

JAN '86

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UK EINSTEIN USER GROUP  
NEWSLETTER

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EDITORIAL

Here we are again! A new year, a new Editor and hopefully lots of new ideas for you. But first I would like to thank William (Robby) Burns for all the hard work and effort he has put in to get the UKEUG off the ground and in making this newsletter the success that it is. THREE CHEERS FOR ROBBY

I only hope I can keep up the good work. We also wish you luck in the Middle East and hope you will think of us when you are in the sun and we are freezing our peripherals off. O.K now down to business, you may have noticed that this editorial is not in two columns, when I can get the control codes right the columns will be back (allright the truth is I did not think I would have enough to say to fill two columns, besides the less I say the more space for you to fill. Hint, Hint ).

Last month we left you with a taster of the MANDELBROT SET in this issue there is more plus an explanation of what it is all about. Also our first ( of many ? ) hardware project. Connect your Einstein to the outside world and see if your batteries need recharging. Speaking of the World that's here as we promised, we do keep our promises ( who mentioned membership cards ), this month part one with all the heavy typing and next month we add the stripes. Plus so much more that if I list it there will not be room to print it, including a reply from TATUNG UK to our question from last month.

We also have a new service for you, as from this issue a disk will be available each month containing all the listings from the current issue I.E Feb's disk will contain Feb's listings. Each disk will cost £6.50 inc p&p. The first disk (Jan) will be a bonus disk containing ALL of the listings published to date.

Right that's all I can think of for now (see two columns would look silly stuck at the top of the page), except for a few reminders.

Our new address, KEITH STOKES  
Hillcroft  
Codmore Hill  
Pulborough  
West Sussex  
RH20 1BQ  
Tel: 07982-2399

If you have a program, even if it charts the sex life of rare frogs, then send it in because someone somewhere is looking for one just like it.

And finally,

The views expressed in this newsletter are those of the contributors not TATUNG UK.

SIDE PRESS SIDE PRESS SIDE PRESS SIDE PRESS SIDE PRESS SIDE PRESS

The SPECTRUM EMULATOR is alive and well.

Not a lot is known yet but here are the details so far.

It comes with software on disk to enable running selected SPECTRUM SOFTWARE ( NOT INCLUDED? ) so far about 20 titles are available including THE HOBBIT. The system allows you to SAVE onto disk the programme as is or at any time whilst playing.

COST : £45.00

WHEN : MID TO END FEBRUARY

WHERE: SCREENS and TATUNG UK

Watch this space for further details as and when available.



Last month we asked if the Einstein could be upgraded to the standard of any future model. The following reply has been received from TATUNG UK LTD.

"There is a company at present completing work on a facility to up-grade the RAM in the Einstein. As I understand it the up-grade could be up to 512K but I must stress that it is not a Tatung product and we cannot control its release. As soon as I know more, I will pass this on to you.

I have also been asked about a possible new machine and, like any progressive company that intends to stay in the computer business, we are always looking at new products. We have just produced our TPC6000 which is our IBM 'lookalike' which runs CCP/M, CP/M86 and MSDOS and will soon be launching the TPC7000 which is our multi-user system.

We do have a new Einstein on the drawing board and, if this does materialise, it will run existing Einstein software. The main difference would be in the video display which would produce very high resolution. I must stress, however, that this product does not yet exist and MAY not be marketed in this country."

DAVID M. BELL

## PATTERNS OF CHAOS by Peter Moon

### THE MANDELBROT SET

"The Mandelbrot set broods in silent complexity at the centre of a vast sheet of numbers called the complex plane. When a certain operation is applied repeatedly to the numbers, the ones outside the set flee to infinity. The numbers inside remain to drift or dance about. Close to the boundary minutely choreographed wanderings mark the onset of instability. Here is an infinite regress of detail that astonishes us with its variety, its complexity and its strange beauty".

So wrote A.K. Dewdney, and I can find no better words to describe this structured marvel, discovered only a few years ago by mathematician Benoit Mandelbrot.

To keep it short, it is a fact that some non-linear iterative processes are unstable for certain numerical values, and in the region of instability, chaos is manifested. By "non-linear" I mean functions whose graphs are not straight lines, such as powers of  $x$ . By "iterative" I mean a process in which a number is calculated from  $x$ , and the result is fed back as the new value of  $x$  in the same process, and so on repeatedly.

Mathematicians have a habit of borrowing ordinary everyday words like root, map, set, domain, prime and so forth, and using them with very special and precisely defined meanings. Chaos is a precise mathematical term applied to irregular behaviour generated by a deterministic (and therefore calculable) process, as distinct from a truly random and unpredictable process such as the decay of radioactive nuclei. Chaos has an irregular, subtle but ordered structure which may be displayed by suitable mappings. In fact mapping in what mathematicians call the complex plane turns out to be the best way to display and visualise the patterns of instability and chaos.

### IMAGINARY AND COMPLEX NUMBERS

This brings us to the awkward number represented by  $i$ , the square root of  $-1$ . At this point you may well feel like turning to Space Invaders as more manageable and entertaining, but bear with me for half a page and I guarantee you'll find nothing incomprehensible about complex numbers.

The numbers we use in everyday life - real numbers - are single entities (like hats) such as 3.14159,  $-7$ , or 29. A complex number is made up of two parts (like a pair of trousers). By convention, the first part is called the real component, and the other bit, the imaginary component, is just a multiplier for our daunting but useful friend  $i$ . Thus two complex numbers might be  $-3+4i$  and  $2-3i$ .

The rules of complex arithmetic are simple. To add two complex numbers, just

add the real and imaginary parts separately. Thus  $-3+4i$  plus  $2-3i$  is  $-1+i$ . Multiplication is no harder. Remembering school algebra!

$$(-3+4i)(2-3i) = -6+8i+9i-12i^2 = -6-i-12i^2$$

As the awkward  $i$  is  $\sqrt{-1}$  it fortunately squares to give  $-1$ , so the complex product becomes  $-6-i-(-12)$  or simply  $6-i$ .

We can express the size of a complex number as the square root of the sum of the squares of the two parts; in this case  $36-(-1)$  or  $\sqrt{37}$ , which is near enough 6.082.

Painless, wasn't it? Now you know enough about complex arithmetic to write your own computer programmes.

#### THE MANDELBROT SET

If we take a complex number  $Z$  (consisting of course of a real part  $RZ$  and an imaginary part  $IZ$ ), square it, and add a complex constant  $C$  ( $RC+IC$ ), we obtain another complex number. If we put this back into the formula as the new value of  $Z$  and go on doing this (iteration) a great many times, one of two things will happen. Either its size will get very large, or it will not about but still remain at some moderate value. Numbers which do not go screaming off to infinity under this iterative treatment belong to the Mandelbrot set. The best way to visualise them is to plot them on a graph, their real parts on the x-axis and the imaginary parts on the y-axis. This is all that is meant by a "Mapping in the complex plane".

#### PROGRAMMING

Now we are in a position to generate a 2-dimensional picture of the Mandelbrot set on the Einstein. The steps are as follows!

1. Consider a square window on the screen with side 2.5 units long having its south-west corner located at  $x=-2$ ,  $y=-1.25$ . Assuming we have  $192 \times 192$  pixels in this window, calculate the co-ordinates of each pixel and use each pair of co-ordinates as the real and imaginary parts of a complex constant  $C$  to be used in the next step.

2. For every constant in turn, start with  $Z=0$  (that is,  $0+0i$ ) and apply the

process  $Z=Z^2+C$ , in other words square  $Z$  and add  $C$  using the rules of complex arithmetic.

3. Take the result as the new value of  $Z$  and repeat step (2).

4. Do this 100 times, and if at any stage the size of  $Z$  ( $\sqrt{RZ^2 + IZ^2}$ ) exceeds 2, stop iterating and plot the corresponding pixel the same colour as the background. Any complex number which gets this big is guaranteed to be on its way to infinity, so waste no more computer time on it. If  $Z$  survives 100 iterations, colour the corresponding pixel white.

