but it can only be indirectly accessed via the registers. This means you can redefine the character set which is held in the VDC RAM, or store directly in screen. However, this cannot be done in BASIC, so we must resort to machine code. The registers we need are 18, 19, 20, and 21. They must be written to in this order:

Store the high byte of the address in register 18.

Store the low byte of the address in register 19.

Store the byte to be poked at address in register 20.

Store the number of characters in register 21.

However, the VDC stores the number of characters plus one. So in register 21 we have to store the number of characters minus one. Also, you may have noticed that you can't print one character. Oh well you can, all you need to do is not write the number of characters to register 21. The whole process is carried out with bit seven of register 24 cleared.

You can also copy RAM from place to place, using the same method (but thankfully it works properly!) The number of characters to be copied corresponds to the word count register (25). The method is basically the same as storing characters but you must set the copy bit in bit 7, register 24. The start address to be copied is stored in registers 18 and 19, and the destination address is stored in registers 32 and 33. The copying process begins when the word count register is written to.

The VDC Screen

The screen is extremely versatile - you can change the physical size of the

Figure 4

Reading and writing RAM. Writing one character:

```

.write
.read
    PHA           /tempory store
    TBA           /store
    LDX #18       /low
    JSR write     /byte
    DEX           /store
    TYA           /high
    JSR write     /byte
    LDX #31       /recall
    PLA           /and store
    JSR read      /data
    LDA #18       /store dummy
    JMP write     /and leave if stand alone
.write
.read
    STX $D600    /omit 'JMP write'
    BIT $D600
    BPL read1
    STA $D601
    RTS
  
```

Writing more than one character: Accumulator holds the character to be stored, location 250 holds number of characters minus 1, X and Y hold the low and high address of the location in VDC memory.

```

.write
.read
    PHA           /store
    TBA           /store
    LDX #19       /write low byte
    JSR write     /byte
    DEX           /store
    TYA           /write high byte
    JSR write     /byte
    LDX #31       /write character
    PLA           /to be stored
    JSR write     /store
    LDA 250       /write number of
    DEX           /characters-1
.write
.read
    STX $D600    /store
    BIT $D600
    BPL read1
    STA $D601
    RTS
  
```

Reading a byte from RAM.

```

.read
.read
    TBA           /store
    LDX #18       /low
    JSR write     /byte
    DEX           /store
    TYA           /high
    JSR write     /byte
    LDX #31       /recall
    JSR read      /and store
    RTS           /return, Acc. = value
.write
.read
    STX $D600
    BIT $D600
    BPL read1
    STA $D601
    RTS
.read
.read
    STX $D600
    BIT $D600
    BPL read2
    LDA $D601
    RTS
  
```

Continued on page 27

Questionnaire 1

Whether you wish to test your neighbour's IQ or find out how clever friends at your computer club are, this program will help you.

By David Warner

Questionnaire 1 enables you to compile your own multiple-choice quizzes and save them out to disk for use at a later date. You can use the program just for fun or even use it for educational purposes.

The program is presented here as two basic programs. Type them both in separately and save them out to disk. When you want to use the program simply LOAD and RUN the program "Q-BOARD". The second part of the program will then load and execute automatically.

What's the question?

Obviously before you use the program for the first time you will need to set up some questions.

When you select the 'create questions' option from the main menu you will be asked for the number of questions that you want to set. You will then be asked for each question in turn together with a number of possible answers. Once all of the information for each question is answered, you will be asked to indicate which is the correct answer.

If you find that your question is over one line in length, you must start the next line three spaces from the start of the second line. This is to ensure that the text will be correctly formatted when displayed on the screen.

For listings see page 75.

Save your work

When saving your questions out to disk, you may find it useful to include the number of questions within the filename. The reason for this is that you will need to tell the computer how many questions are to be loaded when you want to reuse any quizzes that you have set. As an example "HISTORY 20" would be a set of 20 history questions.

Time out

Provision is made within the program

to display a clock on the screen. To use this feature you should enter the time in the format P.12:05.00 the P being PM (A for AM) and the following numbers being the hours, minutes and seconds respectively.

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Should you purchase this month's software for sale disk you will find that there are three sets of example questions for this program on it.

QUESTION NO. 1
WHAT IS THE SMALLEST BIRD IN BRITAIN?

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- B. COAL TIT
- C. GOLDCREST
- D. WREN

ENTER A,B,C,D,? #

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601500000	3.80	4.20
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May I Interrupt?

How to make your C64 reveal its split personality.

By Norman Doyle

Interrupts can make your computer do things that it was never designed to do. For example, it is impossible to have capital letters, Commodore graphics and lower case letters on the screen at the same time. The usual fonts is capitals and graphics with no lower case or capitals, lower case and limited graphics.

To have everything on the screen at the same time, we have to change the scan cycle in mid-scan. This is known as a raster interrupt because it takes place during the time that the screen, or raster, is being scanned.

First of all, we have to tell the computer when we want the interrupt to occur on the screen. The scan time is divided into 256 parts but although a full scan takes 256 raster count units, the screen is only visible when the value lies between 31 and 251. By storing a value in \$10012, you can cause an interrupt to occur at any moment during the scan period. If this occurs while the visible portion of the screen is being scanned, it is called a split-screen interrupt.

First of all, we have to set up the interrupt conditions. Listing 1 may seem familiar because it's based on the routine that I showed you last month. The new part of the initialize routine sets the raster interrupt.

The accumulator is loaded with the value which represents the point at which I want to interrupt the screen. It is stored in location \$10012—the raster compare byte. Next, the computer has to be told to expect a raster interrupt. This is done by setting the first bit in location \$1001A.

You'll notice that there are two interrupt routines and that one modifies the interrupt vector (enable byte \$0014) to point to the other routine. So you establish two interrupt environments which are executed on alternate interrupt periods.

The basic routine causes the colours of the screen and border to change in mid-scan and the effect on the screen makes the top of the screen yellow and the bottom area black.

Apert bytes changing the interrupt vector, each routine has to reset the

Table 1

Command Type	Examples	No of cycles
Implied	CLC CLD CLI CLF DEX DEY INC INV NOP SEC SED SEI TAX TAY TBR TZA TZA TZA	2
	PHA PHP	3
	PLA PLP	4
	RTE RTS	6
Absolute	JSR	6
Relative	BCC BCS BEQ BMI BME BPL BVC BVS	2+

**Add an extra clock cycle when the program takes the branch and add another if the branch then crosses a page boundary.*

value of the interrupt compare byte to that of the other interrupt value. Then the computer is ready to execute the next screen interrupt by setting the lowest bit of location \$D815.

In case you're wondering why two interrupt routines are necessary, consider what would happen with only one. When the first interrupt occurs the screen colour changes and will not automatically change back to the original colour. The net effect, therefore, would be to maintain yellow as the screen colour no matter what the run time program was trying to do. The second interrupt changes the colour so that the colour bursting ceases.

The RASTER1 and RASTER2 values are arbitrary ones which I have selected for this demo. The first value must be less than 51 otherwise a black band would appear at the top of the screen - a good way to create a coloured band across the middle of the

screen. RASTER2 determines where the colour change occurs, therefore any value between 64 and 576 could work.

The second routine starts off with several NOP commands. Although these apparently do nothing, their effect is to delay the execution of the colour change so that it occurs at the end of a line. Without this delay, the interrupt would occur in the middle of the line causing glitches which may show up as flickering or create a 'step' on the smooth line of the screen split.

Such timing problems can be tackled in one of two ways. The NOP system lengthens the interrupt code and reduces the amount of time in which other things could be done. A better way of overcoming this problem is to place the colour change code further down the routine, after calculating the number of clock cycles which are needed for the delay. A list of these cycle times can be found in Table 1 and Table 2.

program should run as if nothing had changed.

```
LDA # ROUTINE1A255 ... 2 cycles
STA LD/VECTOR ... 4 cycles
LDA # ROUTINE1B258 ... 2 cycles
STA HL/VECTOR ... 4 cycles
LDA # RASTER1 ... 2 cycles
STA $D812 ... 4 cycles
Total=18 cycles
```

To get both sets of characters on the screen at the same time means introducing in a little simulation. This may seem like cheating but a little study of the ROM handling will reveal the reasons why the technical white lie is necessary.

The VIC chip can only access one 16K block of memory at a time. This not only applies to the screen but also to the character set. On power up the screen is situated at \$D400 but the character ROM list at \$D900 will over 16K away. To allow the VIC to 'see' the ROM, the operating system places an 'image' of the ROM at \$D400. This image is invisible to the user but essentially very real and necessary to the operating system of the computer.

All we do with the supplementary Listing 2 is to physically transfer the ROM characters to the lower section of memory where its image normally lies.

Having done this, the two routines have to be altered to switch between the 'original' characters and the lower case ones. This is done by altering location \$D818 which acts as a character pointer. How this works does not concern us yet, it will be the subject of a later section of this series.

Next, enter Listing 3 and then run it. You will see two capitals blocks but press any key and the bottom set changes to lower cases. Now we have both character sets displayed at the same time.

Move the cursor to the bottom line of the screen and continue pressing down the cursor until the first line of the bottom block lies on the screen split. Now you can see that my 'arbitrary' split value was not so arbitrary after all!

What you should see is that the top half of the letters are in capitals while the bottom half remains in lower case.

That's as far as I am going during this session but next time I'll be concerning myself with smooth scrolling and the tricks that all this can open up to the programmer. ☺

See listings on page 77.

Table 1

	Accumulator	Immediate	Absolute	Absolute,X	Absolute,Y	Absolute Indirect	Zero Page	Zero Page,X	Zero Page,Y	Indirect,X	Indirect,Y
ADC	5	4	4*	4*	.	.	3	4	.	.	2*
AND	5	4	4*	4*	.	.	3	4	.	.	2*
ASL	3	6	7	7	4*	.	6	.	.	.	5*
BIT	4	4	.	.	.	.	3	.	.	.	.
CMF	4	.	4*	4*	.	.	3	4	.	.	3*
CPX	4	4	.	.	.	.	3	.	.	.	.
CPY	4	4	.	.	.	.	3	.	.	.	.
DEC	4	6	7	7	.	.	5	6	.	.	.
EOR	5	4	4*	4*	.	.	3	4	.	.	3*
INC	4	6	7	7	.	.	5	6	.	.	.
JMP	3	3	.	.	.	.	3	.	.	.	.
LDA	4	4	4*	4*	.	.	3	4	.	.	3*
LDX	4	4	4*	4*	.	.	3	4	.	.	3*
LDY	3	4	4*	4*	.	.	3	4	.	.	.
LSR	3	4	7	7	.	.	5	6	.	.	.
ORA	5	4	4*	4*	.	.	3	4	.	.	3*
ROL	3	6	7	7	.	.	5	6	.	.	.
ROR	3	6	7	7	.	.	5	6	.	.	.
SEC	3	4	4*	4*	.	.	3	4	.	.	3*
STA	4	4	5	5	.	.	3	4	.	.	6
STX	4	4	.	.	.	.	3	.	.	.	.
STY	4	4	.	.	.	.	3	4	.	.	.

* Address cited cycle if addressing crosses a page boundary.

The timing is not too crucial because setting up a new scan line takes approximately 28 cycles. From our example, we can calculate that

nine NOP actions represent 18 cycles. This means we have to add between 18 and 46 cycles. If the following lines are moved to replace the NOPs, the

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BobstTerm Pro

A close look at what could be the ultimate C&D communications program.

By David Janda

BobstTerm Pro (BTP) was produced in the United States by Bobst Termint, a leading authority on Commodore communications. The package is being distributed in the UK by Precision Software who are best known for their Superbase and Superscript packages.

To refer to BTP as communications software would be a bit of an understatement. BTP is a complete telecommunications environment that incorporates almost every facility you could hope for. I say "almost" because the package was written for the American market, and as such there are a few facilities that we would not use here in the UK - the Point-to-Point file transfer protocol being one example. Having said that, the few inconsistencies that I noticed do not affect the overall performance of the package.

User Friendly

BTP is a complex package, yet easy to

use. This is because the author has opted to make BTP completely menu driven. Not the best user interface when compared to something like Amigas Kickstart, but it's very fast and effective in use. All the menus are well laid out and it was immediately apparent that a lot of thought went into the design of the menus. Presenting a screen full of detailed information such as the XMODEM transfer characteristics in a clear, easy to read format is not an easy task, but BTP succeeds in this respect.

The menus are in a hierarchical form with the main menu at the 'top' with sub-menus leading from it. Most of the commands are of the single key type with the letter corresponding to the action, e.g. pressing the Commodore key with L will toggle the video. There are 19 such commands which are called context commands, and pressing 'K' from the main menu will list them with their associated functions.

Features

There are three methods of entering terminal mode in BTP, by pressing 'T' from the main menu, from the auto menu after dialing a number, or from the auto menu in answer mode. Once in terminal mode you are presented with a blank screen with five status lines at the top, the first of which is used to display various context settings e.g.:

```
CR:BFXXXX:EL:LD:CF:ASC:
:XXXXXXXXXXXXXXXXXXXX
```

'BF' will show how many characters there are in the buffer (which starts off at 25,500 bytes). 'E' indicates whether video is enabled and so on. Options that are enabled have their corresponding letters displayed in reverse video, and all the context commands are accessed by pressing the Commodore key followed by a letter (Table 1).

The next line consists of 40 dashes or a double row of dashes depending on whether the modem is on or off hook, and the following two lines are used to display various messages when transferring files. If anything drastic happens, such as an aborted file transfer, a flashing message will be displayed on the next line.

Communication is carried out on the following twenty lines by forty characters with the option of entering text in a two-line window. This is very handy for those who like to play online adventure games or use real time chat facilities because the entered text will not be broken up by any incoming text.

One comkey command of particular interest is the word wrap feature. When enabled, text entered by the user will be formatted. Likewise, text being sent from the host system will also be formatted and this feature proved to be most useful when using BBS that are set up for 80 column output.

The terminal mode and the rest of BTP has a couple of cosmetic features. If you don't like the character set that is used then you can select another from a choice of seven more, and you have the ability to define your own. The colors used for text, error messages, screens and so forth can all be individually changed as well.

Buffering

Most packages have some sort of buffering facility which can be used to grab text that is being sent from the host system. With BTP the concept of buffering is taken much further. You have the option to SAVE/LOAD to/from disk or RAM, after the buffer with a complete array of editing commands that would put some word processing packages to shame, and much more. BTP does not limit the buffer to ASCII use only. Basic programs can be automatically converted to ASCII when loaded into memory and sequential listings can be converted into Basic programs. A host of other conversion formats are available, and BTP enables you to define your own!

A detailed optical bound user guide that's over 100 pages in length describes very clearly every aspect of the package. A section is devoted to each feature and the six page contents creates easy reference. The guide is

TABLE 1 — COMKEY COMMANDS

A — ASCII/BINARY
B — BUFFER
C — CAPS LOCK
D — DISPLAY TRANSFER
E — ECHO
F — SCREEN FORMATTING
H — HOOK TOGGLE
I — LINEFEED IN
O — LINEFEED OUT
K — FUNCTION KEY LIST AND EDIT
L — LINE/CHAR ENTRY MODE (TERM MODE)
N — NULL STRIP (TERM MODE)
P — PRINTER ONLINE (TERM MODE)
R — RESET TIMER
S — SET TIME/START-STOP TIMER
T — TIME/TIMER TOGGLE
X — XFER FILES (TERM MODE)
@ — DISPLAY CTRL CHARS
* — CLEAR SCREEN (TERM MODE)

sightly divided into three sections: the first part covers getting started (for the impatient), next follows a detailed description of the package and the remainder of the guide covers parameter setting.

Compatibility

Before I detail BTP's features it's worth noting what the package cannot do, and the features that probably will not be of use to UK users.

First, BTP only works with modems that are connected to the user port, or modems that are interfaced with an RS232 converter which in turn is connected to the user port. This rules out the UK Commodore modem (commonly referred to as the Computer modem). BTP contains a number of 'drivers' and is configured to work with the following modems:

Commodore 1650 Autodem;
Commodore 1680 Modem/200;
Commodore 1670 Modem/1200;
Winstray Modem;
Master Modem;
Mity-Mo Modem;

Hio 1 and 11 Modems;
Total Telecom Modem;
Hayes Smartmodem.

Most of the modems listed are not available here in the UK. This is not a problem though as BTP will work with any manual modem that's connected to an RS232 interface. However, unless you have one of the intelligent modems listed, or a Hayes-compatible modem such as the Pace Series Four you will not be able to make use of the automatic features of the package. Demons/Younger owners will not be able to auto-dial with BTP as these modems auto-dial by toggling the RTS line which is rather unconventional. Having said this it should be possible to make use of the auto-answer feature of these modems as long as pin eight on the RS232 connector is connected.

BTP allows pause or tone dialing. The tone dialing feature is created by feeding the audio output of the C16 pack into the modem, but this feature is redundant because the UK System X dial tones are different from those used in the States — enough said.

Two other points worth noting are the Pause file transfer protocol and repeat dialing. BTP provides a number of file transfer protocols from straight ASCII to XMODEM (which is widely used throughout the UK). The Pause protocol is quite common in the US but not so here. However, I understand that a number of European Commodore Bulletin Boards will soon be using Pause, and if you should dial direct to the States it will be doubt be of use!

On a more serious note, BTP allows for repeat dialing. That is, when a number is auto-dialed and the host at the other end of the line does not answer BTP will continuously try the number over and over again. Your Commodore would like to point out that it is currently illegal for modems to repeat dial more than four times in succession, and as there is no facility to limit the number of re-dials it had going this feature should be used with caution.

The Clever Stuff

The auto mode in BTP is used with one of the intelligent modems that is supported by BTP or a Hayes

compatible modem. From the auto mode menu you can enter a phone number and BTP will send the necessary command string to the modem to get it to dial the number. In answer mode the package will wait for an incoming call, answer the phone and display a welcome message which can be defined by the user. A new feature is the ability to set up a password, thus offering a degree of security.

No doubt there are many similar sets of commands that you use when logging onto a BBS or database. BTP allows the user to define a series of operations, called macros, that can be executed manually or automatically. Basically, a macro can consist of any BTP command, but at menu level, a context command or text that you would enter in terminal mode. The macro facility also has a degree of program control, so it's possible to detect whether certain characters have been sent by the host, and if so perform another set of commands.

The macro commands can be executed manually or automatically by writing a time when they should be executed. I had great fun defining a macro to dial Telecom Gold, enter my ID and password, check if there was any mail, speed it to disk if so and log off, or log off if there was none—all done when I was down the pub!

It's not as easy as it sounds though, and I wish BTP had more sophisticated macro commands. As it is, the present commands are rather limited.

