Designed especially for beginners . . .

DREAM 6800

3rd article has interesting programs

In this third article in the series on Michael Bauer's innovative design for the DREAM 6800 computer, we described how to connect it to a TV set and provide listings and instruction for sample programs. Next article in the series will give the lowdown on CHIP-8 programming.

Last month's article which gave complete construction details for the DREAM 6800, made only a brief mention of the video connection from the DREAM. The easiest way to connect the system to your TV set is to use an RF modulator (strictly speaking, this should be called a video-modulated RF oscillator), which enables a simple connection to the TV set antenna terminals.

You may be able to wreck a defunct video game and use its modulator. While the modulators used in most video games do not provide very sharp resolution, they are quite suitable for the chunky graphics display of the DREAM. You can also purchase a suitable modulator complete with instructions, from Dick Smith Stores. Catalog price is $3.00.

Our approach was to make a direct video connection to the TV set. With the DREAM 6800, the method of video connection is less critical than for the usual "glass terminal" which uses the full screen and has small alpha-numeric characters. The fact that the DREAM uses a rectangle in the centre of the screen means that its relatively simple sync pulse "trains" will not cause "flag-waving" (horizontal jitter) at the top of the screen. The centrally located rectangular display also takes advantage of

the superior linearity available in this area of the screen. So even old valve sets with quite poor linearity will give a reasonable display of the DREAM graphics.

The other reason why the DREAM is relatively non-critical of the method of video connection is that the chunky graphic display does not require as wide a picture bandwidth as a normal computer's alpha-numeric display. This means there is no need to improve the picture bandwidth by removing sound traps or other modifications.

Even so, the use of a direct video connection gives a quite worthwhile improvement in picture quality compared with that available via a RF modulator. And there is also less chance of interference to other TV sets in the near vicinity.

Our approach is to connect the video output from the DREAM to the input of the video amplifier in the TV set; ie, immediately after the video detector. If you have access to the circuit diagram of the set you should be able to find the appropriate spot in the circuit without any trouble. Ideally, the circuit will also show the shape and amplitude of the composite sync/video waveform which is normally present at the input to the video amplifier stage.
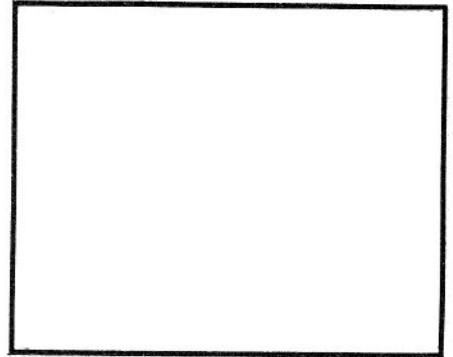
For example, in a small valve portable TV set we modified for this purpose, the composite sync/video waveform is normally 2 volts peak-to-peak with positive video and negative sync. This is in the right ball-park for the DREAM, which has a composite sync/video amplitude of 1 volt peak-to-peak. All that we did was to connect the video from the DREAM via a 100uF/16VW electrolytic capacitor to the grid of the video amplifier valve.
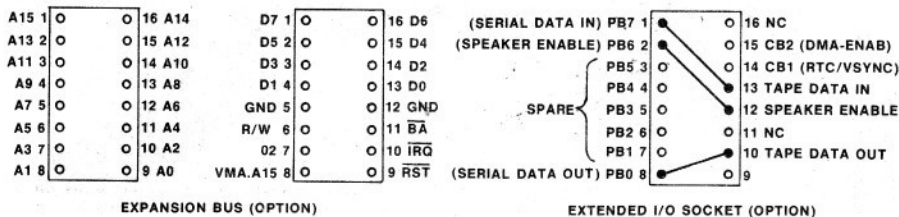
Much the same approach applies to solid state sets. Find the video detector and check the video waveform. Provided its polarity is correct and the amplitude is in the ball-park, you can feed the DREAM video signal into the base of the following video amplifier stage via a 100uF capacitor, as before.