5. Repeat (2) to (4) for every value of  $C$ , i.e. for every pixel in the window.

A programme in BBCBASIC is given below. If you are using a colour monitor you have 192, not 768, pixels to play with. If all the pixels required the full 100 iterations the programme would go through lines 230-290 3.7 million times, and the BASIC interpreter takes 11.5 hours to wade through this. The programme can be speeded up by using fewer pixels, iterating less than 100 times, using a language which is compiled rather than interpreted (such as FORTRAN), or using machine code for the frequently executed lines.

The definition of the picture can be improved, if you have a dot matrix printer capable of bit image mode, by plotting a dot or a blank for every possible position of a single pin on the print head. If you can command 60 dots per inch across an 8" paper width, and can specify a linefeed of 1/60th of an inch, you have the equivalent of  $480 \times 480 = 230,000$  pixels, and the definition is much improved (at the expense of execution time!)

Figure 1 was produced in this way.

```

10 REM *****
20 REM *
30 REM *
40 REM *          PROGRAMME MANDEL3
50 REM *
60 REM *          P.W.H. Moon.    25 December 1985.
70 REM *
80 REM * Version 3.1 for UK Einstein User Group
90 REM *
100 REM *          BBCEASIC
110 REM *
120 REM *****
130 :
140 REM INPUT WINDOW CO-ORDINATES
150 INPUT "XMIN, XMAX, YMIN, YMAX ";XMIN,XMAX,YMIN,YMAX
160 CLS
170 TIME=0
180 DELTAX=(XMAX-XMIN)/767
190 DELTAY=(YMAX-YMIN)/767
200 FOR X=0 TO 767 STEP 4
210 RC=XMIN+X*DELTAX
220 FOR Y=0 TO 767 STEP 4
230 IC=YMIN+Y*DELTAY
240 RZ=0:IZ=0:XCOUNT=0
250 RZNEW=RZ*RZ-IZ*IZ+RC
260 IZNEW=2*IZ*RZ+IC
270 RZ=RZNEW:IZ=IZNEW
280 XCOUNT=XCOUNT+1
290 SIZ=RZNEW*RZNEW+IZNEW*IZNEW
300 IF SIZ>4 THEN 330
310 IF XCOUNT<100 THEN 250
320 PLOT 69,X,Y
330 NEXT Y:NEXT X
350 PRINT TAB(73,2);"MANDEL3";TAB(73,4);"X";TAB(73,5);XMIN;TAB(73,6);XMAX
360 PRINT TAB(73,8);"Y";TAB(73,9);YMIN;TAB(73,10);YMAX
370 PRINT TAB(73,12);"TIME";TAB(73,13);INT(TIME/6000);TAB(73,14);"MINS."
380 END

```

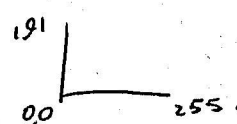
PASCAL

```

x = -1
REPEAT
  xc = x + 1;
  RC = XMIN + x * Delta X;
  Y = -1
  REPEAT
    y = y + 1;
    SIZ = 0;

```

XBAS.



Col.  
 $2 + 11$   
 $2 + 11 \ln(\sqrt{x} + 1)$

# WHAT YOU SHOULD GET

The Mandelbrot looks like a squashed bug, covered with warts and excrescences, each wart resembling but not identical with the parent figure. By choosing more restricted windows in the complex plane you can magnify parts of the border, and it turns out that there are warts on the warts and so ad infinitum. For large magnifications it becomes necessary to use double precision arithmetic to avoid the iteration step falsely flying off to infinity because of small repeated rounding errors.

Space does not permit more than a mention of the beautiful effects which can be obtained by assigning graded colours to the pixels representing values of C which are marginally unstable, just outside the Mandelbrot figure. See A.K. Dewdney's excellent article in "Scientific American" (August 1985), and Howard Oakley's programme in PCW (January 1986).

If you're thinking of using the Einstein's colour graphics, be warned in advance that, in spite of what the book implies, you can't colour all the pixels differently.

There is a closely related subject called Julia sets, and the next issue will continue the theme of Patterns of Chaos for this phenomenon.

After playing with Mandelbrot and Julia sets for two months and having only scratched the surface, I still marvel that a formula as simple as  $Z=Z^2+C$  can give rise to such intricately complex patterns. Beats a Spirograph hollow! (to be cont -ED).



# PLOTTING

Last month we took MARTIN PAGE'S map of Britain and wrote a machine code routine to plot Ireland using the data that he had so painstakingly plotted. This month we have THE WORLD in Basic by MARTIN and if you think the data for Britain was, bad guess how long it took to plot this lot. Those of you who are following this series should enter the machine code routine as it forms an integral part of next weeks modification. If you have the patience then you can convert all the data for the world into HEX and enter it all starting at POINTS to draw the world in double quick time but if you wait till next week then we have a basic routine that will do it for you. Once complete the program you end up with will allow the drawing of anything in super fast time.

```

10 REM*****
20 REM
30 REM      WORLD.
40 REM
50 REM COPYRIGHT:- MARTIN PAGE
60 REM 021 749 5583      26/11/85
70 REM FREE TO EINSTEIN USER CLUB
80 REM      MEMBERS
90 REM*****
100 CLS40:BCOL7:GCOL12
110 FOR X=0 TO 1 STEP 0
120 READ N:IF N=0 THEN X=1:GOTO150
130 READA,B:REM USSR,AFRICA,INDIA
140 FORJ=1TO N:READC,D:DRAW A,B TO C,D:A=C:B=D:NEXTJ
150 NEXT X
160 REM EVEN SMALLER ISLANDS
170 PLOT248,76:PLOT251,75:PLOT250,74
180 PLOT213,94:PLOT214,95:PLOT215,97
190 PLOT58,154
200 PLOT133,120:PLOT134,120
210 PLOT113,124:PLOT114,124:PLOT113,125:PLOT113,127:PLOT127,121
220 PLOT117,124
230 PLOT203,105:PLOT204,105:PLOT204,106
240 FILL125,43,12:REM AFRICA/EUROPE
250 FILL117,144,12:REM SCANDINAVIA
260 FILL63,25,12:REM AMERICIA
270 FILL80,148,12:REM GREENLAND
280 FILL227,41,12:REM AUSTRALIA
290 FILL206,77,12:REM INDONESIA
300 FILL232,82,12:REM INDONESIA
310 FILL211,81,12:REM INDONESIA
320 FILL146,58,12:REM MALAGASY
330 FILL69,151,12:FILL67,160,12:FILL50,163,12: REM CANADIAN ISLAND
340 FILL66,166,12
350 GCOL1:ELLIPSE128,96,170,0.56:GCOL12
360 FILL239,0,1
370 FILL237,191,1
380 FILL0,191,1
10020 DATA323,105,135,113,140,113,142,115,140,119,140,121,143,123,143,123
10030 DATA145,124,145,125,146,124,147,122,148,125,152,125,153,121,153,121
10040 DATA151,119,149,119,145,117,143,116,143,116,144,114,146,111,145,111
10050 DATA149,113,149,120,156,122,157,124,156,128,156,126,154
10060 DATA126,152,129,154,132,155,133,155,134,154,136,154,137,155,139,154
10070 DATA145,157,145,160,148,157,151,162,153,162,153,158,155,154,156,155
10080 DATA155,162,160,159,159,162,157,163,159,163,158,164,164,165,165,167
10085 DATA172,166,172,165,169,161,173,164,177,163,182,164
10090 DATA184,164,186,165,189,163,190,165,194,165,195,164,205,164,206,163
10100 DATA207,164,218,164,219,163,224,163,226,161,219,161,218,160,219,158
10110 DATA221,158,223,157,223,156,220,153,223,151,223,147,224,145,218,150