As I have mentioned before, BTP is a sophisticated telecommunication package, yet it's easy to use. Even though the package is loaded with features, using it is simplicity itself, and if you use the phone book option which dials a set number each time it is executed things are even easier. For example, from the main menu, connecting to a BBS or database can be as little as three key presses away; this ease of use is by far BTP's strongest point. The menu system and excellent

manual enabled me to use the package straight away with no problems whatsoever which is ideal in a console environment. No console package can offer a set of pre-defined settings that will see you through all possibilities. BTP offers some, but it also allows the user to tailor just about every aspect to their own requirements and save them as default settings.

In simple terms, BobTans Pro is the best piece of terminal software I have used on the Commodore 64. Its powerful features match and surpass those found on many professional PC based console packages, and at £24.95 it represents excellent value for money. **BB**

Feedback:

Name: BobTans Pro, Supplier: Precision Software Limited, 6 Park Terrace, Haslemere Park, Surrey KT7 5JF. Tel: 01-330 7366. Machine: Commodore 64/128. Price: £24.95.

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Sprite Library

Continuing our Sprite Library series, this month we look at the ways of producing different types of vehicles.

By Mike Bevan

This month's addition to the Sprite Library will be helpful in the area of scrolling backdrops. The vehicles listed in the table require multi-colour mode and each definition needs two sprites per vehicle. Each vehicle is made up of four blocks of sprite data - the first pair being a side view and the second pair depicting a birds eye view. All the traffic faces right so if you need any of the vehicles facing left they will need to be manipulated by a suitable sprite editor.

Table (Vehicles - Multi-colour)

Hex	Decimal	Description
A8-A3	160-163	Bicycle
A4-A7	164-167	Tandem
A8-A9	168-170	Scooter
AC-AF	172-175	Motorcycle
B0-B3	176-179	35 CWT Van
B4-B7	180-183	Light van
B8-BB	184-187	Land Rover
BC-BF	188-191	Light pickup
C0-C3	192-195	Jeep
C4-C7	196-199	Generic car
C8-CB	200-203	Small hatchback
CC-CF	204-207	Saloon car
D0-D3	208-211	Sports car
D4-D7	212-215	Ferris
D8-DB	216-219	Racing car
DC-DF	220-223	Taxi cab

Getting it all in

Type in the basic loader as published and *only* *don't* run it as it will self-destruct. Before running the loader program you will need to reset the computer and type the following:



POKE\$A=POKE4464:POKE\$B204,
ICHW and press return. This will
trick the computer into believing that
the Basic row starts at 54000 instead of
88881. Load in the Basic loader and
run it if error free, the program will
automatically save itself as a block of
data. If you reload that data in the
future remember to add 1 after the
device number. The data is saved in the
following location: 32800-32776.

The sprites run from 160 to 223 in a
compartiment to avoid the area of 30000
traditionally set aside for redlined
character graphics and to avoid the
need of typing in lines after lines of data.

If only one or two sprites are
required then use this formula:
C:Sprite block No.-660 > *48 + 160
the data line number at which the
sprite blocks data starts. Remember to
type in the following three lines of data
and alter the variable #L to the
number of data lines you have in your
finished program, line 1.

The small basic program Vehicle
Display will print the sprites variously
in expanded form on the screen in both
side and top views simultaneously. To
hold on any sprite enter the same
number for Start and End.

Any Sprite Editor program will
enable you to change and adapt the
individual sprites to your own
requirements.

See Listings on page 77.

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Bothersome Basic

The old trainee garbage in, garbage out is still relevant today, especially when using the INPUT command.

By Norman Doyle

One of the most common reasons why a program crashes is through unexpected responses when the user has to input some data through the keyboard. Tapping these unorthodox entries not only calls for an alert programming mind but also for a rethinking of the whole situation.

The problem with the Basic INPUT command is that it acts according to its own rules. This is fine if the users understand what these conditions are but not very forgiving if they don't. If the input is stored as a string variable the problems are easily rectified but using a numerical variable causes real problems.

Using inputs which take up less than two screen lines will rarely cause problems as long as the string does not include a comma or a colon. Either of these symbols act as a terminator and only that part of the entry before the first occurrence of one of these symbols will be accepted as input, the rest is ignored. The computer responds to an incomplete acceptance of the attempted input with a rather unkindly EXTRA IGNORED message.

A simple program such as:

```
10 INPUT "ENTER MESSAGE"; A$
20 PA$
```

would respond to an input such as

```
1 MASTER OLIVER TWIST, WANT MORE
in the following way:
EXTRA IGNORED
!
```

If the user made a mistake and went bonkers with the delete key so as to totally erase the ENTER MESSAGE prompt, further chaos would result with the following response:

```
EXTRA IGNORED
RTWIST
```

The part typed over shows the original prompt was up to the cursor's old starting position has been ignored, as well as the extra piece after the cursor.

The number of characters typed as an input can also cause problems. If the input continues beyond two screen lines and onto a third, only the characters on the third line will be accepted and no error message will appear.

The only way around this is to get confirmation of each entry with a check routine such as:

```
10 INPUT "ENTER MESSAGE"; A$
20 "PLEASE CONFIRM THAT YOUR MESSAGE WAS:"
30 PA$?
```

```
30 "PRESS Y OR N"
40 GET B$;IF B$="Y" GOTO 40
50 GET B$;"N" GOTO 10
60 GOTO 40
90 REM REST OF PROGRAM
```

Of course this only confirms or denies that the entry was correct. A total novice might keep trying to type in the same message until boredom and frustration sets in. The only foolproof way out is to give specific details of what can and can't be done when an error is confirmed. Quite a painful and dull way to write an interactive program.

As if this wasn't bad enough, numerical variables can be weird! At least the integer string inputs don't result in the termination of the program. With an interactive math program it's always tempting to enter very large numbers. Try entering a six number into this program:

```
10 INPUT "ENTER A NUMBER"; A
20 PA
```

As the number increases it is eventually treated as an exponential value such as 1.234E+36. If the exceeds the maximum number that the computer can deal with (1.70140884E+38), an OVERFLOW IN LINE 10 error will be generated and the program will crash out and return to

the READY prompt and direct keyboard control. Not very impressive in a complex accounts program.

This can only be avoided if the number is entered as a string such as AS and then evaluated and stored as a numerical variable, A, after complex processing. There must be a better way!

The best way, though long winded, is to use the GET command and build a string character. In this way you decide which characters may be entered.

First of all a suitable prompt message and a GET loop must be set up:

```
10 "ENTER MESSAGE":
20 GET AS:IF AS="" THEN 30
```

Now we need to print the character on the screen as each is typed in and to store them as a separate array, BS:

```
30 BS=""
100 FOR BS=BS+AS:GOTO 20
```

The difficult part is deciding which characters will be accepted and which will be rejected. First we'll assume that the message is going to be a mixture of numbers and letters (alphabetic characters).

Every letter and number has a value assigned to it under a system known as ASCII (the American Standard Code for Information Interchange). CHRS has its own version of this which is officially called Commodore ASCII (pronounced 'asky') but has commonly become known as PETASCII after Commodore's old range of computers which first used this system.

Under this system the numbers are to nine have values from 48 to 57 and 'A' to 'Z' have values ranging from 65 to 90. The numbers 58 to 64 cover such things as the question mark, comma and colon, so to make things simple, we may as well include those in acceptable range. Thus we get a range of 48 to 90.

This range does not include some other useful punctuation marks such as the comma, full stop or exclamation mark, nor does it include the value of 32 which represents a space. Fortunately these can all be incorporated by attaching the lower limit down to 32.

At this point we can use the greater than and less than facilities as follows:

```
30 IF AS < CHR$(32) AND AS > "Z" THEN 30
```

This means that each character is checked to see if its ASCII value lies between 32 and 90, if not it is rejected and the program loops back to get another keypress.

With the program as it stands BS can be extended to hold 255 characters and no more. We need a delimiter which will stop any user from trying to type in more than that number:

```
90 IF LEN(BS) > 255 THEN
100 "MESSAGE TOO LONG.
PLEASE TRY AGAIN":GOTO 5
```

There are kinder ways to do this but that will be covered in a later article.

The routine so far will work as long as the user types in the message correctly. What if a mistake is made?

First we must check for a DEL keypress. To jump to the routine for deleting the last letter from BS and from the screen. Even the DEL key has a value assigned to it and this is 26.

If you enter CHR\$(26), a 'Z' will be printed on the screen, similarly CHR\$(20) will cause a deletion of a character. So we can easily complete one of the demands of constructing a routine by using the CHR\$(26) command:

```
30 IF AS < CHR$(26) THEN 30
30 CHR$(26)
```

Obviously this deals with the screen but what about BS? It has to be dealt with using the string manipulation commands. What we need is to keep the left-hand side of BS and disregard the last letter. Putting it another way we reduce the length, LEN(BS), by one, LEN(BS)=LEN(BS)-1 is an illegal command but

```
60 BS=LEFT$(BS,LEN(BS)-1):GOTO 30
```

will do the trick until LEN(BS)=0. A string cannot have a negative length and an error message would be generated if nothing were done. To trap this problem the following line will act as a filter:

```
40 IF LEN(BS)=0 THEN 20
```

The final stage of the line input routine is to check for a carriage return, ASCII 13, and exit to the rest of the program:

```
30 IF AS=CHR$(13):GOTO 130
110 CHR$(LEN(BS))
```

Although this is better than the normal INPUT command, it's not perfectly foolproof and it does take up a lot more space than the normal input procedures. This can be compensated for by parameter swapping. As you can see from the slightly modified Listing 1, the routine is set up as a sub-routine. If the main program avoids using the parameters mentioned (AS,BS) you can GOSUB to this routine. On RETURNING BS can be simply returned with a command such as RETURN BS and the routine can then be called again for the next input later on.

For numbers the acceptable range needs only to be ASCII 48 to 57 with special allowances if decimal points, currency symbols or arithmetical operators are expected.

Evaluation of BS would be a nuisance in a numerical variable after first showing the string to a manageable length for the computer to deal with. This is rather like deciding how many significant figures, and hence the degree of accuracy, of a calculation. In this way numbers in excess of 1.9141884E+38 can be rejected before the program tries to use them and subsequently crashes out.

The Deep End

For the more accomplished, the INPUT command can be forced to accept colons and commas by skilled wickerers. Before using the INPUT command, quotation marks are placed in the keyboard buffer as though they had been typed there.

To do this ASCII 34 is poked into the first buffer byte at 161 and the buffer space at 198 is informed that there's one character already waiting there. When the INPUT command is executed, the quotation mark is printed alongside the input question mark.

```
10 POKE 161,34:POKE 198,1
20 INPUT "ENTER MESSAGE":AS
30 TAB
```

I hope that I cannot answer your problems by phone but if you have any queries about Basic routines or about these articles, please send them to: Redstone Base, Your Commodore, 1 Gadsden Square, LONDON W9W 1AB (including an SAE and any relevant program) or recordings. ☐

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Ackroyd's Saga

Let your computer take the strain of learning tables.

By Allen & Margaret Webb

In case any regular readers of my Teacher's Pet column haven't worked it out for themselves, I've got a pretty shocking confession to make. I am very old fashioned, both in the way I bring up my children and in their education. I believe in old fashioned values of politeness, honesty and respect for one's elders and those old hat school subjects of spelling and learning tables. Both of these have been out of favour; the former because it was believed that it stifled creativity, the latter in some cases simply because the diversity of the curriculum pushed these subjects to the bottom of the pile. Luckily the primary school that both of my children attended believed that learning tables was important and table tests were a regular occurrence.

A look around the shops will confirm the need for mental arithmetic and multiplication tables. How many

times have you watched as simple calculations have been worked out on scraps of paper or the ubiquitous calculator when they could have been computed just as quickly in the brain?

Improving Numeric Skills

Ackroyd's Saga is the first of two games aimed at helping the learning process of mental arithmetic skills. In the game, the 8 to 12 times tables are tested. The eight times table is included since it is a difficult concept to grasp. In the game, you play the role of a trainee knight searching for the parts of the key which will let you into Ackroyd's castle. (Ackroyd is the usual evil king.) On your way to the castle you will encounter various monsters. You must fight these if you

want to get passed them, and 'fighting' involves answering tables questions. You answer an odd number of questions. If you get more correct than wrong, you win.

There are five levels in the game with each level posing questions on different tables. The easiest level deals with 8 to 9 times tables, the most difficult deals with 10 to 12. In addition, the levels give you different times to respond. The default values give ten seconds at the easiest level and six seconds at the top level. You can change the times and number of casts if you wish by choosing the edit option in the game loader.

The game is controlled by a joystick (in port 2) or keyboard (C moves south, E east, N North, W West). To answer questions you simply type in the answer and press Return. Delete will clear any mistakes.

LOADER	SAVE name	Start Address	Finish address
1	SPRITES	12583	14784
2	CHARSET	18240	11287
3	HOUSE-GLASS	8182	8920
4	OBJECT.1	8144	7573

The game comprises six modules. To convert the loaders to usable code, use the following procedure:

Type in POKE 44,64 POKE 64,256:NEW

LOAD and RUN the loader LOAD and RUN the Code Saver routine using the details given in the table. You don't have to use the suggested names but if you don't, you must amend the BASIC portion accordingly.

Once you have completed this procedure for each loader, you can test them by LOADING them all (don't forget the secondary address... LOAD "name".8,1 or LOAD "name",1,1). And type in the line: SYS 6044:SYS8123

You should get the display and be set a question to answer. If this happens, all is well.

The BASIC program controls the whole program. You should note that the first portion assumes that you are loading from disk. Cassat to users must change the device number.

The game play is quite simple. The knight walks in the direction you specify. If you use keyboard control, auto repeat allows you to hold the keys down. When you reach the edge of the window, the next part of the map is

on. If you enter a square with a part of the key, it is automatickly yours. If all all four keys and reach the castle door and the game ends.

Now we will complete the loaders and show you how to run the game. The last two loaders are converted to code as before but with a slight difference:

Type in POKE 26,128 CLR LOAD and RUN the loader LOAD and RUN the Code Saver routine using the details given in the table.

To play the game, reset the computer by turning it off and on or by using SYS 8478. You then just LOAD and RUN in the BASIC portion.

Next time we will give a map of the

LOADER	SAVE name	Start Address	Finish address
3	OBJECT.1	12768	36176
6	MAP	36884	40343

displayed. If you enter a square with a star, you must fight. If you win, the starly vanishes. If you loose, you are dumped on the last square you were

game and an editor will allow you to change the location of the key parts and the monster.

See things on page 77.

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Games Reviews

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consult our review pages.*

Quaz-dex



Inspired by Grindin's *Blonder*, *Quaz-dex* is an arcade game in which you must hunk below you leap if you're going to get to the top of the high score table.

Quaz-dex consists of ten tracks of planes that can be strung in any order but only the very brave or stupid dive straight into plane fire.

In plane one you simply have to complete a series of exercises that will prepare you for what's to come. In the other planes you must reach the GOAL before the time runs out. To get to the goal you will have to negotiate a maze, travel long lifts and through teleports, avoid ground that drains your time and areas that just disappoint leaving you on the way to oblivion. You will have to get around locked doors that are opened only by finding specific keys. To add to your problems some keys remain invisible until you're next to them, and are usually next to a killer Skull and Cross bones, where one wrong move will cost you that game.

However, you can get some help from objects you can pick up such as anchors that reveal the GOAL, and objects that give you extra speed or more time and several surprise buttons that may help or hinder you.

At the end of each plane you have a chance to pick up some extra points in a bonus screen and a chance to test before attempting the next plane. This game would be tough enough without the time limit, with it, it's almost impossible. T.H.

Publisher:

Title: *Quaz-dex*; *Developer:* Thomas J. Minter; *Music:* Calvin Park; *Adaptation:* Revision 817 AGS; *Machine:* C64; *Price:* \$9.99 (C) 1988 (Rev.)

Originality: 7/10; *Graphics:* 7/10; *Playability:* 4.5/10; *Value:* 8/10.

Starfox



In the unofficial sequel to *Starfox* you are Banders and your mission is to destroy the aliens that have invaded the protective Rubicon cube that surrounds eight planets.

The standard *Starfox* is equipped with a turbodrive that will send you hurtling through space but will also drain fuel at an alarming rate and a standard laser. However, you can improve your chances and your fuel by dodging with motherlode that orbit the eight planets and choosing from the selection of weapons that include energy bolts, shockers and more powerful lasers.

You'll need this extra weaponry to wipe out the invading swarms of aliens that come at you ten at a time. If you haven't got the right weapons you may have to shoot each alien four times to destroy it.

The aliens don't actually fire at you but they do exhaust your fuel supply, which will cost you the game. You can refuel at a planet or from a refueling ship but only if you can find one in time.

Starfox is a game that will require its players to invest some time in it before they become hooked. Once they've completed a few levels (this will take some time) they will become hooked by it.

Touchline:

Title: *Starfox*. **Supplier:** *Acclaim*, 9 Newark Rd, Pinner, London W5 3DA. **Tel:** 89-783 4383. **Machine:** *Com. Price:* £9.99 (ret) £12.99 (dist). **Originality:** 3/10. **Playability:** 5/10. **Graphics:** 5/10. **Value:** 6/10.

Indiana Jones and the Temple of Doom

Indiana Jones is set to burst onto the small screen in the CD-ROM conversion of the Atari out-of-print version of the film.

Armed with just his trusty whip (only must fight off Thugger guards and snakes as he attempts a three stage game). In part one he must rescue children trapped in cages by whacking the locks off. These cages are spread throughout a cave network linked by ladders and ledges as



well as pots that our hero can attach his whip to and swing across Tazman style. If he manages to free all the children he can escape in a mine cart and into part two.

This is the shortest part of the game and is simply a ride in a mine cart down a broken track. When you come to a break in the track leaving over will avoid disaster, but may bring you into range of the Thugger guards or into the path of the pursuing cart. This is an all-out dodging stage as taking a wrong turn will cost you a life but once you've learned the route it couldn't be easier.

At the end of the track you enter the Temple of Doom and an attempt to control one of the Bunko stones. Once again you're attacked by Thugger guards and shattering snakes but if you get your timing right you can swing over the flag ganings, grab a stone and escape only to find yourself back in the caves with more children to rescue.

As a conversion the game is reasonably close to the original (although the music is terrible). Unfortunately, the original game rapidly became repetitive, and desperately needed three or four more levels. A good conversion but this is have been better games to convert. **T.M.**

Touchline:

Title: *Indiana Jones and the Temple of Doom*. **Supplier:** *USA Gold*, 213 Midford Way, Basingstoke, Hants. **Tel:** 01753-531388. **Machine:** *CD-ROM*. **Price:** £29.99. **Originality:** 3/10. **Playability:** 6/10. **Graphics:** 3/10. **Value:** 6/10.

Captain America

What America is threatened with total annihilation who do you call. Superman? Ghostbusters? No! This time it's Captain America – the defender of the Constitution who must save the day!