The TV set tuner is set to an unused channel. This means that no video modulation is present from within the set. The DREAM video signal will swamp the noise to produce a sharp display.
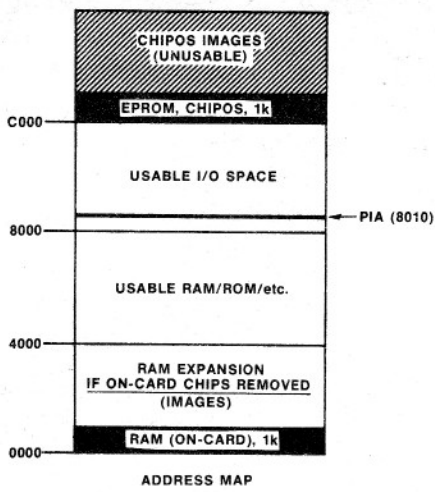
By suitably adjusting the brightness and contrast controls, a bright and steady display is obtained. The polarity of the electrolytic coupling capacitor must be correct and it must have low leakage to avoid upsetting the bias of the following stage.

All the foregoing assumes that you have a set with earthed chassis and transformer isolation from the mains supply. If not, you will just have to use an RF modulator.

Some other sets which have a separate sync detector will not be suitable for the above method of video

A15 1	o	o	16 A14
A13 2	o	o	15 A12
A11 3	o	o	14 A10
A9 4	o	o	13 A8
A7 5	o	o	12 A6
A5 6	o	o	11 A4
A3 7	o	o	10 A2
A1 8	o	o	9 A0

EXPANSION BUS (OPTION)

D7 1	o	o	16 D6
D5 2	o	o	15 D4
D3 3	o	o	14 D2
D1 4	o	o	13 D0
GND 5	o	o	12 GND
R/W 6	o	o	11 $\overline{BA}$
02 7	o	o	10 $\overline{IRQ}$
VMA.A15 8	o	o	9 $\overline{RST}$

(SERIAL DATA IN) PB7 1	o	o	16 NC
(SPEAKER ENABLE) PB6 2	o	o	15 CB2 (DMA-ENAB)
PB5 3	o	o	14 CB1 (RTC/VSYNC)
PB4 4	o	o	13 TAPE DATA IN
SPARE PB3 5	o	o	12 SPEAKER ENABLE
PB2 6	o	o	11 NC
PB1 7	o	o	10 TAPE DATA OUT
(SERIAL DATA OUT) PB0 8	o	o	9

EXTENDED I/O SOCKET (OPTION)

Held over from last month, this diagram shows the leadouts for the output sockets on the PCB.

Memory map (Address Map)

```
           CHIPOS IMAGES
           (UNUSABLE)
C000 ----  EPROM, CHIPOS, 1k
           USABLE I/O SPACE
8000 ----                          ← PIA (8010)
           USABLE RAM/ROM/etc.
4000 ----
           RAM EXPANSION
           IF ON-CARD CHIPS REMOVED
           (IMAGES)
0000 ----  RAM (ON-CARD), 1k

           ADDRESS MAP
```

Memory map for the Dream 6800.

DEVICE		BASE ADDRESS	A15	A14	A13	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1	A0
RAM (ON-CARD)		0000	0	0	—	—	—	—	*	*	*	*	*	*	*	*	*	*
RAM (EXT)†		0000	0	0	*	*	*	*	*	*	*	*	*	*	*	*	*	*
ANYTHING		4000	0	1	*	*	*	*	*	*	*	*	*	*	*	*	*	*
PIA (ON-CARD)		8010	1	0									1	—	—	*	*
EXT. I/O DEVICES	1	8020	1	0									1		*	*	*	*
	2	8040	1	0								1			*	*	*	*
	3	8080	1	0							1				*	*	*	*
	4	8100	1	0						1					*	*	*	*
	5	8200	1	0					1						*	*	*	*
	6	8400	1	0				1							*	*	*	*
CHIPOS EPROM		C000	1	1	—	—	—	—	*	*	*	*	*	*	*	*	*	*

DEVICE-SELECT TABLE

KEY

0	LINE MUST BE LOW TO SELECT DEVICE
1	LINE MUST BE HIGH TO SELECT DEVICE
*	LINE IS DECODED BY DEVICE TO SELECT REQUIRED BYTE; NOTE: I/O DEVICES MAY HAVE UP TO 16 ADDRESSABLE 1-BYTE REGISTERS
—	IRRELEVANT (DONT CARE)
(BLANK)	LINE IS NOT DECODED, BUT MUST BE LOW TO AVOID BUS CONTENTION
†	IF EXTERNAL RAM IS PUT AT 0000, THEN ON CARD RAM MUST BE REMOVED OR RELOCATED (E.G. TO 4000);

connection. In these cases it may be possible to connect the sync and video from the DREAM separately, rather than use the composite waveform.