```

10115 DATA218,153,215,156,214,156,212,154,214,153,212,152  
 10120 DATA211,152,210,153,207,151,206,147,207,146,211,146,212,145,213,140  
 10130 DATA214,140,214,137,213,136,214,135,213,134,212,134,211,133,211,130  
 10140 DATA214,125,212,125,208,130,207,129,206,130,205,131,203,128,204,127  
 10145 DATA207,127,207,125,211,119,210,115,210,113,207,111  
 10150 DATA206,110,204,108,203,109,201,109,200,108,200,105,204,100,204,97  
 10160 DATA202,95,201,97,197,99,197,94,201,88,200,88,195,94,201,88,200,88  
 10165 DATA196,94,195,94,195,99,193,102,191,101,188,109,183,109  
 10170 DATA183,106,178,102,178,92,176,94,174,99,174,100,170,107,167,107,169  
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 10190 DATA112,156,113,147,116,146,116,151,112,151,110,152,109,155,110,157  
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 10200 DATA134,115,133,114,138,106,144,97,148,95,152,97,149,95,152,96,150  
 10210 DATA95,152,95,143,82,140,75,142,73,143,70,141,66,137,64,137,59,131  
 10220 DATA50,125,47,121,48,120,52,118,54,119,56,117,60,115,63,115,68,117  
 10225 DATA70,117,72,115,74,115,78,112,81,112,85,113,87,113,88,112,89,109  
 10230 DATA89,107,91,104,89,103,89,102,90,100,89,95,89,94,90,94  
 10240 DATA91,91,94,91,95,88,98,89,104,89,108,94,113,95,113,97,115,97,117  
 10250 DATA100,120,104,120,109,122,113,122,115,118,117,118,119,116,120,116  
 10260 DATA122,115,124,119,128,116,130,117,131,116,132,117,136,117,136,122  
 10270 DATA135,123,134,122,132,122,131,123,130,123,128,125,130,126,132,127  
 10275 DATA133,128,134,127,140,127,140,129,139,130,138,130  
 10280 DATA137,131,138,133,135,133,133,131,135,131,133,133,130,132,129,131  
 10290 DATA129,127,127,128,126,127,126,124,125,123,118,131,115,130,115,129  
 10300 DATA118,126,119,126,119,124,118,123,119,124,113,130,110,130,109,129  
 10305 DATA108,129,107,128,107,127,105,125,105,124,104,123  
 10310 DATA102,123,100,122,98,123,98,127,99,128,99,129,101,129,102,128,105  
 10320 DATA131,105,132,103,134,105,135,107,136,106,137,105,138,106,139,104  
 10330 DATA141,104,143,103,144,102,144,103,143,103,141,104,140,104,139,102  
 10335 DATA138,101,139,101,140,100,140,99,139,99,138  
 10340 DATA101,139,102,138,103,137,101,136,106,137,103,138,105,139  
 10350 DATA189:REM AMERICAS  
 10360 DATA69,23,67,24,66,23,66,24,62,24,65,25,63,27,63,30,64,32,61,32  
 10370 DATA62,33,61,34,62,35,62,36,61,37,62,38,63,39,63,40,66,41,66,42  
 10380 DATA65,44,66,45,67,44,69,48,70,48,71,52,71,55,74,58,78,59,78,70  
 10390 DATA81,73,81,76,77,80,76,79,74,81,73,80,70,82,68,80,67,81,67,82  
 10400 DATA68,83,66,82,65,83,67,85,67,88,65,88,63,90,61,89,59,92,58,92  
 10410 DATA57,95,54,94,51,95,45,96,44,94,40,94,36,98,37,99,37,100,34,100  
 10420 DATA33,101,33,105,35,107,34,107,32,104,29,104,28,105,28,107,27,108  
 10430 DATA27,111,30,114,30,115,31,116,33,116,35,118,37,118,41,114,41,111  
 10440 DATA42,110,42,111,43,112,43,119,46,119,46,120,49,123,49,124,54,129  
 10450 DATA56,129,56,130,58,132,63,134,61,131,65,132,66,133,61,134,63,135  
 10460 DATA63,136,57,136,61,138,69,138,71,139,71,141,67,145,68,147,65,146  
 10470 DATA64,147,65,149,62,151,60,149,60,147,55,142,55,141,53,139,52,140  
 10480 DATA53,143,50,144,48,146,48,150,55,155,57,157,62,157,62,158,61,157  
 10485 DATA60,158,58,158,58,161,57,161,56,158,55,157,54,158,52,158,51,159  
 10490 DATA49,158,47,159,46,158,44,160,41,160,40,161,35,161,33,160  
 10500 DATA30,162,29,162,27,164,24,163,23,162,17,162,16,160,12,160,14,158,7  
 10510 DATA156,7,153,4,151,8,151,9,152,11,152,12,153,14,153,15,154,21,150  
 10520 DATA21,147,19,145,20,145,20,142,19,141,19,137,15,130,14,129,14,120  
 10530 DATA15,121,15,116,17,111,16,119,17,120,19,118,20,111,22,104,26,101  
 10540 DATA29,101,33,98,37,93,43,91,43,89,39,79,43,68,50,64,51,63,57,28,62  
 10550 DATA24,65,24,66,23,38:REM GREENLAND  
 10560 DATA80,146,85,151,90,153,93,156,94,155,97,155,99,157,100,157,99,158  
 10570 DATA99,159,102,162,105,167,106,167,108,169,105,169,104,170,102,170  
 10580 DATA101,171,97,171,95,169,92,169,91,168,89,170,87,168,86,169,85,169  
 10590 DATA84,168,82,170,79,170,80,170,77,166,75,166,77,165,79,165,80,161  
 10600 DATA78,165,79,162,80,159,79,146,42:REM AUSTRALIA  
 10610 DATA208,45,211,45,213,47,219,47,221,45,221,44,222,45,224,45,222,42  
 10620 DATA223,40,226,39,229,39,233,43,234,43,237,46,237,47,239,49,239,50  
 10630 DATA240,51,240,57,239,58,239,59,238,60,238,61,237,62,237,69,236,70  
 10640 DATA232,62,229,66,230,70,226,70,223,67,222,68,214,60,210,60,207,56  
 10650 DATA207,55,206,54,206,47,205,46,205,45,206,44,207,44

10660 DATA16:REM NEW ZEALAND  
 10670 DATA232,27,247,36,247,37,246,38,246,40,245,35,246,37,243,36,244,34  
 10680 DATA242,33,240,33,240,34,231,28,232,28,240,33,238,29,236,30  
 10690 DATA17:REM INDONESIA  
 10700 DATA193,90,196,87,196,85,198,82,205,75,214,74,218,75,220,74,218,75,  
 10710 DATA13,74,210,75,205,80,205,81,204,80,203,81,200,85,197,87,194,90,23  
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 10740 DATA240,77,236,81,231,83,231,80,229,80,229,83,228,79,228,82,227,81  
 10750 DATA231,79,233,77,232,75,233,75,234,74,235,74,21,206,85,207,82,207  
 10770 DATA81,210,80,212,80,213,84,213,85,219,86,217,85,215,84,214,80  
 10780 DATA216,83,217,79,216,82,218,83,215,78,215,85,213,85,213,91,214,90  
 10790 DATA212,89,207,86,17:REM DEAD SEA?  
 10800 DATA143,133,144,130,145,129,147,127,146,125,147,125,148,124,151,123  
 10810 DATA151,125,150,128,151,129,150,130,149,130,148,131,150,131,150,133  
 10820 DATA149,134,144,133,9:REM MALAGASY  
 10830 DATA147,57,149,69,146,66,145,66,145,64,146,63,146,61,145,60,145,58  
 10840 DATA147,57,23:REM JAPAN  
 10850 DATA218,125,219,125,219,124,220,125,221,128,222,128,222,130,221,131  
 10860 DATA221,133,220,134,221,135,221,136,220,136,218,138,218,137,220,135  
 10870 DATA219,135,220,134,221,133,221,129,219,127,219,126,220,126,220,127  
 10880 DATA26:REM CANADIAN ISLANDS  
 10890 DATA70,149,70,150,71,151,71,153,74,151,72,155,72,156,70,158,70,159  
 10900 DATA67,162,66,161,64,161,63,162,64,164,63,160,65,159,68,158,69,157  
 10910 DATA68,156,69,155,69,154,69,153,66,153,66,154,66,152,68,150,69,150  
 10920 DATA16  
 10930 DATA66,165,68,165,69,166,70,166,71,167,72,168,72,168,73,169,74,170  
 10940 DATA74,171,72,170,71,169,70,170,66,169,67,167,65,167,65,166,13  
 10960 DATA48,162,49,163,50,162,51,161,52,162,53,163,54,163,55,164,53,166  
 10970 DATA52,165,51,164,50,164,49,165,47,163,2,44,163,45,163,46,165  
 11000 DATA1,53,167,55,168,1,56,166,59,170,1,58,166,59,167,1,61,166,62,167  
 11040 DATA2,62,170,64,170,65,171,1,70,163,71,163,10,95,148,96,147,99,149  
 11070 DATA98,150,97,149,96,149,96,150,95,149,96,148,97,148,98,149  
 11070 DATA5,224,33,226,36,226,35,224,37,224,34,223,33,3,243,77,244,77,246  
 10180 DATA79,244,80,4,252,71,253,70,253,73,252,73,252,72  
 11100 DATA13,215,106,215,101,216,100,217,100,216,99,217,99,218,98,217,97  
 11110 DATA220,98,218,96,220,96,218,94,218,92,219,94,3,219,94,221,92,221  
 11120 DATA93,220,94,2,180,91,180,94,181,92  
 11130 DATA6,38,107,39,108,43,107,44,106,43,105,43,106,40,107  
 11140 DATA0

NICAD  
 by P.W.H. MOON.