Dr. Megalomaniac, a man who the CIA claimed they killed in Cuba in the early sixties has emerged from hiding and claimed the Presidency of the US of A, and if power isn't handed over he'll fire a nuclear parked full of killer viruses at North America and wipe everyone out.

One hundred elite marines stormed the mad doctor's base but were all killed by the deadly virus. Now you, Captain America, must save the world!

The doctor is holed up in the tube of Edoon and it's not going to be easy to get him out. The tube of Edoon consists of three concentric tubes packed with laser firing robots. Your mission is to fight your way through all three levels to destroy the robot, and bring Dr. Maglousian to justice. As the game begins you are sitting at the controls of the Orbitaler, an elevator that runs between the outer and middle cylinders. From this you can gain access to the rooms of the tube of Edoon.



The deeper you get into the tube the greater the level of the virus that will slowly overcome even Captain America's superhuman strength and so you must stay within your immunity range. You must also find a way to increase your immunity so you can explore these deeper levels.

Perhaps the answers lie in the rooms that you can reach by battling the robots in each level. Here you'll find many laser firing and bombing enemies as well as a scanner for your Captain America shields (your only weapon) and maybe even a few clues.

Captain America is a massive arcade adventure in which your reactions will have to match your brain power if you're going to survive long enough to save the day. **T.H.**

Touchline

Title: *Captain America*. **Supplier:** GDC, 2/3 Midland Way, Midland, Birmingham, B6 7AE. **Tel:** 021-356 1388. **Machine:** C64. **Price:** £299. **Originality:** 3/10. **Playability:** 7/10. **Graphics:** 6/10. **Value:** 7/10.

On Court Tennis

On Court Tennis is another of the Artistic Games Computer games to be re-released by Firebird at a budget price. This time you can pick up your racket and stride out onto the court with as fast, smart, John or Janey to take on a

computer or human opponent in a match lasting three or five sets.

As the players take their places on court the temptation is to write the game off as having poor graphics but gradually the attractiveness of the gameplay takes over. Even when you're 5-0 down you still think you've got a chance!

The game is controlled entirely by the joystick with it's movements deciding the strength and direction of the shot. This, of course, depends on how well you time your shots and whether you play the right shot at the right time. Wish that let us think about it's lucky that the computer automatically moves you to the ball so you can concentrate on the shot.

The result is a tennis game that was over priced in the full-priced market, but at least as found it's right value for money, it's limited and at times not very pretty but as a cut price tennis game it has the advantage. **T.H.**



Touchline

Title: *On Court Tennis*. **Supplier:** Firebird, 64/76 New Oxford Street, London WC1A 1PS. **Tel:** 01-379 6715. **Machine:** C64. **Price:** £1.99. **Originality:** 4/10. **Playability:** 6/10. **Graphics:** 6/10. **Value:** 5/10.

Beach Head II

Beach Head II, the game that shocked the world with it's realistic screens is back as part of Mastertron's Anniversary range. In this, the sequel to the highly successful Beach Head the evil, screaming, bloodthirsty, power crazed marine detacher known as the dragon is out for revenge and plans to destroy the forces that wrecked his fortress in the original game, that means you.

As in Beach Head, Beach Head II is a multi-stage attack game, only this time you can play either side in a head to head contest.

The first sequence is a two-part game with the detacher making a massive gun that tries to blast the good guys as they've dropped by helicopter behind the first line of defence. Once they've all been dropped you must bring



them forward while running the gauntlet of the giant's gas. If they're hit, they let out a bloodcurdling scream as you'll get a medal. As you approach the gas you can send one to cover a wall while the gas will be destroyed but soon replaced so you have to move quickly.

In stage two you must rescue the men captured by the dictator by taming their own gas against them. This isn't going to be easy as the prisoners escaping across the coast yard can be hit by men on walls, blown up by mines thrown out from trap doors, killed by a truck or slowly and loudly crushed by a tank.

Part three is a Zaxxon style screen in which you must fly the escaped prisoners to safety in three helicopters, along as you can get past the Dragon's dictators and finally in part four, your job is to man combat with the dictator in his underground caves. To win you must land pointed sticks at the villain and escape his deadly throws.

Break Head III is a fast, action-packed side-scan arcade game that won't win any good taste awards. **T.H.**

Touchline:

Title: Break Head III. **Supplier:** American & B Paul Street, London W2. **Feb 01-177-8880. Machine:** C&A. **Price:** £2.99. **Originality:** 4/10. **Playability:** 3/10. **Graphics:** 4/10. **Value:** 5/10.

Nebulae

Nebulae is yet another incredibly addictive Huxson arcade game in which you, as a little frog like creature, must destroy a series of unauthorised towers that someone has built in the sky. Your job is to climb up to the top of these towers and destroy them.

Unfortunately, this is going to be far from easy. You arrive by air-roads at the base of the first of eight towers. Around it you can see a series of platforms and it's here you must navigate as well as to walls that lead from one side of the tower to the other. Each tower is also patrolled by a selection of nasties. Some can be blasted with your bubble gun, while others are indestructible and must be avoided at all costs. This isn't always easy when you're walking along

platforms that disappear from under your feet, slide you backwards as quickly as you can run forward and gaps that are just further than you can jump.

It all adds up to a great game that adds new lease of life to the addictive platform game format. **T.H.**



Touchline:

Title: Nebulae. **Supplier:** Huxson Computers, Huxson House, 300 Nylon Trading Estate, Milton, Abingdon, Oxon. **Feb 0215 812610. Machine:** C&A. **Price:** £2.99. **Originality:** 4/10. **Playability:** 3/10. **Graphics:** 3/10. **Value:** 5/10.

Action Force

When the evil enemy Cobra attacked the small island of Borneo, the military installations were destroyed. All except the eastern part which contains some classified information stored on hard disk. This data must not fall into enemy hands. There just isn't time to organise a conventional force attack so they must send in the Action Force.



Lady Jay and Crankcase man the A.W.E. Striker that has been quickly modified for data retrieval and so must be protected by you, Wild Bill, and Flint in the Dragonfly XH-1 helicopter.

The enemy will bombard you with other helicopters, planes, guns and missiles that you must blast and avoid while clearing a path for Striker.

The result is a standard sideways-scrolling shoot 'em up with eight levels that may have some appeal for Action Force fans. Anyone else who wants helicopter action should take *Gunship* for a test flight. **T.H.**

Touchline:

Title: *Action Force: Gunship* **Supplier:** Virgin Games, 3-4 Fosseway Yard, Parkside Rd., London W11 3SE. **Tel:** 01-727 4878. **Machine:** C64. **Price:** £9.95 - disk only. **Originality:** 4/10. **Playability:** 6/10. **Graphics:** 5/10. **Value:** 6/10.

On the Tiles



Febird and Odo present the first driving simulation in which you must prove the streets in search of fish bones to gain control of right streets.

Unfortunately, all is not perfect for our fancy here who must avoid the attentions of blood sucking flies and the draining effect of frogs as well as the fatal touch of tiny banks and ledgtops. Luckily, you can regain lost energy for gulping a sparrow or mouse as you leap from window sill to rooftop.

You can protect yourself from things that cost one of your nine lives by spitting some green unaroused substance at them. However, at times you don't have time to react since you must press the space bar in fire which is never near enough to the joystick to save myself.

On the tiles it is a good but tough game which features some nice animation and addictive gameplay. **T.H.**

Touchline:

Title: *On The Tiles* **Supplier:** Firebird/Odo, 64/76 New

Oxford St., London WC2A 3PS. **Tel:** 01-379-6755. **Machine:** C64. **Price:** £7.95 (C) £17.95 (Disk).

Originality: 6/10. **Playability:** 6/10. **Graphics:** 5/10. **Value:** 6/10.

Super Sprint

Super Sprint is the latest coin-up-conversion for the C64 and attempts to recreate the arcade racing game that's been an amazing arcade hit.

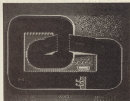
Unfortunately, it's impossible to get three players around a C64 and so this conversion has only a one or two player option with the remaining cars driven by droids. These droids never skid or crash but are easily beaten by a skilled player, but will wipe you out if you battle around every bend and end up in a smouldering heap. Your car is quickly replaced by one that arrives by helicopter but you will have lost valuable time.

Once you've selected one or two players (and if two either a head to head conflict or a normal super sprint) you can select one of the four tracks that feature tight bends, bridges that obscure your view and gaps that open and close to allow you to take short cuts that could win you the race.

On the track you may also find oil slicks that will send you spinning, bonus points and occasionally gold sponsors. If you collect three of these sponsors in a race you can improve your car by adding super traction, turbo acceleration or a higher top speed or just improve your score with a score multiplier.

Whatever you choose even the experienced champions have to avoid the spinning whirlwind that gets you in a spin if you're caught in it's path.

Super Sprint is a good conversion that will drive racing fans round the bend as they attempt to build a car that can beat all comers. **T.H.**



Touchline:

Title: *Super Sprint* **Supplier:** Electric Dreams, Terminus House, Terminus Terrace, Southampton, Hampshire SO9 1JF. **Tel:** 0703 226666. **Machine:** C64. **Price:** £9.95 (C) **Originality:** 4/10. **Playability:** 6/10. **Graphics:** 6/10. **Value:** 5/10.

Teacher's Pet

Need some help with your studies? Then take a look at the latest educational packages. Learning can be fun!

By Margaret Webb

Following the dearth of new educational software over the last year or so, it's nice to have enough material to write another Teacher's Pet column. I want to discuss three packages which are all very different in subject matter. While the review copies all came on disks, there are no technical reasons to preclude their appearance on cassette. In fact, *Biology*, from Software Horizons, came with a cassette delay.

'O'/'GCSE Mathematics

The first package is written by Evelyn Mills, a name which should be familiar to regular readers of *Four Corners*. This package covers some of the main areas of the 'O' level and GCSE syllabuses in mathematics. Extensive use of a graphics system called Video Basic 64 is used, which allows easy use of high resolution graphics, permitting the drawing of circles and lines and the use of fancy shadows and patterns which is used to enhance the appearance of the package and illustrate certain aspects.

The software covers six main topics which include:

- Basic Mathematics.
- Algebra.
- Geometry.
- Progressive Mathematics.
- Trigonometry.
- Linear programming and statistics.

A final section provides a selection of questions extracted from past 'O' level exam papers. In keeping with more exam based educational software, the material provided is

many of a revision aid for use in conjunction with normal texts and tuition. To give you some idea of the content, I will run through two of the sections - geometry and algebra.

The use of high resolution graphics is put to best use in the geometry section. This section covers a number of topics which include circles, sectors, chords and tangents, plane shapes and polygons. The algebra section, on the other hand, requires less emphasis on graphics. The areas covered include line of indices, cross multiplication, removal of brackets, factorising quadratic equations and simultaneous equations.

The examination section is, as expected, fully testing and extends beyond the material given in the package. I think however, this is only to be expected.

All sections give a good mix of handy tips or rules of thumb and illustrative examples. There is, however, no error trapping, allowing ridiculous answers to crash the program. Some examples required input from the user - ensuring that he didn't fall asleep! Overall, the content is good and is presented in an interesting manner. Although it may sound copping, there was one irritating aspect.

All sections use Video Basic to generate fancy (and in my view) superfluous displays between topics. Some of these took some time to be drawn and became a little boring. My main objection is that these displays occupy valuable program space which could be used to better effect.

Notwithstanding this point, the

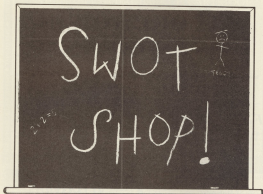
disk is filled with something like 120K of software on it. One final point is that the examination section expects you to work from the monitor. This won't present a problem for those using their own copy at home but is of little value in a busy classroom since it locks up a machine which could be otherwise used. A better idea would have been to provide an option to allow you to make a hard copy of the examination questions and so that the computer could be released for other users. It could be necessary to return to the machine for the answers.

History Package

The next offering comes courtesy of Quacan House School, Ashford. This software uses the Quill adventure writer to create a novel approach to the teaching of History. History is usually a case way to send pupils to sleep, as it is always full of dates, places and names and has as much life in it as a building brick.

The fact is that History is a living subject which involves people of all walks of life. By involving the pupil in the subject, it becomes live and interesting, and software uses the adventure concept to achieve this goal.

The disk contains two packages covering different aspects of the same problem. The main portion relates to an investigation of the past. The pupil has to "travel" around asking information which will help solve a Victorian murder. To achieve this aim, you must examine a wide range of sources of information such as



records, diaries, memorials, is distributed and taken to the group.

In the first part you have to compile the basic facts from archival material. You have access to contemporary material in the second part, and with this you attempt to form a case against the murderer. Two further parts provide further information and give your findings.

In the second package, the pupil has to explore a Kenyan village and map it. The final aim is to compile as much information as possible about a family that lived there.

Overall, the main theme of the package is that there is a lot of material available which is used to explore the past and shows where it is found and how it can be used. The software is detailed and well thought out - the documentation is copious and extremely useful, providing teacher's notes and help for the pupils. The material is ideal for project work, both for groups of children and the individual. I believe that this software

is free provided that a blank disk or tape is used.

Revision Series

Finally, I received some sample extracts from a series, written by Software Horizons, whose software is very much of the subject summary/revision genre. The system uses a kernel of routines which perform some fixed actions on a database. The database is specific to each subject. The format is text only with choices made from menus.

Each topic has a block of notes occupying two or three screen loads, which must be read in conjunction with normal notes. There are then a number of questions aimed at testing the pupil's knowledge. These are:

Simple questions: these simply require a typed answer to a question.

Multiple choice: three possible answers are given for the pupil to choose from.

True or false

Group questions: answers are chosen

from a given selection to answer a group of questions.

True or false

Fill in paragraph: the pupil has to insert the missing keywords into a paragraph.

A nice touch is the program's ability to tolerate minor deviations in spelling. Overall this package does its job well, but due to the lack of graphics, is rather unexciting.

Finalists

Title: O/V/GCSE Mathematics.
Supplier: Adamsoft, 18 Norwich Avenue, Rockdale, James O.V. 102.
Price: £12.95.

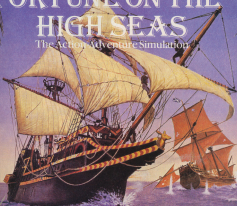
Title: History Revision. **Supplier:** Mr A. Fanning, Durston House, York Way, Durston House School, Nantwich Road, Nantwich, Cheshire.
Price: Five of charges.

Title: Revision Series. **Supplier:** Software Horizons, The Mill Centre, Main Street, Wickham Town, Co. Wicklow, Eire. **Price:**

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Enlarging the C64

Create User Definable Graphics to produce enlarged characters on your C64.

By Adam Wright

This program will enlarge any character up to a maximum square size of 8width by 8height. In fact, as long as the combinations of width and height when applied to the formula $(width-1)^2 * (height-1)$ is less than 255 then other size combinations can be created. If you can take into account the massive amount of memory that is used when creating enlarged characters then I'm sure that you will appreciate that the size combinations available are very acceptable.

The program creates UDG's (User Definable Graphics) which when joined together in the correct order will produce the enlarged character. This program therefore works in the normal low-res screen mode. One advantage of this method of creating enlarged characters is that no hires screen areas have to be assigned. The disadvantage of this method is that the total number of characters defined must not exceed 255. One way to overcome this limitation is to create the enlarged characters that are going to be used beforehand.

Getting it all in

In order to enter correctly the Enlarge program the following steps have to be taken:

- Enter program 1.

- Run the program making sure there are no errors.
- Save the program (SAVE "PROGRAM 1".II)
- Load the code by typing SYS 49613 "ENL CODE" 49151,49571,1"
- Enter program 2.
- Save the complete program (SAVE "ENLARGE".II)
- Disk Users replace the 1 with an 8

How to use the routines

Enlarge Character

This is the main routine which as its name suggests, enlarges characters. Routines that must be called before calling this routine are:

Data Store, Character Data, Width, Height

SYNTAX - SYS EC

Print Character

This routine puts the enlarged character on the screen. Note that the kernel print routine could not be used because as you will know, some ASC codes do things like clear the screen, etc, therefore the characters are "POKE'd" into screen memory. Routines that must be called before calling this routine are:

Character Colour, Base Character, XY Position, Width, Height
SYNTAX - SYS FC
Data Store

This routine is used to set up the address for the enlarged characters - (default 12288)

SYNTAX - SYS DS, enlarged character address

Character Data

This routine tells the computer where the 8 bytes of character definitions are - (default 14320)

SYNTAX - SYS CD, character definition address

Character Colour

This routine simply changes the current enlarged character colour.

SYNTAX - SYS CC, colour of character

Base Character

This routine changes the initial character that is used as the base for the Print Character routine. (See example 1)

SYNTAX - SYS BC, base character number

XY Position

This routine changes the enlarged character coordinates.

(Not to be confused with CURSOR MOVE)

SYNTAX - SYS XY, X coordinate, Y coordinate

Width and Height

This routine sets up the width and the height of the character to be enlarged.
SYNTAX - SYS WH, width of character, height of character

Example 1 Base Character

```

00111111000011111111
01001110001100110000
0101110011000000100000
0101110011000000111100
0100000010000000111100
0100001001100100110000
001111000011110000110000
00000000000000000000
0001000011110000111100
001111000011000010001100
010011001000100010000000
0111111000100010001100
010011001000100010001100
010011001000100010001100
010011001000100010001100
00000000000000000000
011111000111110010001100
010011001100000010001100
010011001100000010001100
01111100011100001111100
010011001100000010001100
010011001100000010001100
011111000111110011001100
00000000000000000000
    
```

Cursor Move

This routine will place the cursor at any position. (No more "QQQQ").
SYNTAX - SYS CM, Horizontal position, Vertical position
Memory Save

This routine will, as its name suggests, save a portion of memory to the current output device. (Tape users can omit the device number.)

SYNTAX - SYS MS "filename", start address, and address, device number

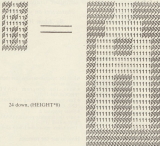
Memory Load

This routine will load a file from the current input device into the computer at the specified start address.

SYNTAX - SYS ML, "filename", start address, device number, secondary address (if required)

Examples of Enlarged Characters

EG. 1. ASC="A", WIDTH=8,
HEIGHT=



34 down. (HEIGHT=8)

8 bits : 8 bits : 8 bits
(24 bits wide - 3 bytes)

Memory Copy

This routine will copy a designated area of memory to another. (Useful for copying character sets).

SYNTAX - SYS MC, start address, destination address, number of bytes to be copied

Memory Fill

This routine will fill an area of memory with a specified byte. (Useful for clearing screens.)

SYNTAX - SYS MF, start address, number of bytes to be filled, byte to fill with.