It is possible that the polarity of the video waveform within your set is reversed to that from the DREAM. This will result in poor or incorrect picture sync and a negative (ie, reversed) picture. The solution in this case is to build a single-stage common-emitter amplifier which will provide the necessary waveform polarity reversal.

Finally, if you propose to use an old set for which no circuit diagram is available, it is usually possible to iden-tify the video amplifier relatively quick-ly. Just take note of the single wire from the picture tube socket which is the video output. Trace this back to the appropriate valve. From there it should be easy to identify the grid. This can be done by measuring voltages — the grid will usually be a few volts negative with respect to chassis.

The same approach would apply to solid state black and white TV sets. The video output transistor can be found by tracing the video output lead to the picture tube, back to its source. From there it's a matter of identifying the base of the transistor and then feeding the signal in via a 100uF capacitor, as before.

Well now you should be champing at the bit to get some programs entered and running. Enter each program in the following sequence and, as soon as you have it running, dump it on cassette. There is nothing so boring as having to enter the same hex listing twice! So make sure you dump all your programs onto tape. Note: Of the following programs, "Block Puzzle" and "TV Typewriter" were written by M. J. Bauer while the others were adapted from the "RCA Cosmac VIP" Instruction Manual.
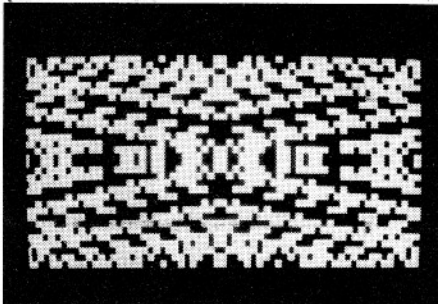
Repeated from the first article in May 1979, this photograph shows the TV displaying the random number generator after the program has been stopped. The "3333" address does not normally occur but was typed in to give good digit display (when this photograph was taken, our prototype was blurring some digits becase of a low spec 4014B IC.)

KALEIDOSCOPE

Use keys 2,4,6 and 8 to enter a short sequence of movements. then press key 0 and watch the computer repeat the sequence to create a moving, symmetrical pattern. Try 44444442220, then experiment with other nice patterns.
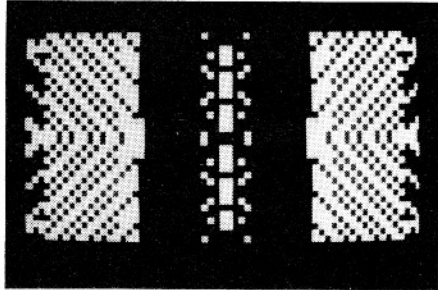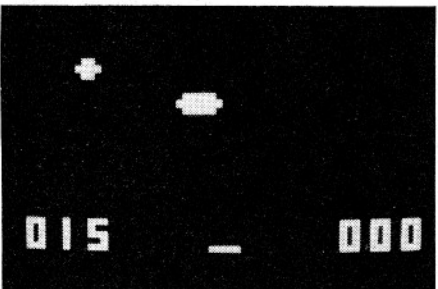

Just two of the many Kaleidoscope patterns.

UFO INTERCEPT

Launch a missile with key 4, 5 or 6 (left, up, right). Hit the small UFO to score 15, the big one to score 5. You have 15 shots.

Two more views of the UFO Intercept game.

WIPE OFF

Use keys 4 and 6 to serve ball and move bat. Score is shown at end of game, after 20 balls. For smaller bat, change data at 1oc. 02CD to FO. For a bat with a hole, use E7!