A PROGRAMME TO MONITOR THE DISCHARGE TESTING OF RECHARGEABLE BATTERIES.

#### INTRODUCTION

Nickel-cadmium rechargeable batteries often do not last as long as their makers claim. Usually they are supposed to stand several hundred charge/discharge cycles, but in practice it seems to be age, rather than amount of use, which limits their useful life. Old cells will usually give about their rated ampere-hour capacity when discharged on test immediately after charging, but after standing for a week following a full charge, only a fraction of the rated ampere-hours may be obtainable.

For critical uses, where premature loss of power would be disastrous, one is faced with the alternatives of discarding a whole set of batteries every couple of years, or testing them periodically to ascertain the amount of recoverable energy remaining after standing for whatever period since charging is appropriate to the circumstances of use.

#### HARDWARE

A discharging test rig was constructed in which up to 20 "D"-size cells are held between conducting spring clips, each cell discharging through a



2.8 ohm 0.5 watt resistor to a common bus bar. This secures for each cell a discharge current of approximately 0.4 amp (the C/10 rate for this type of cell - ie the full charge of 4 A-h is dissipated in 10 hours.) Each cell positive terminal is connected (see circuit diagram) to a rotary switch capable of continuous rotation without limit stops. The switch is rotated in steps of 18 degrees by a simple stepping device actuated by a geared motor rotating continuously at 1 revolution in 9 seconds, which also opens and closes a microswitch once per revolution by a cam on the motor spindle. The stepping switch thus goes through its 20 stations once every 3 minutes, and the microswitch closes for 3 seconds during each period of about 8 seconds when the switch is stationary.

Connections from the microswitch and the stepping switch are taken via 6-core screened cable to a 7-pin DIN plug inserted into the ANALOGUE 1 port (M014) of the EINSTEIN. The microswitch is connected as for the "fire button" of a games joystick, and the battery voltage is applied to Channel 0 of the A/D facility.

#### PROGRAMME

This is written in BBC BASIC (Z80) because this version of BASIC supports procedures. As the programme has several logical sub-sections these are written as procedures rather than subroutines, enabling the programme structure and logic to be more readily understood.

Input data comprises job title, the limiting voltage at which the cell is considered to be discharged, and an A/D voltage conversion factor which defaults to  $3.11E-5$  unless the user thinks he knows a more accurate value.

After input of this data, the programme displays instructions on the screen for setting up the test rig, and waits for a keyboard "GET" to run the monitoring and measurement section. The action of the programme will be apparent in detail from the flowchart, but in outline what happens is as follows.

At every step of the rotary stepping switch the programme goes through a delay loop until closure of the microswitch signals that the switch contact is stationary and measurements may be taken. As there is a certain amount of noise in the measuring circuit in spite of cable screening, the voltage is sampled 100 times and an average value is computed. The programme does not proceed until the opening of the microswitch signals that another switch station is coming up. (Failure to observe this point, and to ensure that the second wait is performed every time irrespective of the path through the flow chart, would result in the main loop of the programme getting out of synchronisation with the stepping switch.)

Every time a cell is measured, the cell number, voltage and cumulative ampere-hours are displayed on the screen, with a reminder of the elapsed time every full cycle of the rotary switch.

When any cell falls below the limiting voltage this regular output of information is suspended (though measurements continue), and an audible warning is given, together with a screen message in red to disconnect the cell concerned.

A rather complicated section of the programme makes sure that normal screen output is not resumed until this instruction has been obeyed, by continuing to monitor the low cell station until the voltage has dropped to just above noise level, showing that the cell has indeed been taken out. When all twenty cells have become discharged and been removed, the final results for all cells are displayed on the screen, and an option to print is offered.

#### CONCLUSIONS

This device and its associated software have proved to be a great saver of time, as well as ensuring that cells on discharge are not run down to harmful levels for lack of attention during a test which lasts about 10 hours. The user is free to occupy himself with other tasks, relying on the system to call his attention when intervention is needed.

Knowing which cells are suspect enables the user to select good ones (a minimum of 10 are required in one particular application) and cells which are consistently poor in performance can be used for less critical purposes.

P.W.H. MOON  
2 Greymouth Close  
Stockton-on-Tees  
Cleveland  
TS18 5LF

```

1 REM *****
2 REM *
3 REM *   PROGRAMME NICAD TO MONITOR *
4 REM *
5 REM *   BATTERY DISCHARGE TEST   *
6 REM *
7 REM *   Version 1.5  27.10.85   *
8 REM *
9 REM *   Copyright P.W.H. Moon   *
10 REM *
11 REM *****
20 ;
30 REM   BBC BASIC (Z80)
50 ;
60 REM CONNECTIONS TO 7-PIN DIN PLUG FOR ANALOGUE 1 PORT M014 ARE AS
   FOLLOWS USING 6-CORE SCREENED CABLE.
70 REM VIEW LOOKING INTO SOCKET OR INTO CONNECTION SIDE OF PLUG.
80 REM SEE EINSTEIN MANUAL PAGE 216.
90 ;
100 ;
110 REM   black +5v 7* U *6 0v white
120 ;
130 REM red channel 1  3*      *1 channel 0 green
140 ;
150 REM   blue Vref   5*      *4 fire 1 yellow
160 REM
170 REM
180 ;
190 REM   BATTERY POSITIVE TO PIN 1
200 REM   "      NEGATIVE TO PIN 6
210 REM   MICROSWITCH TO PINS 2 AND 4
220 REM   CONNECT PINS 2 AND 6 TOGETHER
230 ;
240 REM INITIALISE VARIABLES, DIMENSION ARRAYS, ETC.
250 DATA 2.845, 2.96, 2.91, 2.88, 2.90, 2.89, 2.85, 2.89, 2.85, 2.93,
   2.89, 2.93, 2.98, 2.93, 2.92, 2.82, 2.90, 2.91, 2.95, 2.89
260 DIM R(20),AH(20),STATUS(20),LAST_TIME(20)
270 FOR J=1 TO 20
280 READ R(J)
285 AH(J)=0
290 STATUS(J)=0
300 LAST_TIME(J)=0
310 NEXT J
330 ;
340 REM DISPLAY INITIAL INSTRUCTIONS
350 PRINT TAB(10);"NICAD Version 1.1"
360 PRINT TAB(10);"-----"
370 PRINT
380 INPUT "JOB TITLE ";JOB$
390 INPUT "LIMITING VOLTAGE ";V LIM
400 PRINT "VOLTAGE CONVERSION FACTOR;"
410 PRINT "DEFAULT VALUE=0.00003066"
420 PRINT "ENTER NEW VALUE OR 0 FOR DEFAULT"
430 INPUT "V.C. FACTOR ";K
440 IF K=0 THEN K=0.00003066
450 PRINT
460 PRINT "SET STEPPING SWITCH TO 01"