Enlarge Routines Checklist

TITLE	SYNTAX	PARAMETERS	PARAMETER RANGES	ADDRESS
Enlarge Character	SYS EC	Name	-	49154
Print Character	SYS PC	Name	-	49588
Data Save	SYS DS,N	N Enlarged Character address	0-65535	49699
Character Data	SYS CD,N	N Character Definition address	0-65535	49825
Character Colors	SYS CC,N	N Colors of Character	0-125 (MOD 16)	49835
Base Character	SYS BC,N	N Base Character number	0-255	49842
X,Y Position	SYS X,Y	X,Y Coordinates	0-369-24	49849
Width, Height	SYS W,H	W,H Width and Height	1-255,1-255	49879
Memory Copy	SYS MC,S,D,N	S Start, D Destination, N Number	0-65535,0-65535,0-65535	49769
Memory Fill	SYS MF,S,B	S Start, N Number, B Byte	0-65535,0-65535,0-255	49786
Cursor Move	SYS CM,H,V	H,V Horizontal and Vertical	0-369-24	49824
Memory Save	SYS MS,"S,E,D"	"filename", S Start, E End, D Dev	0-65535,0-65535,1 or 0	49853
Memory Load	SYS ML,"S,D,S"	"filename", S Start, D Dev, S Sa	0-65535,1 or 0,0-15	49922

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screen of the VDC can be easily, but you have to remember BASIC isn't prepared for this, so you may have to write special routines to make this possible. First let's try to make the screen smaller horizontally, by:

POKE 54764:POKE 54765,75

The number of characters displayed has changed to 75, but it doesn't quite work because the spare five columns are printed on the next line. So we must store five to register 25:

POKE 54764:POKE 54765,5

This solves the problem by adding five lines to make the total equal 75+5=80. The maximum number of characters is 80. We can also change the number of vertical characters using register 6:

POKE 54764:POKE 54765,10

No problems this time. The rest of the screen is swallowed up a screen though it is still there if you store 25 in register 6. Now try this:

POKE 54764:POKE 54765,28

Wow! My new screen appears to have 28 lines, although they can't be used yet, and probably contain garbage. In fact we can have up to 32 lines although some monitors may not be able to display them all, so it's best just to add a few. Also, if you change the size of the screen it would be useful if you could centre the display. Well, you can't at present. Just use registers 2 and 7 to change the horizontal and vertical sync respectively. It's best to experiment and I would recommend that your programs that change the size of the screen allow individual users to alter the syncs for their individual monitors.

Like the 48-column screen, the 80-column has an attribute screen, but with some added features. Each of the 2000 bytes (see Fig. 5) affect the corresponding byte of screen RAM, the individual bits mean:

(see Figure 11)

Bit 0 indicates which character set is in use.
 Bit 1 Reverses characters, but not used by KERNAL.
 Bit 2 is used to underline characters (CTRL-B).
 Bit 3 The bit flashes characters on and off.
 Bits 0 - 3 are used for the screen colours.

It is also possible to change the position of the screen and the

Figure 5

Copying the VDC RAM from place to place. Store the destination address in 254 and 251, the number of bytes in Acc. Also, store the source address in 252 and 253.

copy	PHA	/temp store number of
	LDX #24	/bytes then set
	JSR read	/copy
	ORA 128	/bit
	JSR write	/and write.
	LDX #18	/size
	LDA 251	/destination
	JSR write	/address
	INX	/high
	LDA 250	/low
	JSR write	/low.
	LDX #32	/size
	LDA 253	/source
	JSR write	/address
	INX	/high
	LDA 252	/low
	JSR write	/low
	PLA	/get number
	LDX #50	/of bytes
	JSR write	/and store
	RTS	/return

Figure 6

VDC RAM organisation

\$0000	- \$01CF	Video RAM, 2000 bytes.
\$07E0	- \$07FF	Not used.
\$0800	- \$0FCF	Attribute RAM, 2000 bytes.
\$0FC0	- \$0FFF	Not used.
\$2000	- \$3FFF	Character RAM, 8000 bytes, one character set, 16 bytes per character (8 not used).

Figure 7

Altering underline scan line.

10	graphic 5.1
20	for t=0 to 28
30	char, 24,chr(211) "How to underline text on the VDC"
40	next t
50	do
60	for t=1 to 8
70	poke 54764,29:rom "register 28"
80	poke 54765,t
90	for d=1 to 25:REM "delay loop"
100	next d
110	next t
120	loop

attributes, as long as you tell the interpreter, which gets the information from a readout about \$A.2F in *same* page. You will need to do this if you enlarge the screen. You change these via functions 12 and 13 (scroll), 20 and 21 (attributes) of the VDC.

For those proud owners of monochrome monitors you can do away with the attributes altogether and use register 26 for the foreground and background colours. To do this you must clear bit 4 of register 25: POKE \$4784,25;POKE \$4785,7

No difference? Well, not yet, but try the program from figure eight. Highlighting the attributes also allows you to utilize more memory for anything else.

Another feature of the VDC is the ability to change the size of the characters. This could be used as a special effect or just to amuse your friends! The registers controlling the size of the characters are 12 and 23 (bits 0-5). However, at present the system can only display up to a maximum of 8 by 8 pixels. But there are 16 bytes per character in the RAM so does this mean that a larger grid is possible? Try this:

```
1 POKE $4784,9;POKE $4785,15
2 POKE $4786,6;POKE $4787,18
3 POKE $4784,23;POKE $4785,15
4 POKE $4786,4;POKE $4787,19
5 POKE $4784,7;POKE $4785,18
RUN
```

So, it is possible to display an 8 by 16 grid, but what about 16 by 8, I'm afraid I haven't figured out how to do this, and I don't think it's possible.

Remember smooth scrolling on the VIC, well it's also possible on the VDC, using registers 28 and 29 for vertical and horizontal scrolling respectively. Notice that 16 bits can be scrolled in the horizontal plane, if bit 4 of register 28 is set then only 22 lines (as opposed to 25) are displayed so you can scroll the next three on. Also, you don't lose lines when scrolling on the VDC, try the program in figure nine.

The cursor is, as mentioned before, controlled by the VDC and has several registers controlling it, namely 14, 15, 16 and 11. Registers 14 and 15 define the address the cursor is at. Register 16 bits 2 and 6 indicate the cursor mode: 00 - The cursor is off.
01 - The cursor is on.
10 - Fast blinking.
11 - Slow blinking.

Bits 0-4 indicate the top line of the cursor, because you can define it as underline, overline, solid, or anything you like. Register 11 defines the end

Figure 8

Changing the character size.

```
10 graphic 3,1
20 input "What is your name?"and
30 name: " "
40 n0:=2000/len(name)
50 name:
60 poke $4784,22;poke $4785,12
70 poke $4784,23;poke $4785,0
80 for i=1 to n0
90 print name;
100 wait
110 for i=1 to 10
120 for n=0 to 8
140 poke $4784,22;poke $4785,12+n
150 poke $4784,23;poke $4785,n
160 for d=1 to 30
170 next d,n,n
180 sleep 3
190 end
```

Figure 9

The VDC scrolling registers.

```
10 graphic 3,1
20 list
30 for i=0 to 24
40 chat,27,i,"Hello all you C128 owners!"
50 next
60 do
70 for n=0 to 7
80 poke $4784,28
90 poke $4785,22+n
100 for d=1 to 60
110 next d,n
120 loop
```

Figure 10

The cursor mode.

```
10 list
20 poke $4784,11;poke $4785,3
30 for n=0 to 85 step 32:rem "bit 5 and 6"
40 poke $4784,10;poke $4785,2+n
50 for n=0 to 70
60 poke $4784,14;poke $4785,0
70 poke $4784,15;poke $4785,n
80 for i=1 to 20:rem "change delay to suit yourself"
90 next d,n,n
100 end
```


scan line. Both are from 0 to 15. See figure 11 for an example of the cursor mode.

And now we come to the highlight of this article. Want to know a secret? HIGH RESOLUTION GRAPHICS! Yes, bit 7 of register 25 defines text or graphics mode and normally the hi-res mode is 640 by 200. This is comparable to the BBC mode 0 graphics, and is quite impressive. However, you will have to write your own graphics routines as Commodore forgot, although I saw a package at a Commodore show which could handle hi-res graphics in 80 column mode. Try this:

```
POKE 54764,25:POKE 54765,135
```

However, if you want to see 80x200 bytes instead of 16000 then try this:
 1:POKE 54764,1:POKE 54765,64
 2:POKE 54764,2:POKE 54765,96
 3:POKE 54764,6:POKE 54765,132
 4:POKE 54764,7:POKE 54765,16
 5:POKE 54764,29:POKE 54765,135

This gives graphics of resolution 512 by 256. I use this a lot more because you can use a technique used on the BBC. Remember registers 12 and 17. Append this to the above program:
 6:DO
 7:FOR T=0 TO STEP 2
 8:POKE 54764,13:POKE 54765,T
 9:FOR S=0 TO 49:PRINT S,T
 10:LOOP

What this program does is move the start of the screen, and as the screen takes exactly 10K bytes there it will wrap around in memory. This is a great feature and scrolling becomes easy. This procedure would be to change the start of the screen instead of scrolling memory, which makes scrolling easy and quick. Also, if Commodore had thought to give the VDC some more memory (quite possible), say 32K bytes there it would have been possible to have displayed 640 by 400 on 512 by 512 pixels resolution using the interleaved graphics mode on register 8. Try poking 215 to this register!

Well, that's all I have to say about the VDC, and I assure you that there is a lot left to find out, and special effects to find. One final possibility that I thought about was to use the 10K bytes as storage for music data, etc. Also, you can use the VDC in 64 mode (as well as the 2 MHz mode). For other information on the VDC refer to one of the good C128 reference guides or *The Anatomy of the Commodore C128*.

Figure 11

A complete list of the VDC registers.

0	:(128)	Total number of characters/line including beam return.
1	:(180)	Number of characters displayed across screen.
2	:(182)	Left border sync. Increasing this register moves the screen left.
3	:(174)	Start address. Bits 0-3 determine line, sync pulse width in characters, bits 4-7 determine vert. sync pulse width.
4	:(186)	Total number of lines including beam return.
5	:(234)	Line adjustment for register 4.
6	:(251)	The number of vertical lines displayed.
7	:(132)	Upper border sync. Increasing this moves the screen up and decreasing it moves the screen down.
8	:(282)	This register determines the interface mode.
9	:(231)	Bits 0-4 determine the number of raster lines/character minus one. The default is 7 (bits not used appear as 1) meaning 8.
10	:(160)	Bits 5-6 set cursor mode and bits 0-3 set cursor start raster.
11	:(231)	The line at which the cursor ends is held in bits 0-4 (normally 7).
12	:(6)	The high byte of the address of the screen.
13	:(6)	The low byte of the address of the screen.
14	:(777)	The high byte of the cursor position.
15	:(777)	The low byte of the cursor position.
16	:(777)	The vertical address of the light pen.
17	:(777)	The horizontal address of the light pen.
18	:(777)	The high byte of the address to be copied, written to or read from.
19	:(777)	The corresponding low address of REG 18.
20	:(8)	The high byte of the attribute screen.
21	:(8)	The low byte of the attribute screen.
22	:(128)	Bits 4-7 determine the number of displayed horizontal lines (7). Bits 0-3 determine the number of vertical displayed lines (8).
23	:(232)	Number of vertical lines displayed (height)
24	:(32)	Bit 7 sets VDC whether copying, reading or writing. Bit 6 is the REVLS bit, used by <ESC> = R and <ESC> = N. Bit 4 scrolls up the last three lines of text on vertically. Bits 0-3 are used for vertical scrolling.
25	:(71)	Bit 7 indicates high or low res. mode. Bit 6 indicates the use of attributes. Bit 5 determines semi-graphic operating mode. Bit 4 indicates double width characters. Bits 0-3 are for horizontal scrolling.
26	:(240)	When in monochrome mode (bit 6 of REG 25), bits 0-3 determine background colour, and bits 4-7 indicate foreground colour.
27	:(0)	The number of characters added to the end of each line. If you make the screen smaller you must make sure REG 1+REG 27=38.
28	:(47)	Character base address (bits 3-7) in 8K steps.
29	:(231)	Indicates which line to underline, and can be from 0-15.
30	:(777)	Number of bytes to be copied or stored.
31	:(777)	Holds data for reading or writing to RAM.
32	:(777)	High byte of start address of block to copy
33	:(777)	Low byte of start address of block to copy
34	:(125)	Number of characters from start of line to first character to be displayed. Can be used to cover left edge of screen.
35	:(64)	As REG 34 but for right edge of screen.
36	:(245)	Bits 0-3 indicate the DRAM refresh rate.

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Array Display Subroutines

Create a screen input and display routine which acts on string arrays, with this handy program.

By Paul Williams

When writing business packages or other programs for various applications, it is often necessary to have screen layouts containing a lot of data all at the same time. For example one record in a database program or the description of one item in a stock control package.

The best way of entering and modifying the data is for the user to be able to move a cursor around the various fields on the screen, using the screen editor to amend the data. However, the cursor must not be allowed to stray outside each field, otherwise it would be very easy for the user to corrupt the screen, and if the user was not familiar with computers, become very confused.

The program described here is a screen input and display routine which acts on string arrays, providing the following advantages over the normal BASIC INPUT command, while still being easy to use.

1. The programmer defines the field positions and sizes on the screen, and it is impossible for the user to stray out of these fields when editing.
2. When editing, the current field is highlighted to show the user the maximum size of entry expected by the program.
3. Left and right cursor controls, home, clear and insert and delete can all be used when editing, but only affect the current field, even if other fields are present on the same screen line.
4. Up and down cursor movements automatically move the user to the previous and next fields on the screen.
5. Apart from the allowed control characters, only letters, digits and characters such as ! and % etc are accepted.
6. Quotes, commas and colons are all readily accepted as legitimate input characters, and do not cause 'EXTRA IGNORED' errors.

7. The programmer can specify that editing is restricted to one particular field, or all the fields on the screen.

8. All the fields on the screen can be displayed and cleared with one command. Also, editing the whole screen is performed with just one command.

9. The whole system produces very neat screen displays, allowing editing to a professional software standard.

The program relies on three one-dimensional arrays for its operation; a field position integer array `PS`, a field length integer array `LS`, and a data array `SB` containing the information to be displayed and modified. The array names are arbitrary - you can use any letters but the two numeric arrays must be integer.

Array `PS` contains the displacement of each field from the top left home position on the screen, e.g. the first column on the second screen line is a displacement of 48 from the top, and the middle of the bottom line is 998. Thus, `PS(1)` defines the location of field 1, and `PS(2)` defines that of field 2.

Array `LS` defines the maximum length of each field - this number determines the size of the highlighted area on the screen and the number of characters strings are truncated to when being displayed by the routine. `LS(1)` contains the length of the first field, and so on.

It is also necessary to set `LS(10)` to the number of fields present on the screen.

Array `SB` simply contains the ASCII strings of data to be displayed; the routine directly modifies the elements of `SB` when editing is taking place.

Once the arrays have been defined, the subroutine is executed in this way: `SN$=IN$(2,PS(1),LS(1),%01,SB(1))`

for whichever array names you have chosen; displays the elements of `SB` in their respective fields.

`SN$=IN$(2,PS(0),LS(0),SB(0))`

allows the user to edit the data in the fields on the screen. The user can move between fields with the cursor up and down controls, and when RETURN is pressed the data in the fields is put back into the elements of array `SB`. Editing and movement can be restricted to, say field `N` by `PS(0)=N` before the above `SN$` command. If `PS(0)=0`, editing is allowed in all the fields.

`SN$=IN$(2,PS(0),LS(0),SB(0))`

clears all field areas on the screen.

The main advantage of this system over normal INPUTs is that if the user has a lot of data to enter on the screen, it is possible to go to the end of the screen, then delete the top record, re-choose modifying, and the cursor controls can be used to skip across the fields to reach that field. The Basic program is held up until the user is completely satisfied with the whole screen; then he/she presses RETURN and all the data is returned to the Basic program in one go.

The machine code program occupies locations `$C080` to `$C326` (hex), and a Basic loader is listed. This contains checkmarks which will point out typing errors when this program is run. Once the program has been installed using this loader, your Basic program can make full use of the package. To demonstrate how the routine is used, a Basic program has been included which draws up a typical stock-control screen and allows full-screen editing restricted to the defined fields. The program is fully commented and should need no further explanation.

The routine is ideal for taking the struggle out of writing business-type packages - after all databases and such like can quite easily be written effectively in Basic, as long as a fast-paced and easy to use input routine is available - this program provides just that!

See listings on page 77.

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C64 Tape System

Provide a menu driven access to multi-program library tapes with this handy program.

By Richard Kyme-Wright

Have you ever put more than one utility or backup program onto a single tape? Have you then forgotten to note the tape counter setting at the start of the second program and had to fish around on tape looking for it?

Unless you are one of the chosen few, or you might use one tape per program, this utility is for you.

The program offers a selection menu of the files of programs stored on the tape. When a selection has been made, the tape will be spooled to the start of the selected program and the LOAD sequence commenced.

The difference between this tape-accessing system and any other I have encountered is that there is no need to REWIND the tape to the beginning for a fresh look at the menu. This menu occurs between the programs so that it is ready to use at any time.

Tape Layout

When you have loaded a program the tape stops at the end of that program and before the start of the next. This is the perfect spot to find a menu. From this menu, any other point on the tape can be reached by spooling fast forwards or using rewind. A menu is also placed at the start of the tape to act as a "registration" point that you can easily find if you do manage to get lost.

Limitations

The C64 tape system is only effective when a tape is being used as a library for your source programs and utilities. These programs must all be set up on the tape before the tape system is added. To change the content of the tape or to update a program involving a change in its length would corrupt the layout on the tape and a new tape would have to be set up.

The system can accommodate as many programs as the tape can hold. During the setting up, however, the more programs you have assembled onto a tape the greater the number of

speed-time intervals to be measured will be, and the necessary increase in data statements will make the menu program longer in size and take longer to load.

The spooler has been compacted to occupy a minimum number of bytes (2444 bytes for the six title versions.) This takes 62 seconds to load normally but can be cut to six file access seconds when using a turbo-erase program or utility cartridge. (Ten seconds to "load" when I use Final Cartridge II.)

The spooler will close off by interrogating the normal loading commands of the C64 when the tape has been spooled to the correct position. The method of editing the next program can be tailored to meet individual program requirements. See Figure 1 for details of this.

Setting up the tape

Type in and "save" the two programs listed here. Note that these are two separate programs and not two parts of the same one.

Place a good-quality audio cassette in your IN cassette unit and reset the counter to 000. Use fast forward to advance the tape past the leader strip; give yourself some spare tape at the start so stop it at a counter reading of, say, "800". There should be enough tape spooled to save the "time" or "spooler" programs at the start of the tape and not run past this point. At "000" save the first program in your library. Note the counter value at the end of the "save" then use "play" to move the tape forward for "30" seconds to leave a space to save the spooler later.