Start and finish of the game of Wipe-Off.
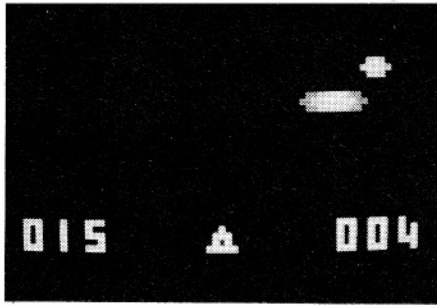


```
0200  6000  6380  611F  620F
0208  2232  A200  F31E  F00A
0210  F055  4000  121C  7301
0218  3300  1208  6380  A200
0220  F31E  F065  4000  121C
0228  7301  4300  121C  2232
0230  121E  4002  72FF  4004
0238  71FF  4006  7101  4008
0240  7201  A277  6AE0  8A12
0248  6B1F  81B2  3A00  7201
0250  6AF0  8A22  6B0F  82B2
0258  3A00  7101  6B1F  81B2
0260  D121  8A10  6B1F  8B25
0268  DAB1  6A3F  8A15  DAB1
0270  8B20  DAB1  00EE  0180
0278  0000
```
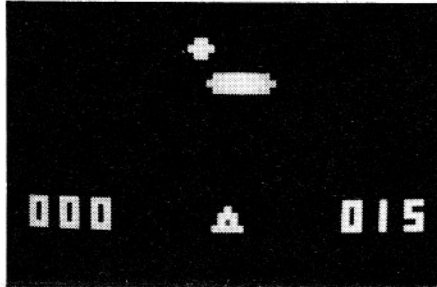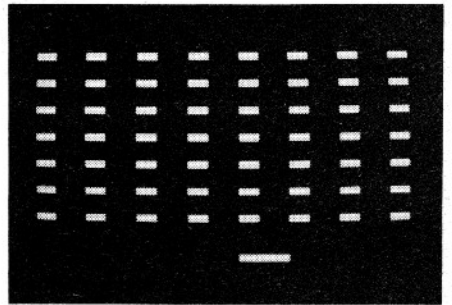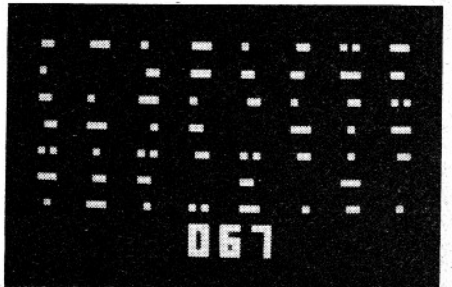

Start of the UFO Intercept game.

```
0200  A2CD  6938  6A08  D9A3
0208  A2D0  6B00  6C03  DBC3
0210  A2D6  641D  651F  D451
0218  6700  680F  22A2  22AC
0220  4800  1222  641E  651C
0228  A2D3  D453  6E00  6680
0230  6D04  EDA1  66FF  6D05
0238  EDA1  6600  6D06  EDA1
0240  6601  3680  22D8  A2D0
0248  DBC3  CD01  8BD4  DBC3
0250  3F00  1292  A2CD  D9A3
0258  CD01  3D00  6DFF  79FE
0260  D9A3  3F00  128C  4E00
0268  122E  A2D3  D453  4500
0270  1286  75FF  8464  D453
0278  3F01  1246  6D08  8D52
0280  4D08  128C  1292  22AC
0288  78FF  121E  22A2  7705
0290  1296  22A2  770F  22A2
0298  6D03  FD18  A2D3  D453
02A0  1286  A2F8  F733  6300
02A8  22B6  00EE  A2F8  F833
02B0  6332  22B6  00EE  6D1B
02B8  F265  F029  D3D5  7305
02C0  F129  D3D5  7305  F229
02C8  D3D5  00EE  017C  FE7C
02D0  60F0  6040  E0A0  F8D4
02D8  6E01  6D10  FD18  00EE
```

```
0200  A2CC  6A07  6100  6B08
0208  6000  D011  7008  7BFF
0210  3B00  120A  7104  7AFF
0218  3A00  1206  6600  6714
0220  A2CD  6020  611E  D011
0228  631D  623F  8202  77FF
0230  4700  12AA  FF0A  A2CB
0238  D231  65FF  C401  3401
0240  64FF  A2CD  6C00  6E04
0248  EEA1  6CFF  6E06  EEA1
0250  6C01  D011  80C4  D011
0258  4F01  1298  4200  6401
0260  423F  64FF  4300  6501
0268  431F  12A4  A2CB  D231
0270  8244  8354  D231  3F01
0278  1242  431E  1298  6A02
0280  FA18  7601  4670  12AA
0288  D231  C401  3401  64FF
0290  C501  3501  65FF  1242
0298  6A03  FA18  A2CB  D231
02A0  73FF  1236  A2CB  D231
02A8  1228  A2CD  D011  A2F0
02B0  F633  F265  6318  641B
02B8  F029  D345  7305  F129
02C0  D345  7305  F229  D345
02C8  12C8  0180  44FF
```