```

```

470 PRINT "SET STRIKER SO THAT NEXT CLOSURE OF MICROSWITCH WILL OCCUR AT
    POSITION 01"
480 PRINT "START MOTOR AND IMMEDIATELY RUN PROGRAMME BY PRESSING ANY KEY"
490 START$=GET$
500 CLS
510 TIME=0
520 REM START THE MAIN LOOP
530 PRINT
540 NOW=TIME
550 HRS=NOW/360000
560 PRINT "    TIME ELAPSED = ";HRS;" HOURS"
570 PRINT
580 FOR CELL=1 TO 20
590 PROC_VOLTAGE
600 PROC_AMPERE_HOURS
610 REM NEXT STEP DEPENDS ON CELL STATUS
611 REM STATUS 0: NORMAL
612 REM      1: LOW VOLTAGE, STILL IN PLACE
613 REM      2: REMOVED
620 ON STATUS(CELL)+1 GOTO 720,630,780
630 PROC_WARNING
634 REM HAS CELL BEEN REMOVED?
635 IF V>0.1 THEN 780
650 REM CELL HAS BEEN REMOVED; SET STATUS 2
670 CLS
680 COLOUR 132
690 STATUS(CELL)=2
700 SOUND 1,-15,100,0
710 GOTO 780
720 IF V>VLIM THEN 750
730 PROC_WARNING
740 GOTO 780
750 REM DISPLAY INTERIM RESULT IN THE ABSENCE OF STATUS 1 OR 2
760 @%=80002030A
770 PRINT "CELL ";CELL;" VOLTAGE = ";V;" Ah = ";AH(CELL)
780 NEXT CELL
790 REM ARE ALL CELLS DISCHARGED?
800 PROC_STATUS_TEST
810 IF SIGMA=40 THEN 820 ELSE 530
820 PROC_FINAL_DISPLAY
830 IF A$="E" THEN 850
840 PROC_PRINT
850 END
860 :
870 DEF PROC_VOLTAGE
880 REM PROCEDURE MUST BE CARRIED OUT IRRESPECTIVE OF CELL STATUS.
900 REM DELAYS ARE INCLUDED TO ENSURE THAT MICROSWITCH HAS CLOSED BEFORE
    MEASUREMENT AND HAS OPENED BEFORE EXIT FROM PROCEDURE, TO PRESERVE
    SYNCHRONISATION WITH STEPPING SWITCH,
910 :
920 REM WAIT FOR MICROSWITCH TO CLOSE
930 IF ADVAL(0)=1 THEN 970
940 FOR DELAY=1 TO 100: NEXT DELAY
950 GOTO 930
960 :
970 REM SAMPLE 100 READINGS
980 SUM=0
990 FOR J=1 TO 100
1000 V=R*ADVAL(1)
1010 SUM=SUM+V
1020 FOR DELAY=1 TO 10:NEXT DELAY
1030 NEXT J
1040 V=0.01*SUM

```



```

1050 ;
1060 REM WAIT FOR MICROSWITCH TO OPEN
1070 IF ADVAL(0)=0 THEN 1100
1080 FOR DELAY=1 TO 100:NEXT DELAY
1090 GOTO 1070
1100 ENDPROC
1110 ;
1120 DEFPROC_AMPERE_HOURS
1130 REM IF STATUS=1 OR 2, OMIT PROCEDURE
1135 IF STATUS(CELL)=1 OR STATUS(CELL)=2 THEN 1200
1140 REM CALCULATE TIME ELAPSED SINCE LAST MEASUREMENT ON THIS CELL
1150 NOW=TIME
1160 TIME_INCREMENT=(NOW-LAST_TIME(CELL))/360000
1170 LAST_TIME(CELL)=NOW
1180 CURRENT=V/R(CELL)
1190 AH(CELL)=AH(CELL)+CURRENT*TIME_INCREMENT
1200 ENDPROC
1210 ;
1220 DEF PROC_WARNING
1230 STATUS(CELL)=1
1250 CLS
1260 COLOUR 134
1270 DISCHARGE_TIME=TIME/360000
1280 PRINT TAB(8,5);"CELL ";CELL;" VOLTAGE = ";V
1290 PRINT
1300 PRINT TAB(10);"Ah = ";AH(CELL)
1310 PRINT
1320 PRINT TAB(5);"DISCHARGE TIME = ";DISCHARGE_TIME;" HOURS"
1330 PRINT
1340 PRINT TAB(10);"REMOVE CELL ";CELL;" NOW."
1350 SOUND 1,-15,100,-1
1360 ENDPROC
1370 ;
1380 DEF PROC_FINAL_DISPLAY
1390 COLOUR 132
1400 SOUND 1,-15,100,0
1410 @%=80002030A
1420 PRINT "      CELL      Ah"
1430 PRINT
1440 FOR J=1 TO 20
1450 PRINT J,AH(J)
1460 NEXT J
1470 PRINT
1480 INPUT "ENTER P FOR PRINTOUT, E FOR EXIT";A$
1490 ENDPROC
1500 ;
1510 DEF PROC_PRINT
1520 *OPT2
1530 L=LEN(JOB$)
1540 A$=STRING$(L,"-")
1550 PRINT JOB$
1560 PRINT A$
1570 PRINT:PRINT
1580 PRINT "      CELL      Ah"
1590 PRINT
1600 REM PRINT WITH 3 DECIMAL PLACES, 12 PRINT ZONE
1610 @%=80002030A
1620 FOR I= 1 TO 20
1630 PRINT I, AH(I)
1640 NEXT I
1650 *OPT0
1660 PRINT
1670 PRINT TAB(10);"RUN COMPLETE"

```

```

1680 ENDPROC
1690 :
1700 DEF PROC_STATUS_TEST
1710 SIGMA=0
1720 FOR I= 1 TO 20
1730 SIGMA=SIGMA+STATUS(I)
1740 NEXT I
1750 ENDPROC

```

The Maidenhead Locator System  
by Dave West G4SHQ

The basic listing shown whilst probably self explanatory to most computer literate radio amateurs will probably bear a few words of explanation to those not familiar with its objectives. First of all though, credit where credit is due, the program is a collection of routines written by John Morris (GM4ANB), the systems devizor, and others co-written by Jeff Howell (G4BXZ) and Brian Kendal (G3GDU). These articles appeared in Radio Communication Oct 84 and Radio & Electronics World Dec 84 and are used with kind permission of the authors and publications. The way I have converted them to Crystal basic and patched them together is probably a structured programmers nightmare however they work and improvements such as increased error checking and memory economy I'll leave to my readers. Basically the MAIDENHEAD LOCATOR system provides radio amateurs with a means of conveying their own geographical position accurately by radio in a simple manner least likely to misinterpretation. The world map is divided up into squares such that each square has a unique six character reference, two letters two figures and two letters. Each square represents 5 minutes E-W and 2.5 minutes N-S. The program will output this unique locator when given either NATIONAL GRID REF or lat & long. Because the so called "QRA" system (which Maidenhead replaced) could be geographically ambiguous and because the square sizes are different the locator converter routine will only output the first two characters of the Maidenhead locator (10degs lat by 20degs long) and even then is only accurate between 40 to 66 degs North and 12W to 40degsE. The last remaining routine will be of use to contest competitors and users of beam serials in that when given two Maidenhead locators this routine will output Range Bearing and Score between them. The score routine consistant with contest rules works on the 50 Km ring system where a contact on the ring scores low. I hope the program will be of use. For those who have not yet got around to the conversion or typing. I will provide a copy on receipt of a blank formatted disc and return postage for a padded envelope.