Use an appropriate shorter time interval if you are utilizing a fast-save utility. The tape is now at the start point for the next library program. Build up your tape in this manner until you have the required number of programs on the tape, and leave enough room at the end of the tape for a final spooler program.

Now I recommend that you rewind

the tape, reset the counter and load each program in turn. Check that the programs load alright and that the counter values agree with your notes. Note that the true start point for each program will be 70 seconds (or less) beyond the end of the previous program and not at the point where your C64 announces to you that it has loaded something.

You now have all the information you need to measure the time it takes the cassette drive to spool between any two of the start settings.

Running the timer program

The TIMER program has to be saved at the very start of the tape. Instructions on its operation are displayed as you go along. Proceed as directed and make the necessary notes on the spooling times chart. Remember, read the tape counter while the tape is being spooled, press space bar as it approaches the required value as the tape will overrun slightly when switched off. This will take a little practice to get right.

Use the chart layout as suggested in Figure 2 to record getting lost between the different programs on the tape. Record the timer values obtained from a rewind as negative values and those from fast forward as positive values. Note that the last line of the chart is set with all negative values. This records the rewinding time to reach the start point of each program from the forward end of the tape. This point is 70 seconds of "play" time (or less) beyond the end of the last program. Make a record and refer to Figures 2 and 2.1 for more details.

Setting up the spooler program on the tape

When your chart is complete LOAD the spooler program (do not RUM) as it will reset itself with NTW when it finishes. List out line 65 and replace

the text found within the quotation marks with the general title for this tape. (Overtype the text then press RETURN.) Do not use the INSERT or DELETE key as the layout of the screen would be corrupted.

Overtype the text in the data statements beginning at line 74 with your program titles in their order on the tape. This is the point where you can make the spooler program to the actual contents of your tape.

If the number of titles is six or less use lines 74 to 80 as given in the listing. Type in all six titles or, if less than six, put in spaces of text on the unused data lines. Select the appropriate method of loading each program from the chart in Figure 1, and put the relevant code into each title line after the comma. Take the first line of numbers from your chart of spool times and type them over the "XXXXX" in line 80.

Your data lines should look like this for four titles:

```
74 DATA" 1: PROGRAM TITLE
ONE " :
75 DATA" 2: TITLE OF PROGRAM
TWO " :
76 DATA" 3: HERE IS PROGRAM
THREE " :
77 DATA" 4: PROGRAM FOUR " :
78 DATA" " :
79 DATA" " :
80 DATA+8000,+0348,+8752,+13
52,+0000,+0000
```

or this for six titles

```
74 DATA" 1: PROGRAM TITLE
ONE " :
75 DATA" 2: TITLE OF PROGRAM
TWO " :
76 DATA" 3: HERE IS PROGRAM
THREE " :
77 DATA" 4: PROGRAM FOUR " :
78 DATA" 5: THE FIFTH
PROGRAM " :
79 DATA" 6: PROGRAM NUMBER
SIX " :
80 DATA +8000,+0348,+0752,+13
52,+1760,+2121
```

If more than six titles are required use line 79 (omit six) for the NEXT SELECTION option and set the code at the end of the line to 'F'. (This triggers the program to the next page of titles.)

Retype the data lines as in lines 74 to 80 starting with the new line number of 11.

From six must again be the NEXT SELECTION option and if this is the last page, set the code at the end of the line to 'F'. This makes the display return to the initial selection.

```
74 DATA" 1: SOUND CREATOR " :
75 DATA" 2: SOUND MAKER " :
76 DATA" 3: SOUND SEQUENCER " :
77 DATA" 4: MUSIC THEMES ALBUM " :
78 DATA" 5: MUSIC HITS ALBUM " :
79 DATA" 6: ----- NEXT LIST ----- :
80 DATA+7650,+0000,+0100,+1530,+2410,+0000
81 DATA" 1: MELODY TIME, POP HITS " :
82 DATA" 2: SYNC. SYNTH. CLASSICS " :
83 DATA" 3: TUNES FOR YESTERDAY " :
84 DATA" 4: TUNES FOR TOMORROW " :
85 DATA" 5: TUNES FOR TODAY " :
86 DATA" 6: ----- NEXT LIST ----- :
87 DATA+3170,+3920,+4670,+5210,+5860,+0000
```

In the second example I have gone a stage farther and used eleven titles spread over three pages:

```
74 DATA" 1: SOUND CREATOR " :
75 DATA" 2: SOUND MAKER " :
76 DATA" 3: SOUND SEQUENCER " :
77 DATA"NOTE ABOUT HARDWARE PUT HERE!! " :
78 DATA"----- " :
79 DATA" 6: ----- NEXT LIST ----- :
80 DATA +8100,-0745,+0000,+0000,+0000,+0000
81 DATA" 1: MUSIC THEMES, ALBUM " :
82 DATA" 2: MUSIC HITS, ALBUM " :
83 DATA" 3: MELODY TIME, POP HITS " :
84 DATA" 4: SYNC. SYNTH. CLASSICS " :
85 DATA"----- " :
86 DATA" 6: ----- NEXT LIST ----- :
87 DATA+1830,+2410,+3170,+3920,+0000,+0000
88 DATA" 1: TUNES FOR YESTERDAY " :
89 DATA" 2: TUNES FOR TODAY " :
90 DATA" 3: TUNES FOR TOMORROW " :
91 DATA" 4: TUNES THAT NEVER WERE ... " :
92 DATA"----- " :
93 DATA" 6: ----- NEXT LIST ----- :
94 DATA+4870,+5210,+5170,-1870,+0000,+0000
```

Figure 2: chart layout for recording
Time values

Figure 1: the options available to the spooler when it hands over to the LOAD sequence.

CODE	LINE	Produces the following response	
1	68	Hold down Shift/Key and press RUN/STOP 'READY'	(use to create an AUTOREUN command when loading BASIC)
2	69	LOAD" " : ; return > PRESS PLAY ON TAPE	(normal LOAD command)
3	62	LOAD" " : ; return > PRESS PLAY ON TAPE	For use with programs saved using the 'Tapes' or 'tapes' facilities of Final Cartridge II
4	63		
5	64		
6	65		
7	66		

Space is available in lines 63 to 66 to define any other load variations you require.

Of course, if your list of titles continues, lines 81 to 87 will be full and the block of lines 74 to 80 can then be repeated again on new lines 88 to 94.

Here are two examples adapted from one of my own applications. In the first there are ten titles on the menu and options six on each 'page' is used to turn to the list on the next 'page' (or to go back to the first 'page').

In this second example I have gone a stage further and used eleven titles spread over three 'pages'.

It is important to note the timer values are not in sequence in lines 86, 87 and 88 as the titles have been grouped by subject and not by the position on the tape. Each timer value must correspond to the program title in the list that owns it. (Type in these data lines and run the program to see how it handles them. Change the SAVE command in line 73 to a STOP command first or your experiment will involve a lot of re-LOADS.)

With the data lines set up, use the speaker program using the fast-own facility if you have one at the appropriate position before the start point of the first program. Next speed forwards to the end of that program, using the tape counter and your notes for guidance.

List speaker to your screen then overtype the timer values (lines 86, 87 etc.) with the second set of figures from your timing chart then SAVE speaker at the tape position you have now reached.

Continue this process until speaker has been saved between each program on the tape and once more after the last program using timer values that are all one.

Begin with the tape positioned at the start of one of the programs by setting the tape to the tape counter value noted for that program on the left of this chart; speed to the start point of a program listed along the top, and record the timer value displayed by the speed timer program in the appropriate box on the chart. See Figure 2.1 for an example.

This chart can be expanded to accommodate any number of programs as long as there is one column per program and one line more than the number of columns.

Figure 2.1: This is an example of the chart when partly filled in. The top and left side of the form is used for setting

Figure 2

PROGRAM NUMBERS	1	2	3	4	5	6	
1	0000	1	0	0	0	0	
2	-	0000	0	0	0	0	
3	-	-	0000	0	0	0	
4	-	-	-	0000	0	0	
5	-	-	-	-	0000	0	
6	-	-	-	-	-	0000	
7	-	-	-	-	-	-	

TIMER VALUES

Figure 2-1

PROGRAM NUMBERS	1	2	3	4	5	6	7	8	9
1	000	0000	0000	0000	0000	0	0	0	0
2	000	0000	0000	0000	0	0	0	0	0
3	000	0000	0000	0000	0	0	0	0	0
4	000	0000	0000	0000	0000	0000	0	0	0
5	000	0000	0000	0000	0000	0000	0000	0000	0000
6	000	0000	0000	0000	0000	0000	0000	0000	0000
7	000	0000	0000	0000	0000	0000	0000	0000	0000
8	000	0000	0000	0000	0000	0000	0000	0000	0000
9	000	0000	0000	0000	0000	0000	0000	0000	0000

Timer - Process Description

Line	Description of process
100	Set up background and border colours
110-210	Print screen layout
230	Deposit character on last position of screen
230-200	Display instructions on the screen, reset the key/f'd register
310	Read keyboard character
320	If character = 1 (EXIT)
330	If character 'STOP' key has been used....
340	If character < > space bar....
350-430	Print timer box on screen
440	Set up timer reference, start speeding the tape
450	Calculate elapsed time
460-570	Display elapsed time, LOOP until space bar is pressed
580	Stop speeding the tape
580	Display prompt "PRESS RETURN TO RESET 'TIMER'"
600-630	Read keyboard character, respond to "RETURNS KEY" and "TI"
640-650	Display prompt "READY FOR NEXT" and reset timer display
660-690	Read keyboard character, respond to "I", "STOP", "SPACE BAR"
700	Reset timer value and go to line 450 (LOOP)
710	BZZZ and FLICKER error procedures
720-750	Display the error message
760	Exit from the program - END

down tape counter values for the start point of each program present.

E.g. (in this example)

The next speed time to be measured is the one between the start of program four back to the start of program two.

The tape counter should show the

number "180". Press the rewind key and then the space bar. Press the space bar again when the counter starts back past "37" to allow the tape to come to rest at "35". Note down the timer value in the box marked "TIT". (I get a timer value of "0090" for this one.)

The Best of 1987

Whether you are looking for a present to buy or want to treat yourself, you'll find something in our list of favorites from 1987.

By Tony Hetherington

It's been a great year for games with more American giants setting up shop on these shores. Soon you won't have to wait for the latest game from Electronic Arts, Microprose, Origin or Infocom as they'll be released simultaneously here and in the States.

This top ten has been compiled by the marks given by the reviewers of each game of the month. For a full review check the relevant copy or contact our back issues department.

California Games/EPY S/US Gold/£9.99 conv/£12.95 disk. The fifth and finest of the games games that started in business, passed through Winter and then went around the World. Now California games takes you through six man stacked sports that feature skateboarding, foot bagging, surfing, roller skating, BMX racing and finally frisbee flinging.



Sentinel/Finbird/£9.95.

A battle of skill and strategy pits you against the money absorbing Sentinel across a staggering 80,000 landscapes. Your aim is to get to the highest peak and absorb the Sentinel before it gets you.

The Last Ninja/System 3/£9.29.

In what must be the last word in martial arts games you have to punch, kick and kill an increasing variety of

opponents with a growing arsenal of weapons that are strewn about the glorious graphic landscapes. If you're into combat games that get the Last Ninja, it beats the opposition.



Dread/Finbird/£7.95.

Dread was the best of the Gauntlet clones as it added the use of spells to top down scrolling adventuring. Our hero has to battle with ghosts, beetles and demons to reach chests that contain magic spells and potions that replace lost energy. When you opened a chest you were faced with a dilemma of which of the powerful spells you should choose. Should you collect more fire, water or electrical attack spells, grab a key or even the Golem, a faithful servant, that could be played by a second player? If you haven't got a copy of Dread yet, then there's no dilemma, buy one.

Gunship/Microprose/£14.95 conv/£9.95 disk.

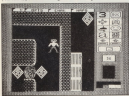
Gunship took flight simulators to new heights with a combination of an easy to fly helicopter that bristled with weaponry and an addictive gameplay that included flying over 100 missions throughout the warzones of the world. If you succeeded in wiping out enemy command posts, tanks, helicopters, gun emplacements and infantry you could gain promotions and medals and progress to more daring missions.

Stuffed and Co./Palace/19.99 cassette/12.99 disk.

Stuffed and Co. brought good eggs, cucumber sandwiches and stiff upper lips to the wicket of adventures as four all round heroes set off to a South American fantasy republic to stop some bandits destroying the world. You'll have to keep a straight face and wits sharpened if you're to survive the onslaught from Generals and other jungle types. Some of these can be solved with falchiffs, others will need the old thinking cap.

**Repton 3/Superior/19.95.**

A boardgameish style of game in which you must collect diamonds and a golden crown to progress to the next level while avoiding plummeting rocks, hatching monsters and ghostly ghosts. A great game if you can keep your nerve. If you can't, you'll soon be given a crushing blow.

**Killed Until Dead/Ascotade/US Gold/19.99.**

Murder, mystery and mayhem lie in store as the Midnight murder club has just broken into the hotel where you're the house detective, and they're all out to prove that they're the world's greatest murderer. Luckily, you're the world's greatest detective and with the help of security cameras and live video breaking in rooms, you just might solve the 20 cases supplied on the game tape or disk.

**Pirates/Microprose/14.95.**

The first ever sea-buckling simulation takes you to the high seas as you take command (right fat command) of a pirate ship. From there you sail the seven seas in search of treasure to plunder and forts to attack. You can opt to be an all out pirate and steal from any ship or instead become a privateer and serve King and Country which means you plunder ships from the rest of the world. A superb simulation that's easy to get into despite the daunting task of a 90 page instruction manual!

**Gambler/US Gold/19.99.**

The peak of the coin-op conversions that gives you 512 dungeon levels to explore as you battle with ghosts, giants, lobbers and sorcerers. This excellent game is now just part of US Gold's Solid Gold compilation which is this month's game of the month.

FOUR FEATURED ADD-ONS.

Are you happy with your computer system or do you want to stretch it a little further? If so, here are four add-ons that Your Commodore has featured in the last year.

Accelerator 4/Eventum Micros/1199.95.

Eventum Micros produced an alternative to the large and lumbering Commodore 1341 disk drive. The Accelerator 4 is smaller and slimmer, compatible with nearly all disk software, claims to be up to 25% faster and costs 140 less! Teletext Adaptor/Micros/1999.95.

Teletext is the information service that's broadcast alongside BBC and ITV programs. Until now you had to buy a

specially adapted TV to receive this information but thanks to the Microcast instant adaptor you can use your C64. You can not only read the pages of news, results, reports and TV listings but also use the information in your own programs thanks to a screen reading utility.

LOAD-IT/Load-It/£18.85.

Available either ready fitted or as a kit for £10 less this little device could save you hours of anguish as you watch tapes not loading. By simply turning a graduated switch you can adjust the angle of the read head in your drive and load in nearly all those programs that you thought were unobtainable.

Epsonizer 64/Data/Electronics/£29.95.

Together with Data's Cartridge Development system (£12.99) you can now create your own cartridges by down loading your programs onto an Epson and then building it into a cartridge. Push your new cartridge into the C64, turn on and there's your program ready to use. With fall easy to follow instructions you can't afford to ignore Epson programming.

BUSINESS AND UTILITIES

More and more people are using their computers for more "serious" applications rather than word processing, storing information or devising amusing graphics. Here are ten programs that we have featured in the *How-To* column that will put your C64 to work.

Mini Office II/Database/£14.95 (also £18.95 disk).

Mini Office II is a package that represents excellent value for money as it includes a word processor, database, spreadsheet, graphics utility, address pack and a helpline for all the price of one. The menu controlled package is easy to use, fully compatible and a must for all users.



Sup Press/AMX Software/£38.85.

Available on its own or with the AMX module for £68.85, Sup Press is a flexible desktop publishing program that can take text from any PET ASCII file and then print it in a variety of fonts and combine it with a library of clipart. The results can then be printed out to form a newsletter or saved for later use.

Advanced Art Studio/Realtime/£24.95 (disk).

The Advanced Art Studio is the first of two graphics packages featured in this roundup. Based on the original window and pull-down menus of the Art Studio, it includes added features such as support for multi-colour mode, user

defined brushes that can include four colours and can be 12x16 pixels big and load, and save and view windows of the screen so easy to build up picture elements.



Mini-Click/CL/£89.99.

A combined business package for the C128 puts this machine to work and turns it into an essential workstation for all small businesses. The package not only contains a word processor, spreadsheet, cash book and database but a bonus can be expanded through extension packages that include a sales ledger, purchase ledger and payroll.



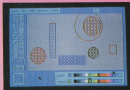
Logotron 128X/Logotron/£12.99 (disk).

A trio of packages that have been tailor made for the British market from the American Spinaker originals. Planner 128X is a particularly comprehensive spreadsheet program and is matched by Writer 128X and Filer 128X, both for users of unusual value for money. Could this trio become the Lotus 1-2-3 of the C64 world?



Gene Extensions/Berkley Software/Microprose UK/£29.95.

GEDS, the Graphic Environment Operating System, took operating system fun brought windows and icons to the C64 earlier this year. Now through a new importer the cost has come down and the original system has now been joined by Writers Workshop, Greffe, GeoCalc and more fonts and desktop utilities including a graphics grabber that can take Newsroom and Print Shop graphics.



Video Title Shop/US Gold/£14.99.

A graphics package and a screen animator combine to form

a package that can be used for anything from a title page for the video of Fred's birthday to a full advertising clone. The text and graphics are created on screen where they can be animated in a variety of ways and saved either on disk or recorded onto a video.



The Image System/CRL/£24.95.

Described as one of the best graphic programs available for the C64 the image system uses the now standard method of joystick control and has a variety of menus from which you can draw, fill and colour shapes, as well as the manual image menu that not only allows you to save, magnify and print parts of the screen but also distort and twist the shape into any other.



Blaker-64/Information Development Systems/£29.98.

Blaker-64 is an invaluable utility for basic programmers and allows you to write programs using existing subroutines that you have already written, tested and debugged on disk. When you've completed the program, Blaker-64 puts in the routines and assembles the program and presents a full on screen report (including the start and end addresses and the number of modules used).

The Ray Shop/Fusion Software/£18.00.

28 working ray models that can be printed out and then built are included on one disk, along with full instruction manual and handy extra components such as small pieces of cloth, rubber stripping and balloons. This may sound a bit like Blue Peter and a bit pointless but it is actually great fun. This could send the paper airplane industry to new heights. It

Listings

Get it right first time with our deluxe program system
for the C64.

You may have noticed that our listings are free of those horrible little black blobs which send you searching around the keyboard for a suitable graphic symbol. You may also have noticed the funny numbers by the side of each line of the listing. First no more, it's all part of our easy entry aid.

Instead of those nasty graphics and rows of constant spaces in PRINT statements and strings we use a special coding system. The code, or mnemonic, is always contained in square brackets and you'll soon learn to decipher their meanings.

For example, [SA] would mean type in a Shifted A, or an ex of squares in layman's terms, and [SAM] would mean a row of ten of these symbols.

[+2] means hold down the shift key and press the plus key twice. It doesn't take a great leap of logic to realise that [C+2] means exactly the same thing except that the Commodore key (bottom left of the keyboard) is held down instead of the shift key.

If more than two spaces appear in a statement then this will be printed as [SPC4] or, exceptionally, [SPC4]. Translated into English this means press the spacebar four times or in the latter case hold the shift key down while you do it.

A string of special characters could appear as:
CTRL N, DOWNLEFT, BLUE,
F1(3)

This would be achieved by holding

down the CTRL key as you press N, press the cursor left key five times, press the cursor left key five times, press the key marked BLUE while holding down the CTRL key, press the F3 key and, finally hold the Commodore key down while pressing the number two key (C2 would of course make the computer print its answer).

Always remember that you should only have a row of graphics characters on your screen with no square brackets and no commas, unless something like this appears:
[SA][C+2]

In this case the two characters should have a comma between them.

On rare occasions [REV T] will appear in a listing. This is a delete symbol and is created by entering the line up to this mnemonic. Then type a closing quotation mark (SHIFT + 3) and delete it. This gets the computer out of quote-mode. Hold down CTRL, and press the number nine key (REV9), type the relevant number of reversed T's and then hold down CTRL, and press one (REV0FF). Next type another quotation mark and delete it again. Now finish the line and press RETURN.

A lot of these special cases is given in the table but remember that only one of these mnemonics will appear outside of a PRINT string (the symbol for pi). This may appear when its value is needed in a calculation so the may look something like:

```
X=C*(PI)*R:
```

(your X in square brackets and just type in a shifted upward pointing arrow (ie. the pi symbol).

PROGRAM: SYSTEM CHECKER

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1 REM ***** SYSTEM CHECKER *****
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by Eric Doyle

Checksum Program

The hexadecimal number appearing in a column to the left of the listing should not be typed in with the program. These are merely checksum values and are there to help you get each line right. Don't worry if you don't understand the hexadecimal system, as long as you can compare two characters on the screen with the corresponding two characters in the magazine you can use our line-checking program.

Type in the Checksum Program, make sure that you've not made any mistakes and save it to tape or disk

immediately because it will be used with most of the present and future listings appearing in *Your Commodore*.

At the start of each programming session, load Checksum and run it. The screen will turn brown with yellow characters and each time you type in a line and press the RETURN key a number will appear on the screen in white. This should be the same as the corresponding value in the magazine.











If the two values don't relate to one another, you have not copied the line exactly as printed so go back and check each character carefully. When you find the error simply correct it and

















press RETURN again.

If you want to turn off the checker simply type STOP/BS and the screen will return to the familiar blue screen. You can then do whatever it was you wanted to do and if this doesn't use the area where Checksum lies you can go back to it with the same STOP/BS command.

Lower Case

Many of the listings are presented in lower case. To turn your computer to lower case mode press the Commodore key and the SHIFT key at the same time. 15

Mnemonic	Symbol	Keypress
[RIGHT]		CRSR left/right
[LEFT]		SHIFT & CRSR left/right
[DOWN]		CRSR up/down
[UP]		SHIFT & CRSR up/down
[F1]		F1 key
[F2]		SHIFT & F1 key
[F3]		F3 key
[F4]		SHIFT & F3 key
[F5]		F5 key
[F6]		SHIFT & F5 key
[F7]		F7 key
[F8]		SHIFT & F7 key
[HOME]		CLR/HOME
[CLR]		SHIFT & CLR/HOME
[RVSON]		CTRL & 9
[RVSOFF]		CTRL & 8

Mnemonic	Symbol	Keypress
[BLACK]		CTRL & 1
[WHITE]		CTRL & 2
[RED]		CTRL & 3
[CYAN]		CTRL & 4
[PURPLE]		CTRL & 5
[GREEN]		CTRL & 6
[BLUE]		CTRL & 7
[YELLOW]		CTRL & 8
[FOUND]		8
[LARRROW]		←
[UPARROW]		↑
[P1]		SHIFT & ↑
[INST]		SHIFT & INST/DEL
[REV T]		no text
[Clear]		CBM + letter
[Store]		SHIFT + letter

LISTINGS

```

54 1219
5C 2740 DAT60.1.255.0.1.255.0.1
  .255.0.1.255.0.0.254.0.1879
5D 2750 DAT60.60.0.0.60.0.0.60.0
  .0.0.263.0.0.263.0.64.256
5E 2760 DAT60.0.0.0.254.0.0.254
  .0.1.255.0.0.255.255.0.254
5F 2770 DAT60.128.0.0.128.0.128.0.0
  .0.255.0.255.128.0.128.0.0.0.0
5G 1220
5H 2780 DAT60.1.255.0.1.255.0.1
  .255.0.1.255.0.0.254.0.2279
5I 2790 DAT60.128.0.0.128.0.1.0
  .0.0.0.0.247.0.0.116.0.64.256
5J 2800 DAT60.0.0.0.254.0.0.254
  .0.1.255.0.0.255.128.0.254
5K 2810 DAT60.128.0.128.128.0.128.0.0
  .0.255.0.255.128.0.128.128.0.0
5L 1230
5M 2820 DAT60.1.255.0.1.255.0.1
  .255.0.1.255.0.0.254.0.2279
5N 2830 DAT60.128.0.0.128.0.0.0.0
  .0.0.128.0.243.128.0.97.128.40
  .1270
5O 2840 DAT60.0.0.0.0.0.0.0.0.0.0
  .0.32.14.0.122.31.149
5P 2850 DAT60.248.423.128.252.128
  .0.183.250.183.255.187.0.229
  .182.0.222.2479
5Q 2860 DAT60.1.128.128.0.221
  .0.0.229.0.0.0.0.0.0.0.0.0.297
5R 2870 DAT60.186.0.0.136.0.0.0.0
  .0.0.0.0.0.0.0.0.0.48.480
5S 2880 DAT60.0.0.0.0.0.0.0.0.0.0
  .1.38.44.0.68.44.0.364
5T 2890 DAT60.64.7.87.64.7.87
  .63.0.63.63.0.63.63.0.63.63
5U 2900 DAT60.37.63.64.37.63.64
  .4.37.184.63.63.173.182.63.18
  .0.188.1511
5V 2910 DAT60.174.168.174.174.173
  .172.181.179.254.243.182.248
  .0.0.0.181.2209
5W 2920 DAT60.0.0.0.0.0.0.0.0.0.0
  .0.0.0.0.32.0.6.72
5X 2930 DAT60.1.268.0.1.268.128
  .2.188.0.0.2.188.0.2.184.482
5Y 2940 DAT60.0.128.128.0.128.1
  .28.2.188.128.0.188.340.2.188
  .182.1287
5Z 2950 DAT60.64.123.0.63.64.0
  .123.64.47.256.252.0.0.0.285
  .1482
5A 2960 DAT60.0.0.0.0.0.0.0.0.0.0
  .0.184.0.2.180.0.3.368
5B 2970 DAT60.0.0.22.0.0.22.0.0
  .0.32.0.0.24.0.0.28.208
5C 2980 DAT60.0.34.0.0.34.0.0.0
  .4.32.18.076.128.128.0.248
5D 2990 DAT60.128.0.0.0.0.0.0.0
  .0.0.0.0.0.0.0.183.764
5E 3000 DAT60.0.0.0.122.184.14.0
  .122.18.2.4.0.98.0.18.823
5F 3010 DAT60.4.40.0.0.4.4.0.12
  .67.182.34.72.0.34.18.0.781
5G 3020 DAT60.0.28.40.10.0.64.0
  .0.1.64.0.4.48.4.0.328
5H 3030 DAT60.0.34.49.244.34.4
  .3.254.2.32.32.1.393.0.289.1
  .145
5I 3040 DAT60.0.0.0.0.0.0.0.0.0.0
  .148.84.2.288.148.0.448
5J 3050 DAT60.64.0.0.64.124.124
  .240.80.0.0.64.0.64.0.224.0.63
  .1448
5K 3060 DAT60.0.11.244.0.2.280
  .0.12.84.0.0.240.0.3.148.880
5L 3070 DAT60.1.112.0.1.112.0.0
  .80.0.0.0.0.0.0.252.861
5M 3080 DAT60.0.0.12.68.64.4.

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PROGRAM LOADER 2