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Aylesbury  
Bucks  
HP21 8DG  
0296-33020

```

5 REM MAIDENHEAD LOCATOR SYSTEM
10 REM FROM ROUTINES WRITTEN BY
15 REM GM4ANB,G4BXZ,G3GDU
20 REM SOME CONVERSION BY GM8JUY
25 REM CONVERTED FOR EINSTEIN XBAS
30 REM AND PATCHED TOGETHER BY G4SHQ
35 CLS:PRINT:PRINT:PRINT:PRINT
40 PRINT "    MAIDENHEAD LOCATOR SYSTEM"
45 PRINT "    ====="

```

```

50 FOR I=1 TO 3000:NEXT:CLS
55 CLEAR
60 DIM T(9):CA=65:CS=32:CO=48
65 DEF FN A(I)=ASC(MID$(M$(J),I,1))-65
70 DEF FN B(J)=(J-INT(J))*60
75 DIM P(2,2),M$(3):M=57.2958
80 DIM BR$(3)
100 PRINT " **** MAIDENHEAD LOCATOR SYSTEM ****":PRINT
110 PRINT " -----MENU-----"
120 PRINT
130 PRINT "National Grid Ref. to Locator          1":PRINT:PRINT
140 PRINT "Lat. & Long. to Locator                    2":PRINT:PRINT
150 PRINT "Locator to Lat. & Long.                        3":PRINT:PRINT
160 PRINT "QRA to Locator                                4":PRINT:PRINT
170 PRINT "Range,Bearing and Score (Loc to Loc)          5":PRINT:PRINT
180 PRINT "Quit program                                  6":PRINT
190 PRINT "      <SELECT A ROUTINE 1-6>"
200 LET K=INCH:IF K<49 OR K>54 THEN 200
210 BEEP 1:ON ERR GOTO 210
220 IF K=49 GOTO 1000
230 IF K=50 GOTO 2000
240 IF K=51 GOTO 3010
250 IF K=52 GOTO 4000
260 IF K=53 GOTO 5000
270 IF K=54 THEN OFF ERR:CLS:END
1000 REM *** NGR TO LOC ***
1020 CLS:PRINT:PRINT " NGR TO LOCATOR CONVERSION"
1030 PRINT:PRINT:PRINT " type in your NATIONAL GRID REFERENCE"
1035 PRINT:PRINT " (example NS 363 345 gives IO75QN) ":PRINT:LET
    N$=INCH$(10)
1040 GOSUB 1150
1050 IF EF>.5 GOTO 1140
1060 T2=INT(N):T3=INT(600*(N-T2)+.5)/10
1070 PRINT:PRINT "          GIVES LOCATION":PRINT:PRINT " ";T2;"
    degrees ";T3;" minutes North"
1080 T1=ABS(E):T2=INT(T1):T3=INT(600*(T1-T2)+.5)/10
1090 T$="East":IF E<0 THEN T$="West"
1100 PRINT " ";T2;" degrees ";T3;" minutes ";T$:IF K=51 THEN GOTO 1120
1110 GOSUB 1380:PRINT:PRINT:PRINT:TCOL 4,15:PRINT TAB(5);"MAIDENHEAD
    LOCATOR=";CHR$(34);L$;CHR$(34);" ";TCOL 15,4
1120 PRINT:PRINT "< P to print or any other key for menu>"
1122 DD$=INCH$:IF DD$="" THEN 1120
1124 IF DD$="P" THEN PRINT CHR$(1):GOTO 1122
1130 CLS:GOTO 110
1140 BEEP 1:PRINT:PRINT " Sorry,that is not a valid NGR":GOTO 1030
1150 LET PT=1:LET L=LEN(N$):LET EF=0
1160 FOR J=1 TO 9
1170 LET T1=-1:IF PT<=L THEN LET T1=ASC(MID$(N$,PT,1))
1180 LET PT=PT+1:IF T1=CS GOTO 1170
1190 LET T(J)=T1:NEXT
1200 FOR J=1 TO 2
1210 T(J)=T(J)-CA:IF T(J)<0 OR T(J)>26 OR T(J)=8 THEN EF=1
1220 IF T(J)>8 THEN T(J)=T(J)-1
1230 NEXT J
1240 FOR J=3 TO 8
1250 T(J)=T(J)-CO:IF T(J)<0 OR T(J)>9 THEN EF=1
1260 NEXT J
1270 IF T(9)>0 THEN EF=1
1280 IF EF>.5 THEN RETURN
1290 TA=INT(T(1)/5):TC=T(1)-5*TA
1300 TB=INT(T(2)/5):TD=T(2)-5*TB
1310 E=-1000+500*TC+100*TD+10*T(3)+T(4)+T(5)/10
1320 N=1900-500*TA-100*TB+10*T(6)+T(7)+T(8)/10

```



```

1330 T1=(N+5548.79)/6371.28
1340 T2=2*ATN(EXP((E-400)/6389.70))
1350 E=ATN(-COS(T2)/(COS(T1)*SIN(T2)))*180/PI-2
1360 LET N=SIN (T1)*SIN (T2);LET N=ATN (N/SQR(1-N*N))*180/PI
1370 RETURN
1380 LET N=N/180+.5;LET E=E/360+.5;LET L$="";LET T=CA;LET F=18;GOSUB 1400
1390 LET T=CO;LET F=10;GOSUB 1400;LET T=CA;LET F=24;GOSUB 1400;RETURN
1400 LET N=F*(N-INT(N));LET E=F*(E-INT(E));LET L$=L$+CHR$(T+E)+CHR$(T+N)
1410 RETURN
2000 CLS;PRINT;PRINT "Lat.& Long. to Locator Conversion"
2010 PRINT;PRINT "INPUT L&L eg 5534N00435W gives I075QN";PRINT
2020 LET LTD$=INCH$(2);IF EVAL(LTD$)<0 OR EVAL(LTD$)>90 THEN BEEP 1:
GOTO 2000
2030 LET LTM$=INCH$(2);IF EVAL(LTM$)<0 OR EVAL(LTM$)>60 THEN BEEP 1:
GOTO 2000
2040 LET LT$=INCH$(1);IF LT$="N" OR LT$="S" THEN GOTO 2050ELSE BEEP
1;GOTO 2000
2050 LET LGD$=INCH$(3);IF EVAL(LGD$)<0 OR EVAL(LGD$)>180 THEN BEEP 1;GOTO
2000
2060 LET LGM$=INCH$(2);IF EVAL(LGM$)<0 OR EVAL(LGM$)>60 THEN BEEP 1:
GOTO 2000
2070 LET LG$=INCH$(1);IF LG$="E" OR LG$="W" THEN GOTO 2080ELSE BEEP
1;GOTO 2000
2080 N=EVAL(LTD$)+(EVAL(LTM$)/60)
2090 E=EVAL(LGD$)+(EVAL(LGM$)/60)
2100 IF LG$="W" THEN E=-E
2110 IF LT$="S" THEN N=-N
2120 REM gotd.maths.line ****
2130 GOTO 1110
3000 REM LOC TO L&L
3010 CLS;J=3
3020 PRINT;PRINT " MAIDENHEAD LOCATOR TO L&L";PRINT " (eg I075QN
gives 5534N 00438W)"
3030 PRINT;PRINT " ENTER LOCATOR ";
3040 M$(J)=INCH$(6);GOSUB 5330
3050 D=FN A(2)*10+FN A(4)-73
3060 M=FN A(6)*2.5+1.25
3070 PRINT;PRINT
3080 PRINT " Latitude =";
3090 IF D>=0 THEN PRINT D;INT(M);FN B(M);"N"
3100 IF D<0 THEN PRINT -1-D;INT(60-M);60-FN B(M);"S"
3110 D=FN A(1)*20+FN A(3)*2+INT(FN A(5)/12)-146
3120 M=INT(FN B(FN A(5)/12)*2+5.01)/2
3130 PRINT;PRINT " Longitude =";
3140 IF D>=0 THEN PRINT D;INT(M);FN B(M);"E"
3150 IF D<0 THEN PRINT -1-D;INT(60-M);60-FN B(M);"W"
3160 PRINT
3170 GOTO 1120
4000 REM *** QRA TO LOC ***
4010 CLS;PRINT;PRINT;PRINT "This routine is valid only between";
PRINT " 40-66N & 12-40E";PRINT
4030 CA=ASC("A");CO=ASC("O");V1=9.01-CA/10;V2=13.01-CA/10
4040 PRINT "Input QRA Square (Ltr prefix only) ";PRINT;PRINT " (eg XJ
gives IN79)";PRINT;S$=INCH$(2);PRINT ;PRINT
4050 E=V1+ASC(MID$(S$,1,1))/10;IF E>11 THEN E=E-2.6
4060 N=V2+ASC(MID$(S$,2,1))/10
4070 F=CO+10*(E-INT(E));O=CO+10*(N-INT(N));E=E+CA;N=N+CA
4080 PRINT"NEW Square=";CHR$(34);CHR$(E);CHR$(N);CHR$(F);CHR$(O);CHR$(34)
;PRINT ;GOTO 1120
5000 REM BEARING DISTANCE AND SCORE
5010 REM J.M.HOWELL JULY 84
5020 GOSUB 5410
5030 PRINT " HOME STATION ";

```

```

5040 J=1
5050 GOSUB 5300
5060 PRINT
5070 PRINT " DISTANT STATION ";
5080 J=2
5090 GOSUB 5300
5100 A=P(2,1)/M
5110 B=P(2,2)/M
5120 L=(P(1,2)-P(1,1))*2/M
5130 E=SIN(A)*SIN(B)+COS(A)*COS(B)*COS(L)
5140 D=ATN(SQR(1-E*E)/E)
5150 IF D<0 THEN D=180/M+D
5160 IF A<>B THEN F=90*(1+ABS(A-B)/(A-B))
5170 IF L<>0 THEN F=90+M*ATN((SIN(A)*E-SIN(B))/(SIN(L)*COS(A)^2))
5180 IF SIN(L)<0 THEN F=F+180
5190 GOSUB 5410
5200 PRINT
5210 PRINT "From ";M$(1);" To ";M$(2)
5220 PRINT
5225 BR$=STR$(INT(F));IF F<100 THEN BR$="0"+MID$(BR$,2,2)
5230 PRINT "Bearing = ";BR$;" Degs "
5240 PRINT
5250 R=6365.11*D
5260 FMT 4,1;R=INT(R*100)/100;PRINT "Range =",R;" Kms (";(R/8)*5;" Miles)"
5270 PRINT
5280 PRINT "Score =",799-2*INT((20000-R)/50);" Pnts."
5290 GOTO 1120
5300 LET M$(J)=INCH$(6)
5310 CLS
5320 PRINT
5330 FOR I=1 TO 2
5340 A=FN A(I)
5350 B=FN A(I+2)+17
5360 C=FN A(I+4)+.5
5370 IF A<0 OR A>18 OR B<0 OR B>9 OR C<0 OR C>24 THEN BEEP 1;RETURN
5375 IF K=51 THEN RETURN
5380 P(I,J)=A*10+B+C/24-90
5390 NEXT I
5400 RETURN
5410 CLS
5420 PRINT
5430 PRINT "MAIDENHEAD LOCATOR"
5440 PRINT
5450 RETURN

```

## SCREEN PLOT 2

This is last months machine code programme which has been slightly modified to allow it to plot any length of data. If you type it in this month you will be ready for part two of the World next month.

```

1      ;MACHINE CODE SCREEN PLOT USING
2      ;MOS ROUTINES
3      ORG 8000H
4      LOAD 8000H
5
6      DON: EQU 0FB8H      ;SCHPAD LINE
7      DOF: EQU 0FBA9H    ;TYPE LOCATIONS
8      DON2: EQU 0FBAAH
9      DOF2: EQU 0FBABH
10     PL2X: EQU 0FB96H    ;X,Y COORDINATE
11     PL2Y: EQU 0FB98H    ;LOCATIONS
12     LD A,0CH           ;CLEAR
13     RST 8
14     DEFB 9EH           ;SCREEN
15     LD A,0FFH
16     LD (DON),A         ;AND
17     LD A,0
18     LD (DOF),A
19     LD (DON2),A        ;LINE
20     LD (DOF2),A        ;TYPE
21     LD BC,(POINTS)     ;NO OF POINTS TO PLOT
22     LD HL,POINTS+2     ;DATA ST
23     LD A,B             ;TEST FOR END
24     OR C
25     RET Z
26     LD A,(HL)          ;START
27     LD (PL2X),A        ;SET UP START
28     INC HL
29     LD A,(HL)
30     LD (PL2Y),A        ;POINTS
31     INC HL
32     JR LOAD            ;JUMP
33     RST 8
34     DEFB 0C8H
35     LD IX,(PL2X)        ;TO HERE.MOVE
36     LD IY,(PL2Y)        ;START TO REGS
37     LD DE,PL2X          ;LOAD NEXT POINT
38     LDI                ;INTO SCRATCH PAD
39     LD DE,PL2Y
40     LDI
41     LD A,B             ;SEE IF THAT IS ALL
42     OR C
43     JR NZ,DISP         ;NO: DO IT AGAIN
44     DEC HL
45     DEC HL
46     LD C,(HL)
47     INC HL
48     LD B,(HL)
49     INC HL
50     JR LOOP
51     JP 0055H
52     POINTS: DEFW 0000   ;DATA START
53     END

```



## REVIEWS

PROGRAMME:- Graphic Screen Dump  
REVEIUED BY:- "LITTLE JOHN"  
PRODUCED BY:- Force 4 Computers Ltd  
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Tel:- (0705) 839135

Whilst getting lost in Portsmouth recently driving my recycled Citroen 2CV6, I happened to look up through the hole in the roof and there it was, a sign in a window three stories up saying "Force 4 Computer Services Ltd". Being the nosey S.O.D that I am I promptly stopped "THE BEAST" and carried it to a convenient parking place between 2 "Rolos" to make it feel embarrassed (alas it had no effect) and walked the short distance to the building the sign was in making sure that if anyone was looking out of the window it looked as if I had got out of one of the snob cars.

The companies offices are in a business centre that is a maze of corridors but with my keen sense of direction I found what I was looking for in 45 minutes flat and very impressed I was too. It was well set out with all types of computers and things (cant spell perihperals) including

Eureka I shouted waking up the chappie with the beard (they all have beards these brainy types don't they). "Can I help you sir" he asked. I looked around to see who he was talking to then realised he had mistaken me for a sir.

What that company does not know about computers is not worth knowing, they answered all my questions without hesitation and I found them extremely helpful. We eventually got on to software and they showed me this screen dump that has been written for the Einstein.

It can be used for colour or monochrome printers and the demo was quite impressive until I ask if it could be used with "Pic Pen". "We can try" they said and try they did. Hmm I thought very helpful people.

After about ten minutes during which there were some very intelligent phrases being used there it was working, we were drawing pictures and printing them. "Would you like to take it home and play with it?"

What could I do exept snatch it out of their hands before they changed their minds. I eventually got home.....a little later than anticipated but who cares and started playing with my new toy.

The disc consists of two programs, one on each side but not having a colour printer I was only interested in the other. There were one or two little bugs but a phone call the next day soon got them sorted out and so far I have used it for drawing plans of buildings and rooms and designed fire alarm systems etc. I think it is excellent and the beauty of it is that it can print in double size.

Just one or two moans,

- 1) I wish it were possible to save on disk what you print.
- 2) I wish that when I grow a beard it would make me more intelligent.

little john

NAME\*MATTHEW BRADBURY  
AGE\*10  
GAME\*SPACE TRAP  
SOFTWARE\*SOLO  
PRICE\*12.95

Space Trap, is the sequel game to Time Trap, with even more complex graphics and a special scrolling effect that has to be seen to be believed! The idea of the game is similer to Time Trap, except instead of walking from screen to screen you walk from planet to planet. There are seven planets in all and you have to try and get as many crystals as you can without

getting caught by various hazards. On each of the seven planets, you are always near a time zone, which you can walk into to go onto the next planet. When you start to walk about on one of the planets you will find that when you have walked a certain distance the screen will suddenly scroll along a little to uncover another part of planet to walk on. It is quite fastenating to watch!

The difficult thing about Space Trap is that as you can only see a certain bit of the planet at a time you do not know what is going to come next. It could be a skull or it could be a crystal, who knows? So Solo software have added an extra feature of being able to scroll the screen along a certain way so you can have a look, to do this you use the cursor keys. Overall I think Space Trap is a great game and well worth the money.

### HINIS and IIPS

I am certain that we have all, like Steve Petersen last month, lost the system tracks from one disk or another. Apart from the inconvenience it can also be very worrying. But it is simple to repair.