```

5N 3090 DAT60.128.128.128.128.128
  .4.32.248.2.248.128.0.144.12
  .0.1190
5O 3100 DAT60.128.128.1.200.0.0
  .0.0.0.0.0.0.0.0.169.950
5P 3110 DAT60.0.0.0.0.0.0.0.0.0.0
  .0.0.0.0.0.0.0.0.0.0.0.0.0
5Q 3120 DAT60.0.0.116.0.0.117.0
  .0.128.128.4.85.126.4.122.87
  .0
5R 3130 DAT60.3.148.0.1.118.0.0
  .0.0.0.0.0.0.0.0.258
5S 3140 DAT60.0.0.0.0.0.0.0.0.0.0
  .0.0.0.0.0.0.0.3
5T 3150 DAT60.0.0.0.0.0.0.0.0.0.0
  .0.0.0.0.0.0.0.0.0.0.0.0.0
5U 3160 DAT60.0.0.0.0.18.0.0.0
  .0.0.0.48.0.0.0.28
5V 3170 DAT60.0.0.0.0.0.0.0.0.0.0
  .0.0.0.0.0.0.0
5W 3180 DAT60.0.0.0.0.0.0.0.0.0
  .0.0.0.0.0.38.76
5X 3190 DAT60.104.0.40.0.104.1
  .184.0.104.0.104.0.184.0.104
  .773
6N 3200 DAT60.0.0.0.0.0.0.0.0.0.0
6O 3210 DAT60.0.0.0.0.0.0.0.0.0.0
6P 3220 DAT60.0.0.0.0.0.0.0.0.0.0
6Q 3230 DAT60.0.0.0.0.0.0.0.0.0.0
6R 3240 DAT60.0.0.0.0.0.0.0.0.0.0
6S 3250 DAT60.0.0.0.0.0.0.0.0.0.0
6T 3260 DAT60.0.0.0.0.0.0.0.0.0.0
6U 3270 DAT60.0.0.0.0.0.0.0.0.0.0
6V 3280 DAT60.0.0.0.0.0.0.0.0.0.0
6W 3290 DAT60.0.0.0.0.0.0.0.0.0.0
6X 3300 DAT60.0.0.0.0.0.0.0.0.0.0
6Y 3310 DAT60.0.0.0.0.0.0.0.0.0.0
6Z 3320 DAT60.0.0.0.0.0.0.0.0.0.0
6A 3330 DAT60.0.0.0.0.0.0.0.0.0.0
6B 3340 DAT60.0.0.0.0.0.0.0.0.0.0
6C 3350 DAT60.0.0.0.0.0.0.0.0.0.0
6D 3360 DAT60.0.0.0.0.0.0.0.0.0.0
6E 3370 DAT60.0.0.0.0.0.0.0.0.0.0
6F 3380 DAT60.0.0.0.0.0.0.0.0.0.0
6G 3390 DAT60.0.0.0.0.0.0.0.0.0.0
6H 3400 DAT60.0.0.0.0.0.0.0.0.0.0
6I 3410 DAT60.0.0.0.0.0.0.0.0.0.0
6J 3420 DAT60.0.0.0.0.0.0.0.0.0.0

```


LISTINGS

44	2630 DATB304, 214, 80, 200, 120,	75	3210 DATB222, 220, 220, 220, 220	37	3110 DATB127, 220, 220, 220, 220
46	2500, 174, 170, 90, 240, 220, 12		220, 220, 220, 220, 221, 221, 220, 220		220, 220, 220, 220, 220, 220, 220
7	220, 227, 222, 2288		220, 221, 221, 221, 2208		248, 229, 229, 224, 2719
3940	DATB127, 217, 217, 217, 217,	86	3210 DATB222, 220, 220, 220, 220	24	3120 DATB0, 0, 0, 28, 63, 0, 220, 0
317	217, 217, 217, 218, 218, 217, 217, 217		248, 220, 220, 220, 221, 220, 224		30, 63, 22, 22, 2, 199, 7, 79
22	217, 217, 220, 180, 3208		224, 220, 222, 222, 2888	24	3120 DATB224, 224, 224, 224, 248
3950	DATB126, 244, 180, 220, 220, 220	36	3210 DATB0, 220, 220, 220, 7, 220	24	221, 221, 22, 0, 220, 0, 0, 129, 0
321	220, 240, 18, 220, 127, 220,		224, 221, 220, 220, 220, 220, 220		27, 220, 220, 22021
229	79, 63, 222, 2078		220, 220, 220, 224, 224	24	3140 DATB7, 247, 7, 22, 220, 222,
2950	DATB22, 224, 124, 220, 80, 1	37	3240 DATB222, 220, 220, 224, 224		124, 221, 224, 222, 220, 220, 220
22	228, 224, 80, 124, 80, 220, 120,		221, 221, 221, 220, 221, 221, 0, 0	34	228, 228, 224, 2026
152	8, 0, 1420		220, 220, 220, 224	34	3150 DATB222, 220, 189, 219, 229
2970	DATB22, 224, 124, 90, 140, 1	38	3240 DATB222, 220, 220, 0, 0, 221		123, 0, 24, 227, 220, 220, 229, 22
33	189, 21, 124, 124, 124, 84, 224		224, 221, 221, 220, 221, 7, 7, 221	37	220, 220, 227, 224
124	124, 124, 124, 1728		221, 221, 2228		320, 222, 224, 0, 0, 120, 224, 220
81	40, 40, 40, 40, 40, 0, 0, 0, 41,	39	3240 DATB2, 22, 42, 42, 42, 42, 4		0, 220, 0, 2202
41	41, 41, 22, 40, 41, 41, 41, 228		4, 42, 41, 21, 21, 20, 22, 21, 21, 21	37	3170 DATB2, 22, 22, 22, 22, 22
3960	DATB124, 224, 124, 124, 124, 124,		249, 249, 249, 8, 8, 220, 220, 220	37	3170 DATB2, 22, 22, 22, 22, 22, 22
84	124, 124, 224, 0, 8, 8, 0, 0, 0, 8, 7		220, 220, 220, 220		7, 224, 224, 224, 248, 240, 240
92		38	3240 DATB0, 0, 8, 220, 220, 220, 2		220, 220, 2200
82	3240 DATB1, 41, 41, 41, 41, 21, 4	38	3200 DATB0, 0, 8, 220, 220, 220, 2		220, 220, 220, 220, 120, 120, 0
41	1, 41, 88, 154, 154, 154, 88, 149, 1	39	3200 DATB0, 220, 220, 220, 220, 0		0, 120, 0, 2202
49	149, 149, 1427		220, 220, 220, 220, 220, 220, 0	38	3240 DATB124, 224, 224, 224, 224
3210	DATB0, 0, 84, 84, 84, 84, 84,	40	3240 DATB222, 222, 222, 222, 222		224, 224, 224, 224, 124, 124, 219
84	8, 0, 0, 148, 148, 148, 148, 148, 1		22, 0, 0, 0, 220, 220, 220, 220, 22		124, 124, 0, 20, 2299
48	2213		12, 12, 12, 2202	37	3240 DATB22, 222, 222, 222, 222
3430	DATB4, 22, 88, 170, 170, 170,	39	3240 DATB22, 222, 222, 222, 222,		220, 220, 220
222	220, 220, 220, 220, 174, 174, 220		220, 220, 220, 220, 221, 221, 7, 7		220, 220, 220, 224, 2723
3430	DATB2, 222, 222, 222, 124, 88, 7	40	3240 DATB2, 22, 12, 12, 12, 220, 220		220, 220, 220
41	88, 220, 188, 88, 20, 20, 10, 0, 2, 2		220, 220, 12, 12, 12, 12, 240, 240		
9, 1272			240, 240, 2408		
3440	DATB2, 144, 144, 144, 144, 80, 2	38	3240 DATB2, 22, 22, 48, 21, 220		
24	154, 149, 0, 12, 12, 12, 80, 120		12, 24, 24, 22, 12, 22, 48, 7, 218, 24		
148	88, 1288		0, 1288		
42	3240 DATB7, 178, 120, 170, 174	39	3240 DATB2, 220, 220, 220, 220, 220		
224	178, 174, 170, 170, 170, 180, 170		220, 220, 220, 220, 220, 220, 220		
170	170, 224, 178, 180, 2222		220, 220, 220, 220		
37	3430 DATB7, 180, 178, 180, 180, 180				
180	180, 180, 170, 170, 170, 90, 224,				
221	248, 88, 88, 2488				
3470	DATB24, 154, 178, 181, 178				
180	180, 220, 178, 180, 212, 170, 248				
170	180, 170, 90, 2228				
37	3430 DATB8, 8, 222, 220, 222, 222				
222	222, 222, 128, 188, 198, 170, 120				
184	180, 178, 2248				
3490	DATB22, 220, 184, 180, 178				
248	97, 170, 21, 148, 240, 22, 14				
8, 130, 27, 68, 2182					
3490	DATB18, 68, 17, 40, 21, 69, 2				
1, 88, 220, 220, 220, 220, 220, 220					
220, 220, 2487					
3110	DATB8, 0, 0, 0, 0, 0, 0, 0, 0, 0				
0, 0, 0, 0, 0, 0, 0					
3420	DATB1, 221, 221, 221, 221, 220				
220, 220, 220, 248, 248, 248, 248					
248, 248, 248, 248, 2427					
3120	DATB2, 227, 192, 180, 180				
227, 147, 220, 221, 221, 221, 0, 0					
220, 221, 220, 2208					
3430	DATB2, 220, 220, 220, 220, 220				
220, 227, 220, 221, 220, 221, 220					
220, 221, 220, 2288					
3130	DATB20, 220, 220, 220, 220, 180				
220, 221, 228, 0, 128, 220, 1224, 2					
48, 248, 227, 224, 2487					
3440	DATB22, 220, 220, 220, 220				
220, 220, 220, 22, 22, 22, 12, 12,					
12, 22, 12, 2180					
3178	DATB22, 220, 220, 220, 220, 0				
0, 0, 0, 220, 220, 220, 220, 220, 2					
20, 220, 2200					
3188	DATB22, 220, 220, 220, 220				
220, 220, 0, 63, 63, 63, 63, 63, 47					
82, 82, 2288					
3198	DATB21, 221, 224, 224, 221, 21				
224, 224, 222, 222, 220, 220, 220					
222, 222, 222, 2228					
3208	DATB2, 228, 228, 228, 228, 0, 0				
0, 224, 224, 0, 1, 2, 7, 12, 21, 67,					
127, 1277					

PROMOGRAM: LAMER 3

LISTINGS

PROGRAM, LOADER &

66	60	NEW	*****
67	20	NEW	LOADER &
68	30	NEW	RAM &
69	40	NEW	RAM &
70	50	NEW	*****
71	60	NEW	*****
72	70	NEW	*****
73	80	NEW	*****
74	90	NEW	*****
75	100	NEW	*****
76	110	NEW	*****
77	120	NEW	*****
78	130	NEW	*****
79	140	NEW	*****
80	150	NEW	*****
81	160	NEW	*****
82	170	NEW	*****
83	180	NEW	*****
84	190	NEW	*****
85	200	NEW	*****
86	210	NEW	*****
87	220	NEW	*****
88	230	NEW	*****
89	240	NEW	*****
90	250	NEW	*****
91	260	NEW	*****
92	270	NEW	*****
93	280	NEW	*****
94	290	NEW	*****
95	300	NEW	*****
96	310	NEW	*****
97	320	NEW	*****
98	330	NEW	*****
99	340	NEW	*****
100	350	NEW	*****
101	360	NEW	*****
102	370	NEW	*****
103	380	NEW	*****
104	390	NEW	*****
105	400	NEW	*****
106	410	NEW	*****
107	420	NEW	*****
108	430	NEW	*****
109	440	NEW	*****
110	450	NEW	*****
111	460	NEW	*****
112	470	NEW	*****
113	480	NEW	*****
114	490	NEW	*****
115	500	NEW	*****
116	510	NEW	*****
117	520	NEW	*****
118	530	NEW	*****
119	540	NEW	*****
120	550	NEW	*****
121	560	NEW	*****
122	570	NEW	*****
123	580	NEW	*****
124	590	NEW	*****
125	600	NEW	*****
126	610	NEW	*****
127	620	NEW	*****
128	630	NEW	*****
129	640	NEW	*****
130	650	NEW	*****
131	660	NEW	*****
132	670	NEW	*****
133	680	NEW	*****
134	690	NEW	*****
135	700	NEW	*****
136	710	NEW	*****
137	720	NEW	*****
138	730	NEW	*****
139	740	NEW	*****
140	750	NEW	*****
141	760	NEW	*****
142	770	NEW	*****
143	780	NEW	*****
144	790	NEW	*****
145	800	NEW	*****
146	810	NEW	*****
147	820	NEW	*****
148	830	NEW	*****
149	840	NEW	*****
150	850	NEW	*****

LISTINGS

	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150
CL	2650	2670	2690	2710	2730	2750	2770	2790	2810	2830	2850	2870	2890	2910	2930
EM	3020	3040	3060	3080	3100	3120	3140	3160	3180	3200	3220	3240	3260	3280	3300
EA	3350	3370	3390	3410	3430	3450	3470	3490	3510	3530	3550	3570	3590	3610	3630
EB	3650	3670	3690	3710	3730	3750	3770	3790	3810	3830	3850	3870	3890	3910	3930
ED	3950	3970	3990	4010	4030	4050	4070	4090	4110	4130	4150	4170	4190	4210	4230
EE	4250	4270	4290	4310	4330	4350	4370	4390	4410	4430	4450	4470	4490	4510	4530
EF	4550	4570	4590	4610	4630	4650	4670	4690	4710	4730	4750	4770	4790	4810	4830
EG	4850	4870	4890	4910	4930	4950	4970	4990	5010	5030	5050	5070	5090	5110	5130
EH	5150	5170	5190	5210	5230	5250	5270	5290	5310	5330	5350	5370	5390	5410	5430
EH	5450	5470	5490	5510	5530	5550	5570	5590	5610	5630	5650	5670	5690	5710	5730
EI	5750	5770	5790	5810	5830	5850	5870	5890	5910	5930	5950	5970	5990	6010	6030
EJ	6050	6070	6090	6110	6130	6150	6170	6190	6210	6230	6250	6270	6290	6310	6330
EK	6350	6370	6390	6410	6430	6450	6470	6490	6510	6530	6550	6570	6590	6610	6630
EL	6650	6670	6690	6710	6730	6750	6770	6790	6810	6830	6850	6870	6890	6910	6930
EM	6950	6970	6990	7010	7030	7050	7070	7090	7110	7130	7150	7170	7190	7210	7230
EN	7250	7270	7290	7310	7330	7350	7370	7390	7410	7430	7450	7470	7490	7510	7530
EO	7550	7570	7590	7610	7630	7650	7670	7690	7710	7730	7750	7770	7790	7810	7830
EP	7850	7870	7890	7910	7930	7950	7970	7990	8010	8030	8050	8070	8090	8110	8130
EQ	8150	8170	8190	8210	8230	8250	8270	8290	8310	8330	8350	8370	8390	8410	8430
ER	8450	8470	8490	8510	8530	8550	8570	8590	8610	8630	8650	8670	8690	8710	8730
ES	8750	8770	8790	8810	8830	8850	8870	8890	8910	8930	8950	8970	8990	9010	9030
ET	9050	9070	9090	9110	9130	9150	9170	9190	9210	9230	9250	9270	9290	9310	9330
EU	9350	9370	9390	9410	9430	9450	9470	9490	9510	9530	9550	9570	9590	9610	9630
EV	9650	9670	9690	9710	9730	9750	9770	9790	9810	9830	9850	9870	9890	9910	9930
EW	9950	9970	9990	10010	10030	10050	10070	10090	10110	10130	10150	10170	10190	10210	10230
EX	10250	10270	10290	10310	10330	10350	10370	10390	10410	10430	10450	10470	10490	10510	10530
EY	10550	10570	10590	10610	10630	10650	10670	10690	10710	10730	10750	10770	10790	10810	10830
EZ	10850	10870	10890	10910	10930	10950	10970	10990	11010	11030	11050	11070	11090	11110	11130

LISTINGS

PROGRAM: AEROVIBS DATA

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75 GO 8-8-1:PRINT FILE"A:IFB-DT
BENLOW"OBJECT".8,1
80 GO 20 IFA=STHENLOW"OBJE"TES".8,
2
85 GO IFA=STHENLOW"OBJE"CT".2".8
-1
90 IFA=STHENLOW"HEAR-CLASS"
".8,1
1E GO IFA=STHENLOW"HEP".8,1
70 GO IFA=STHENLOW"OBJECT".2".8
-1
84 TR FORKED..24,CLA
86 GO PRINT"CLA,DOMNO"TAB(10)
"2...PLAY GANE"
90 GO PRINTTAB(10)"2...EDOT GAN
E"
1A 180 GETHI:IFIB="THRO50
87 120 IF 18-7:THRO50
87 120 IF 18-7:THRO10
8A 120 SYND2500
8B 140 PRINT"NAME,WHITE,DOMNO,
RIGHT"ATP8000 MM ET"
8C 120 GETHI:IFIB="THRO150
8D 160 FORK 8100,21:PRINT"CLA,
WHITE",FORKED,24,FORKED,
81,0,FORKED,24,0,FORKED,24,0
7B 170 IFA=STHENLOW"OBJE"CT".8,1
8E PRINT"FORKED,WHITE,DOMNO,
RIGHT"ATP8000 MM ET"
8F 120 IFA=STHENLOW"OBJE"CT".8,1
89
90 GO 12-18:IFC=200-4
9C 120 V=8,FORM=200-4,V=8-3:V 8
8UT
93 110 FORM=200-4:FORKED,24,
4,MEET
94 120 GETHI:FORM=1:100L,CLAS
C,MEET
95 140 FORM=2-30:FOR 3-100L
10 120 FORK 5000,1,1,50
11 120 FORK 5100-2:11-11,2
12 120 FORK 5000-2:11-11,3
13 140 FOR 7-7:25,8-8-3:MEET
14 120 FORK 8100,4,FORM 8100,
V,FORM 5000,8
17 120 DATA 8,11.8,3,1,1
88 100 DATA FORMIN,ALOR,PIRE,8
NAME,CLOUD,WEATHER
18 110 DATA WOLVER,MOLE,WIZARD
8,SHARK,DOMNO
19 120 PRINT"NAME,DOMNO"TAB(1
21,
24 120 ONLY GOTO 140,170,190,41
0,430,450,4700
88 120 PRINT"YOU'VE DIDN'T DO V
ERY WELL"
85 120 PRINTTAB(10)"IT'S BACK T
O OURSIC SCHOOL"
89 120 PRINTTAB(10)"FOR YOU"-GO
10470
8A 120 PRINT"NOT SO GOOD, YOU V
ON'T KILL"
90 120 PRINTTAB(10)"WHY DIDNO
HE TRAY ME?"-GOTO430
91 120 PRINT"WHEN A LITTLE FOR
CTICE"
94 120 PRINTTAB(10)"WHY'D DO V
OU ANY BANG"-GOTO470
95 120 PRINT"KEEP AT IT - YOU'L
L SHOO"
9A 120 PRINTTAB(10)"BECOME A X
MURDER"-GOTO470
9E 120 PRINT"VERY GOOD - THE 81
NO BIVER"
9C 120 PRINTTAB(10)"YOU & BEND

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96 480 GETHI:IFIB="THRO480
17 480 FORK 8100,8,FORMED,27,0,
FORMED,27,0
100 100 FORM=200-4:FORKED,24,
4,MEET
97 210 FORK 5100,100
98 120 GETHI
78 880 PRINT"CLA,DOMNO"TAB(10)
"1...CHASSE TIRAGE"
8F 240 PRINTTAB(10)"2...CHASSE
8,8AND"
90 500 GETHI:IFIB="THRO500
88 240 IF 18-7:THRO510
90 570 IF 18-7:THRO550
92 240 GETHI:FORM=1:100L,CLAS
C,MEET
12 500 PRINT"CLA,SPIC"OBJE"CT".
BALMS AND"
90 400 PRINT"DOMNO"
72 510 FOR 8-100L
84 430 V=FORM,200-4:0,SHARK
85 480 PRINT"NAME"TAB(10)"T
HRO"
90 440 MEET
85 480 INPUT"DOMNO"TAB(10)
ALORNO GO TO 87:IF 8
90 480 IF 8:DOMNO"THRO500
84 470 IFA=STHENLOW"
90 480 INPUT "% OF BANG 01 TO 5
3-5"
87 880 IFA=STHENLOW"THRO500
8A 780 FORK 3400-8,8-GOTO880
90 710 PRINT"CLA,SPIC"OBJE"CT".
BALMS AND"
8F 720 PRINT"THRO540"
83 780 FOR L=1-1000
83 780 V=FORMED,200-4:0,8
81 750 PRINT"LEVEL"TAB(10)"T"
SECS"
78 760 MEET
80 770 INPUT"DOMNO"LEVEL TO 8
CHASSE 10 TO 87:IF 8
80 780 IFA=STHENLOW"THRO570
87 790 IFA=STHENLOW
87 800 INPUT"HOW MANY NO AND
-40 8000000-8
80 810 IF 8:1-8:8-4:1:THRO50
82 810 FORK 3400-1,8,8
8E 830 GOTO810

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PROGRAM: PROGRAM 1

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CF 8 888 (RELEASE (PROGRAM 1)
88 2 1-4-122
88 3 08-8:IF RECD(4010)-8 AND
FORM(4000)-150 THEN GOO0 LI 3
80 4 PRINT"CLA,SVCHS(PLEASE WA
IT 10"
8A 5 RECD 8,IF 8-250 THEN PRINT
"THRO508:1"-GOTO 118
8E 8 FORK L,8,1-1-1-1-1-1-1-1-1-1
0 0
82 7 IF 00-0-0870 THEN PRINT"

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8VCHS(88888 1"-8880
8 8 DATA 0.8,100.0,140.8,180.1
2F 8 DATA 0.140.1,180.100.1,120
8,250
82 10 DATA 140.1,130,160,18,18,
10,140
75 11 DATA 84,180,170,0,180,180
-0,30
94 12 DATA 140,160,100,78,160.1
70,8,200
13 13 DATA 170,138,70,180,8,180
78,140
88 14 DATA 21,180,180,0,180,0-8
8,40
84 15 DATA 108,8,180,1,48,150,2,
4,300
84 16 DATA 1,140,83,180,200,204
-184,254
82 17 DATA 204,13,180,208,208,1
94,184,251
83 18 DATA 208,210,173,13,190.1,
83,251,250
87 19 DATA 1,190,180,190,180,8,
141,1
24 20 DATA 180,200,208,300,30,1
79,17,180
80 21 DATA 130,200,208,8,180,17,
3,0,100
76 22 DATA 281,8,180,21,179,53,
182,24
70 23 DATA 180,1,140,50,192,140
80,192
13 24 DATA 244,0,238,54,182,238
-80,182
25 25 DATA 95,179,53,192,84,100
-1,540
82 26 DATA 85,190,140,80,180,14
4,131,238
18 27 DATA 84,190,238,80,180,24
-144,348
28 28 DATA 0,180,0,180,8,4,24,8
73
72 29 DATA 184,180,100,1,141,18
0,180,180
81 30 DATA 0,208,180,190,80,180
-230,230
83 31 DATA 1,180,180,179,2,180,
251,180
87 32 DATA 231,238,234,180,280,
288,230,84
89 33 DATA 173,24,230,40,234,14
1,18,238
84 34 DATA 185,1,40,251,130,1,1
79,0
84 35 DATA 288,160,0,88,24,179,
208,180
80 36 DATA 185,1,141,230,182,14
4,8,238
10 37 DATA 208,190,84,179,208,1
92,185,1
18 38 DATA 241,218,180,144,2,20
8,239,250
89 39 DATA 84,160,238,230,1,133
-288,174
87 40 DATA 2,180,250,180,230,20
8,237,180
87 41 DATA 200,200,200,180,1,8,
4,130
83 42 DATA 1,173,14,200,9,1,141
-14
72 43 DATA 230,88,240,0,180,8,3
2,140
84 44 DATA 179,50,10,108,288,0,
288,88
80 45 DATA 82,140,179,50,43,288
-30,11
80 46 DATA 188,248,0,180,8,32,1
48,179
80 47 DATA 30,180,184,30,247,18
3,148,0
7A 48 DATA 24,181,20,141,85,192

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LISTINGS

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149,4
82 49 DATA 103,32,141,96,183,35
9,0,34
83 50 DATA 103,38,141,97,183,36
7,215,181
84 51 DATA 21,142,98,203,98,1,1
0
85 52 DATA 9,0,0,0,168,1,141,99
86 53 DATA 193,173,99,183,339,2
52,173,94
87 54 DATA 193,133,203,173,97,1
93,133,204
88 55 DATA 173,98,193,133,205,1
43,1,148
89 56 DATA 9,173,93,183,208,93
183,140
90 57 DATA 293,173,94,183,249,2
24,183,232
91 58 DATA 24,298,40,133,282,14
4,2,238
92 59 DATA 283,183,204,24,105,4
0,133,204
93 60 DATA 144,2,238,205,208,28
0,218,179
94 61 DATA 99,183,24,108,3,141,
99,181
95 62 DATA 144,2,238,94,183,173
,97,183
96 63 DATA 84,183,2,141,97,193,
144,3
97 64 DATA 204,98,193,204,98,18
9,208,181
98 65 DATA 98,32,42,193,141,33,
150,141
99 66 DATA 28,182,148,54,192,14
9,83,192
100 67 DATA 98,32,42,193,141,30,
182,140
101 68 DATA 21,182,86,32,42,193,
140,84
102 69 DATA 183,94,32,42,183,241
,93,187
103 70 DATA 98,32,42,193,201,40,
144,5
104 71 DATA 76,72,178,143,83,203
,32,43
105 72 DATA 108,281,20,144,3,76,
72,178
106 73 DATA 143,28,193,32,28,193
,94,53
107 74 DATA 43,193,281,0,208,3,7
6,72
108 75 DATA 178,141,53,182,242,1
81,193,30
109 76 DATA 43,183,281,0,208,3,7
6,72
110 77 DATA 178,141,57,182,141,1
58,193,172
111 78 DATA 19,182,136,188,0,32,
140,179
112 79 DATA 32,12,188,189,0,208,
0,32
113 80 DATA 140,179,32,43,188,32
,12,189
114 81 DATA 179,17,182,188,0,32,
188,179
115 82 DATA 32,43,188,32,32,188,
188,0
116 83 DATA 148,1,32,140,179,32,
126,184
117 84 DATA 32,247,183,183,28,14
1,121,182
118 85 DATA 96,32,43,183,247,213
,182,240
119 86 DATA 214,182,32,43,183,14
1,110,192
120 87 DATA 240,209,191,30,43,19
9,133,208
121 88 DATA 152,251,32,248,100,0
0,32,43
122 89 DATA 183,241,184,182,142,

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192,192,32
93 82 DATA 42,195,182,209,192,0
81,32,43
94 83 DATA 208,141,142,182,32,1
82,192,94
95 84 DATA 32,43,183,201,40,144
,3,76
96 85 DATA 72,278,72,32,43,198,
281,28
97 86 DATA 144,3,76,72,178,24,1
78,184
98 87 DATA 148,32,248,208,94,32
,125,184
99 88 DATA 32,203,174,32,214,19
4,174,203
100 89 DATA 132,204,32,206,209,1
68,203,184
101 90 DATA 284,148,281,74,98,32
0,32,184
102 91 DATA 173,32,247,183,188,3
0,184,32
103 92 DATA 84,183,1,188,8,189,
0,32
104 93 DATA 186,289,32,120,0,24
0,14,32
105 94 DATA 87,228,32,228,174,3
2,218,198
106 95 DATA 134,251,132,282,84,
182,31,76
107 96 DATA 55,264,189,8,130,10
,32,228
108 97 DATA 184,32,238,238,188,
100,188,231
109 98 DATA 184,202,30,213,203,
144,5,74
110 99 DATA 249,214,185,10,248,
3,78,138
111 100 DATA 228,32,180,200,41,1
81,248,212
112 101 DATA 78,186,228,32,228,1
94,32,158
113 102 DATA 173,32,247,183,188,
28,184,32
114 103 DATA 98,298
115 104 DATA 218

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PROGRAM: PROGRAM 3

READY.

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22 119 REM ENHANCE (PROGRAM 2)
23 120 CO=4959:CO=4960:CO=4961
24 28:CO=4962:CO=4963
25 128 ST=4949:ST=4957:ST=491
26 24:CO=4978:ST=4979:CO=4982
27 4
28 195 REM=4955:RE=4952:REM RE
29 REM=4950
30 128 BYE NO:53248,54256,26400
31 BYE NO:53248,53872,54256:CO
32 0:55296,14848,812
33 188 BYE NO:12288,8,0:REM "8"
34 REM = " "
35 179 BYE NO:12288:REM DATA OT
36 ORS
37 188 BYE CO:14304:REM CHAS CO
38 TA
39 188 BYE NO:1824,1808,0:REM C
40 240:1808:8
41 220 FORS 50002:IFORS 52007:IF
42 IFOR40:12
43 200 BYE NO:1:REM SET PAGE CH
44 ANCHOR
45 220 GOTO 5000:REM START PROC