Go into MOS, insert a disk with system tracks and type R 1000 3800 <ENTER>, then put in the faulty disk type W 1000 3800 <ENTER>, this will write the system tracks back to the faulty disk which should now function properly.

```
*****
X                               WARNING                               X
X                                                                 X
X IT IS AN INFRINGEMENT OF COPYRIGHT TO LEND OR GIVE A DISK TO ANYONE X
X                               UNLESS THE SYSTEM TRACKS HAVE BEEN REMOVED X
X                                                                 X
*****
```

### JIMALL EIX II (or possibly not)

This is your column to ask questions and give answers

Printers: I'm told there have been several occurrences of straight-forward FAULTS in the output port. (The Z80 PIO). The only easy test is to try another printer. If faulty, refer to supplier.

Windswept: The Commodore 64 uses a 6502 CPU which is completely different from the Z80, making a simulation very awkward. The best way is probably to stick with the Pascal and write a machine-code function to read the Einstein A/D converters which are ports 38 through 3F. This may even be possible using a 'IN' statment depending on the Pascal used.

Paul Burgess

### CONVERSATIONS

We do not know much about the Einstein Speech Synthesiser but watch this space for further information.

### AUTOEX

A new improved version of Autoex should be available shortly.

### GRONKS

There appears to be a bug in this game which causes the screen to freeze after a long session. Is this general or only on a few copies.

### MORE BUGS

Do you have any programmes which show signs of infestation if so let us know so that we can warn other users.

## HELP

Tony Robson would like help in choosing an Assembler programme if you can help give Tony a ring on Bexhill-on-sea (0424)222226.

## DATA DATA DATA

A lot of our programmes contain large amounts of data statements (look at the world), if having typed a program in and it does not work as expected then please CHECK the data statements CAREFULLY as most problems will be found in this way.

## PREVIEW

### NEXT MONTH

#### SYSTEM 5

WORLD part 2

AUTO BAUD RATE

PATTERNS OF CHAOS part 2

These are some of the items in preparation for future issues.

## EDUCATIONAL SOFTWARE

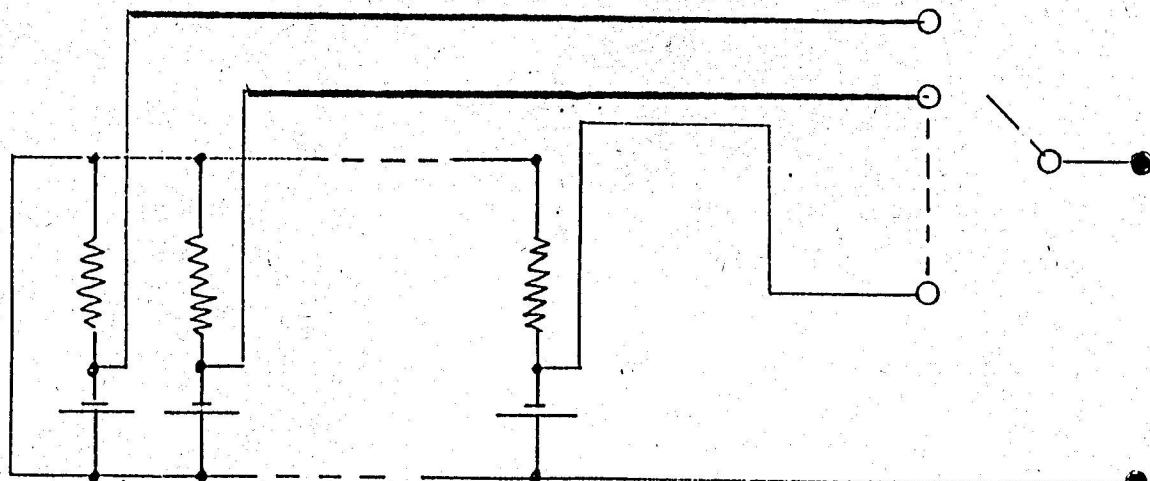
TALKING MICRO'S

ADVENTURES

MOS/DOS CALLS

MODEM REPORT

Any material or thoughts on the above or any other subject which you would like included then send it in.



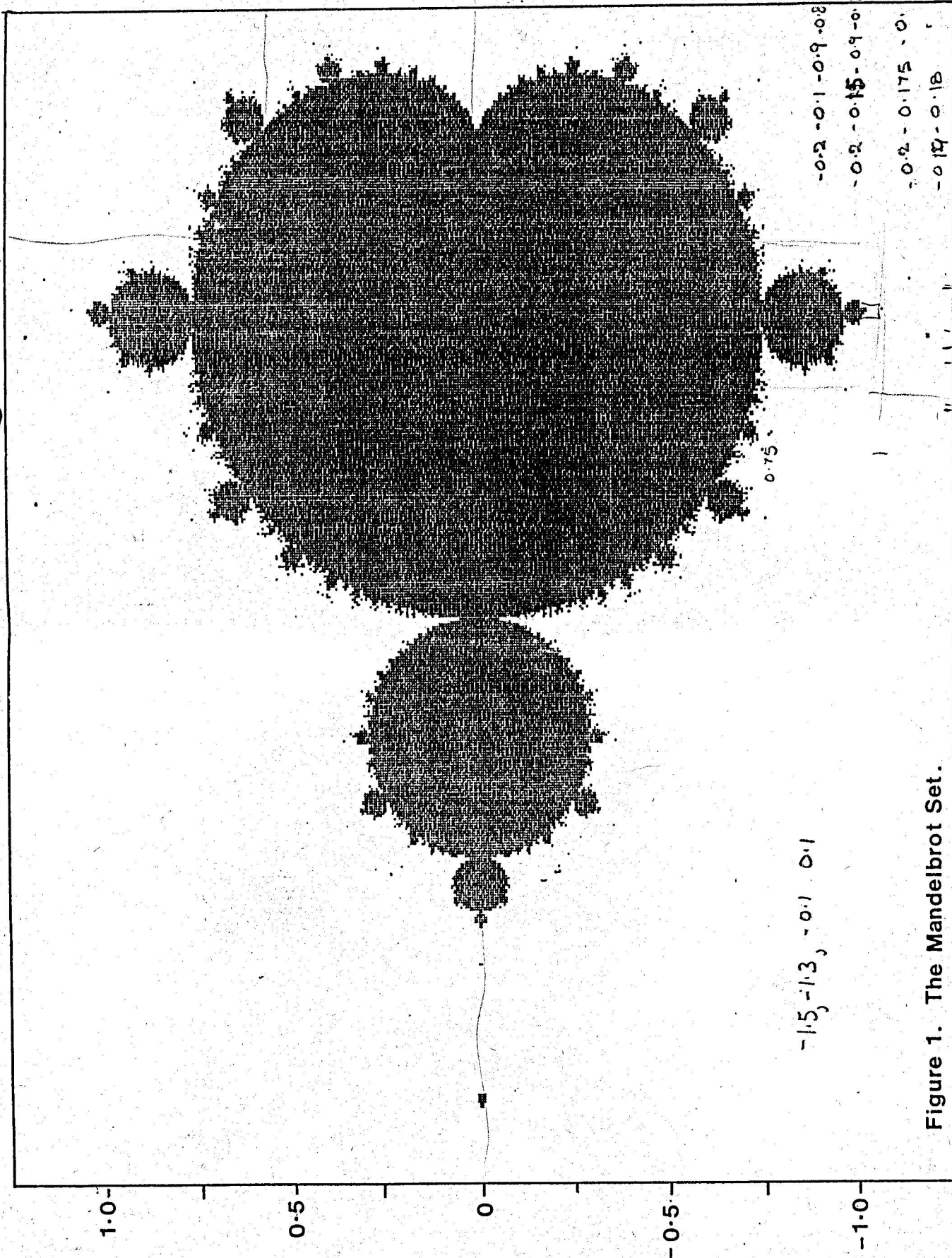
Circuit for NICAD.

Copyright P.W.H. MOCN.

17 October 1985.



-0.19 - 0.189 - 0.8537 - 0.8525



-1.5, -0.1, 0.1

-0.2 - 0.1 - 0.9 - 0.8

-0.2 - 0.15 - 0.9 - 0.85

-0.2 - 0.175 - 0.875 - 0.85

-0.19 - 0.18

-0.19 - 0.185

-0.19 - 0.1875

-0.855 - 0.85

-0.8575 - 0.85

-0.85375 - 0.85

Figure 1. The Mandelbrot Set.

-1.5

-1.0

-0.5

0

0.1

0.3

0.5