```

```

123 100
124 248 REM ENHANCE TO PRINT CHA
125 RACTED
126 281 BYE XY:2,7:BYE ME:MOON.
127 HEIGHT:STP:0,0,0
128 281 FORS 5-1:73:LEFTST:1
129 278 CO=8108:TECHS:8,11:88-82
130 118Y
131 293 SET CO:14304:IFOR8:BYE
132 8:BYE PC:REM B:SETLMS
133 88 899
134 1000 REM SHOW HOW TO USE
135 1018 FORS:CO=8,8:FORS:CO=8,4
136 4:FORS:8-1
137 1028 TECHS="YOUR COMPILER"
138 848:798:8:IFOR8:8:REMOR8:CO=8
139 4:FORS:8:8
140 1038 TECHS="ELEMENTS":8,8,7,7
141 4:MOON:8:HEIGHT:1:CO=8:CO=8
142 8:8:8:8
143 1048 REM:7:8:8:8:8:4:8:HEIGHT:
144 2
145 1058 REM:2:"ENHANCE"
146 1068 FORS 1:1:1:1:1:1:1:1:1:1:1:1
147 7:1:1:1:1:1:1:1:1:1:1:1:1:1:1:1
148 7:1:1:1:1:1:1:1:1:1:1:1:1:1:1:1
149 7:1:1:1:1:1:1:1:1:1:1:1:1:1:1:1
150 7:1:1:1:1:1:1:1:1:1:1:1:1:1:1:1
151 7:1:1:1:1:1:1:1:1:1:1:1:1:1:1:1
152 7:1:1:1:1:1:1:1:1:1:1:1:1:1:1:1
153 7:1:1:1:1:1:1:1:1:1:1:1:1:1:1:1
154 7:1:1:1:1:1:1:1:1:1:1:1:1:1:1:1
155 7:1:1:1:1:1:1:1:1:1:1:1:1:1:1:1
156 7:1:1:1:1:1:1:1:1:1:1:1:1:1:1:1
157 7:1:1:1:1:1:1:1:1:1:1:1:1:1:1:1
158 7:1:1:1:1:1:1:1:1:1:1:1:1:1:1:1
159 7:1:1:1:1:1:1:1:1:1:1:1:1:1:1:1
160 7:1:1:1:1:1:1:1:1:1:1:1:1:1:1:1
161 7:1:1:1:1:1:1:1:1:1:1:1:1:1:1:1
162 7:1:1:1:1:1:1:1:1:1:1:1:1:1:1:1
163 7:1:1:1:1:1:1:1:1:1:1:1:1:1:1:1
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172 7:1:1:1:1:1:1:1:1:1:1:1:1:1:1:1
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182 7:1:1:1:1:1:1:1:1:1:1:1:1:1:1:1
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184 7:1:1:1:1:1:1:1:1:1:1:1:1:1:1:1
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189 7:1:1:1:1:1:1:1:1:1:1:1:1:1:1:1
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191 7:1:1:1:1:1:1:1:1:1:1:1:1:1:1:1
192 7:1:1:1:1:1:1:1:1:1:1:1:1:1:1:1
193 7:1:1:1:1:1:1:1:1:1:1:1:1:1:1:1
194 7:1:1:1:1:1:1:1:1:1:1:1:1:1:1:1
195 7:1:1:1:1:1:1:1:1:1:1:1:1:1:1:1
196 7:1:1:1:1:1:1:1:1:1:1:1:1:1:1:1
197 7:1:1:1:1:1:1:1:1:1:1:1:1:1:1:1
198 7:1:1:1:1:1:1:1:1:1:1:1:1:1:1:1
199 7:1:1:1:1:1:1:1:1:1:1:1:1:1:1:1
200 7:1:1:1:1:1:1:1:1:1:1:1:1:1:1:1

```

PROGRAM: REMOY LOADER

READY.

```

201 20 R=49152
202 20 FOR=870012
203 25 0=8
204 25 FOR=87708
205 80 REMOY
206 80 FOR=8
207 80 R=41:CO=48:7:8:4
208 80 REMOY
209 80 REMOY:IFOR:ALTRHEPRINT:DAT
210 8 REMOY:ON LINE:1:1:20:1:88
211 100 REMOY
212 110 IFOR:ALTRHEPRINT:REMOY
213 8 REMOY:ON LINE:1:1:20:1:88
214 120 REMOY
215 130 DATA:8,182,74,188,183,
78,727
216 201 DATA:185,32,128,182,188
,28,708
217 202 DATA:141,88,3,238,88,3,17
9,498
218 203 DATA:8,1,30,218,182,180,
0,471
219 204 DATA:77,188,204,87,3,144
,2,897
220 205 DATA:148,32,32,82,182,148
,203,983
221 206 DATA:79,134,1,140,203,28
5,204,1131
222 207 DATA:85,3,289,220,179,84,
3,748
223 208 DATA:28,84,3,208,212,86,
12,850
224 209 DATA:1,12,141,77,3,184,4
,142
225 210 DATA:112,74,74,74,74,170,
189,787

```


LISTINGS

20	311	DATA108	142	13	77	3	84	7	55
08	312	DATA141	25	241	77	3	104	4	143
09	313	DATA174	74	74	74	170			189
0F	314	DATA113	143	13	77	3	84	7	55
1E	315	DATA18	32	48	8	10	84	80	354
24	316	DATA64	64	32	40	76	112	8	484
26	317	DATA68	32	318	0	31	138	3	73
2E	318	DATA188	71	73	183	72	72		32
3E	319	DATA113	8	32	108	178	102		71
47	320	DATA71	185	72	72	31	105		0
47	321	DATA33	188	173	32	348	17		3
4F	322	DATA75	133	108	145	72	13		3
50	323	DATA184	103	185	104	132			103
5A	324	DATA133	108	184	133	185			185
5C	325	DATA177	107	141	64	3	100		3
5C	326	DATA177	108	141	76	3	148		185
5D	327	DATA141	68	3	348	188	141		89
5E	328	DATA182	182	187	141	73	2		3
42	329	DATA188	143	71	3	185	108		141
90	330	DATA72	3	185	118	141	73		3
88	331	DATA64	170	15	34	188	48		3
23	332	DATA133	108	188	0	108	88		3
72	333	DATA133	108	185	10	24	18		8
88	334	DATA33	133	107	188	3	108		71
08	335	DATA33	133	108	138	143	74		3
6D	336	DATA10	34	108	74	3	24		18
04	337	DATA72	3	185	108	185	0		89
08	338	DATA75	3	133	118	182	1		77
6D	339	DATA103	133	121	132	203			34
8C	340	DATA77	185	102	4	102	12		3
64	341	DATA108	212	133	284	208			187
8F	342	DATA61	48	3	183	8	177		89
08	343	DATA41	87	3	208	177	188		133
6F	344	DATA108	180	177	188	133			103
38	345	DATA72	88	3	138	142	188		144
A3	346	DATA87	177	121	121	32	24		3
0C	347	DATA208	140	67	3	152	52		112
78	348	DATA188	188	8	177	251	82		88
08	349	DATA21	142	95	208	204	4		3
88	350	DATA208	143	148	8	173	67		3
38	351	DATA40	188	208	185	90	1		48
8F	352	DATA208	143	148	8	173	67		3
8F	353	DATA208	143	148	8	173	67		3
8F	354	DATA177	107	141	64	3	100		3
8F	355	DATA177	108	141	76	3	148		185
8F	356	DATA141	68	3	348	188	141		89
8F	357	DATA182	182	187	141	73	2		3
8F	358	DATA188	143	71	3	185	108		141
8F	359	DATA72	3	185	118	141	73		3
8F	360	DATA64	170	15	34	188	48		3
8F	361	DATA133	108	188	0	108	88		3
8F	362	DATA133	108	185	10	24	18		8
8F	363	DATA33	133	107	188	3	108		71
8F	364	DATA33	133	108	138	143	74		3
8F	365	DATA10	34	108	74	3	24		18
8F	366	DATA72	3	185	108	185	0		89
8F	367	DATA75	3	133	118	182	1		77
8F	368	DATA103	133	121	132	203			34
8F	369	DATA77	185	102	4	102	12		3
8F	370	DATA108	212	133	284	208			187
8F	371	DATA61	48	3	183	8	177		89
8F	372	DATA41	87	3	208	177	188		133
8F	373	DATA108	180	177	188	133			103
8F	374	DATA72	88	3	138	142	188		144
8F	375	DATA87	177	121	121	32	24		3
8F	376	DATA208	140	67	3	152	52		112
8F	377	DATA188	188	8	177	251	82		88
8F	378	DATA21	142	95	208	204	4		3
8F	379	DATA208	143	148	8	173	67		3
8F	380	DATA40	188	208	185	90	1		48
8F	381	DATA208	143	148	8	173	67		3
8F	382	DATA208	143	148	8	173	67		3
8F	383	DATA177	107	141	64	3	100		3
8F	384	DATA177	108	141	76	3	148		185
8F	385	DATA141	68	3	348	188	141		89
8F	386	DATA182	182	187	141	73	2		3
8F	387	DATA188	143	71	3	185	108		141
8F	388	DATA72	3	185	118	141	73		3
8F	389	DATA64	170	15	34	188	48		3
8F	390	DATA133	108	188	0	108	88		3
8F	391	DATA133	108	185	10	24	18		8
8F	392	DATA33	133	107	188	3	108		71
8F	393	DATA33	133	108	138	143	74		3
8F	394	DATA10	34	108	74	3	24		18
8F	395	DATA72	3	185	108	185	0		89
8F	396	DATA75	3	133	118	182	1		77
8F	397	DATA103	133	121	132	203			34
8F	398	DATA77	185	102	4	102	12		3
8F	399	DATA108	212	133	284	208			187
8F	400	DATA61	48	3	183	8	177		89
8F	401	DATA41	87	3	208	177	188		133
8F	402	DATA108	180	177	188	133			103
8F	403	DATA72	88	3	138	142	188		144
8F	404	DATA87	177	121	121	32	24		3
8F	405	DATA208	140	67	3	152	52		112
8F	406	DATA188	188	8	177	251	82		88
8F	407	DATA21	142	95	208	204	4		3
8F	408	DATA208	143	148	8	173	67		3
8F	409	DATA40	188	208	185	90	1		48
8F	410	DATA208	143	148	8	173	67		3
8F	411	DATA208	143	148	8	173	67		3
8F	412	DATA177	107	141	64	3	100		3
8F	413	DATA177	108	141	76	3	148		185
8F	414	DATA141	68	3	348	188	141		89
8F	415	DATA182	182	187	141	73	2		3
8F	416	DATA188	143	71	3	185	108		141
8F	417	DATA72	3	185	118	141	73		3
8F	418	DATA64	170	15	34	188	48		3
8F	419	DATA133	108	188	0	108	88		3
8F	420	DATA133	108	185	10	24	18		8
8F	421	DATA33	133	107	188	3	108		71
8F	422	DATA33	133	108	138	143	74		3
8F	423	DATA10	34	108	74	3	24		18
8F	424	DATA72	3	185	108	185	0		89
8F	425	DATA75	3	133	118	182	1		77
8F	426	DATA103	133	121	132	203			34
8F	427	DATA77	185	102	4	102	12		3
8F	428	DATA108	212	133	284	208			187
8F	429	DATA61	48	3	183	8	177		89
8F	430	DATA41	87	3	208	177	188		133
8F	431	DATA108	180	177	188	133			103
8F	432	DATA72	88	3	138	142	188		144
8F	433	DATA87	177	121	121	32	24		3
8F	434	DATA208	140	67	3	152	52		112
8F	435	DATA188	188	8	177	251	82		88
8F	436	DATA21	142	95	208	204	4		3
8F	437	DATA208	143	148	8	173	67		3
8F	438	DATA40	188	208	185	90	1		48
8F	439	DATA208	143	148	8	173	67		3
8F	440	DATA208	143	148	8	173	67		3
8F	441	DATA177	107	141	64	3	100		3
8F	442	DATA177	108	141	76	3	148		185
8F	443	DATA141	68	3	348	188	141		89
8F	444	DATA182	182	187	141	73	2		3
8F	445	DATA188	143	71	3	185	108		141
8F	446	DATA72	3	185	118	141	73		3
8F	447	DATA64	170	15	34	188	48		3
8F	448	DATA133	108	188	0	108	88		3
8F	449	DATA133	108	185	10	24	18		8
8F	450	DATA33	133	107</					

LISTINGS

710	REP REP	4150	AND JMP BACK TO MAIN ROUTINE.	4950	END WORKING
712	END OVERLAY	4152		4952	END TESTFILE
714		4154	OVERLAY LTA 00	4954	END TESTFILE
716		4156	LTA JZERENNOE, Y	4956	
718		4158	REP REP	4958	LTA JZERENNOE
720	JZERO CHARACTER IN TESTFILE	4160	RCC REPREP	4960	END WORKING
722		4162	REP REP	4962	
724		4164	PRINTS LTA JZERENNOE, Y	4964	WORKING
726	LET IN	4166	LTA 00	4966	
728	STA TESTFILE, Y	4168	END JZERENNOE, Y	4968	
730		4170		4970	
732	CONVERT ASCII INTO SCREEN CODE.	4172		4972	LTA JZERENNOE
734		4174		4974	END WORKING
736	END WORK	4176		4976	
738	REP REP	4178		4978	LTA JZERENNOE
740	END REP	4180	DELETION & OVER LEFT ROUTINE	4980	END WORKING
742	REP REP	4182	IF END OF SCREEN, EXIT.	4982	
744	JZERO CASE	4184		4984	WORKING
746	JZERO CASE	4186		4986	ACCOMPLISH AND TEST IT.
748	REP REP	4188		4988	IF OVER, EXIT.
750	END REP	4190		4990	
752	END REP	4192		4992	
754	END REP	4194		4994	F.L.A
756	END REP	4196		4996	END REP
758	END REP	4198		4998	END WORKING
760	END REP	4200		5000	
762	PRINT BRACKET OVER SCREEN.	4202		5002	PRINT A SPACE OVER LETTER
764	PRINT STA JZERENNOE, Y	4204		5004	
766	LTA JZERENNOE, Y	4206		5006	LTA 00
768		4208		5008	LTA 00
770		4210		5010	STA TESTFILE, Y
772	ADVANCE TO NEXT PRINT POSITION	4212		5012	END WORKING
774		4214		5014	
776	WORKING LTA JZERENNOE	4216		5016	LTA 00
778	END WORKING	4218		5018	LTA 00
780	END WORKING	4220		5020	STA JZERENNOE, Y
782	END WORKING	4222		5022	
784	END WORKING	4224		5024	PRINT JWP QUERY
786	END WORKING	4226		5026	
788	END WORKING	4228		5028	
790	END WORKING	4230		5030	END TEST
792	END WORKING	4232		5032	END WORKING
794	END WORKING	4234		5034	
796	END WORKING	4236		5036	
798	END WORKING	4238		5038	
800	END WORKING	4240		5040	
802	END WORKING	4242		5042	
804	END WORKING	4244		5044	
806	END WORKING	4246		5046	
808	END WORKING	4248		5048	
810	END WORKING	4250		5050	
812	END WORKING	4252		5052	
814	END WORKING	4254		5054	
816	END WORKING	4256		5056	
818	END WORKING	4258		5058	
820	END WORKING	4260		5060	
822	END WORKING	4262		5062	
824	END WORKING	4264		5064	
826	END WORKING	4266		5066	
828	END WORKING	4268		5068	
830	END WORKING	4270		5070	
832	END WORKING	4272		5072	
834	END WORKING	4274		5074	
836	END WORKING	4276		5076	
838	END WORKING	4278		5078	
840	END WORKING	4280		5080	
842	END WORKING	4282		5082	
844	END WORKING	4284		5084	
846	END WORKING	4286		5086	
848	END WORKING	4288		5088	
850	END WORKING	4290		5090	
852	END WORKING	4292		5092	
854	END WORKING	4294		5094	
856	END WORKING	4296		5096	
858	END WORKING	4298		5098	
860	END WORKING	4300		5100	
862	END WORKING	4302		5102	
864	END WORKING	4304		5104	
866	END WORKING	4306		5106	
868	END WORKING	4308		5108	
870	END WORKING	4310		5110	
872	END WORKING	4312		5112	
874	END WORKING	4314		5114	
876	END WORKING	4316		5116	
878	END WORKING	4318		5118	
880	END WORKING	4320		5120	
882	END WORKING	4322		5122	
884	END WORKING	4324		5124	
886	END WORKING	4326		5126	
888	END WORKING	4328		5128	
890	END WORKING	4330		5130	
892	END WORKING	4332		5132	
894	END WORKING	4334		5134	
896	END WORKING	4336		5136	
898	END WORKING	4338		5138	
900	END WORKING	4340		5140	
902	END WORKING	4342		5142	
904	END WORKING	4344		5144	
906	END WORKING	4346		5146	
908	END WORKING	4348		5148	
910	END WORKING	4350		5150	
912	END WORKING	4352		5152	
914	END WORKING	4354		5154	
916	END WORKING	4356		5156	
918	END WORKING	4358		5158	
920	END WORKING	4360		5160	
922	END WORKING	4362		5162	
924	END WORKING	4364		5164	
926	END WORKING	4366		5166	
928	END WORKING	4368		5168	
930	END WORKING	4370		5170	
932	END WORKING	4372		5172	
934	END WORKING	4374		5174	
936	END WORKING	4376		5176	
938	END WORKING	4378		5178	
940	END WORKING	4380		5180	
942	END WORKING	4382		5182	
944	END WORKING	4384		5184	
946	END WORKING	4386		5186	
948	END WORKING	4388		5188	
950	END WORKING	4390		5190	
952	END WORKING	4392		5192	
954	END WORKING	4394		5194	
956	END WORKING	4396		5196	
958	END WORKING	4398		5198	
960	END WORKING	4400		5200	
962	END WORKING	4402		5202	
964	END WORKING	4404		5204	
966	END WORKING	4406		5206	
968	END WORKING	4408		5208	
970	END WORKING	4410		5210	
972	END WORKING	4412		5212	
974	END WORKING	4414		5214	
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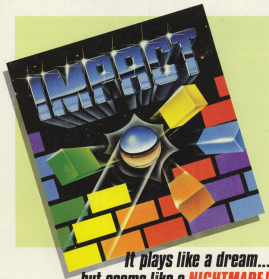
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