BLOCK PUZZLE

The screen shows a 4 x 4 board with symbols 0 to 9, A to F arranged in order, with a blank square upper left. Watch the computer jumble the blocks, then you try to re-order them using keys 2 (down), 4 (left), 6 (right) and 8 (up) to move a block into the blank space.
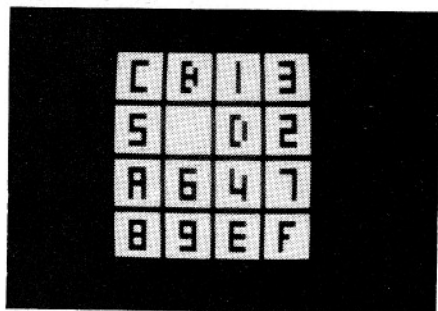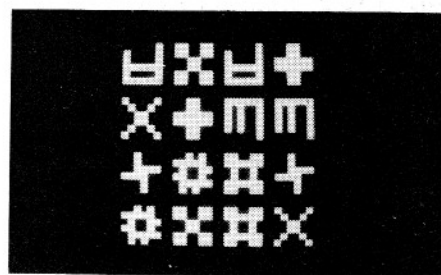

Each start for the Block Puzzle is different.
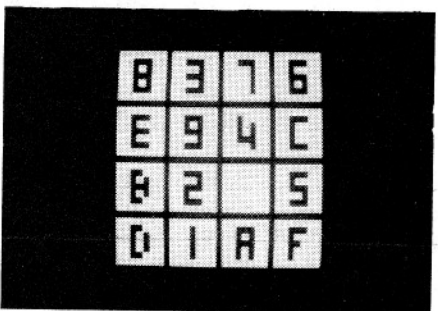
0200	6A12	6B01	6110	6200
0208	6000	A2B0	D127	F029
0210	3000	DAB5	7108	7A08
0218	3130	1224	6110	7208
0220	6A12	7B08	A300	F01E
0228	F055	7001	3010	120A
0230	6A12	6B01	6C00	62FF
0238	C006	7002	2252	72FF
0240	3200	1238	6E00	0000
0248	F00A	2252	7E01	0000
0250	1248	84A0	85B0	86C0
0258	3002	1264	4501	1264
0260	75F8	76FC	3008	1270
0268	4519	1270	7508	7604
0270	3006	127C	4412	127C
0278	74F8	76FF	3004	1288
0280	442A	1288	7408	7601
0288	A300	F61E	F065	8100
0290	6000	A300	F61E	F055
0298	A300	FC1E	8010	F055
02A0	F129	D455	DAB5	8A40
02A8	8B50	8C60	00EE	EE5E
02B0	FEFE	FEFE	FEFE	FEFE

ERRATA

The DREAM 6800 uses a 6821 PIA instead of the 6820 shown on circuit and PCB diagram.

CONCENTRATION

Two players, A and B, take turns to find matching pairs of symbols arranged in a 4 x 4 matrix. The hex keys correspond to board positions, so just press a key to see the symbol there. When player A gets a match, the computer replaces his two symbols with A's, and same for B, so you can see who won. The computer also shows whose turn it is to play.

0200	A385	6002	6102	6202
0208	6302	6402	6502	6602
0210	6702	F755	6300	A385
0218	C107	F11E	F065	4000
0220	1216	70FF	A385	F11E
0228	F055	A38E	F31E	8010
0230	F055	7301	3310	1216
0238	2314	C501	22C4	6B00
0240	6D10	F00A	A375	F01E
0248	F065	90D0	1242	8D00
0250	22D8	3B00	125E	6B0F
0258	8CD0	89A0	1242	6020
0260	F015	F007	3000	1262
0268	99A0	1278	22C4	7501
0270	6001	8502	22A0	123C
0278	6020	F018	7E01	22A0
0280	A385	FA1E	60DD	F055
0288	4500	1296	A367	D346
0290	A367	D126	12B8	A33F
0298	D346	A33F	D126	12B8
02A0	22D8	8130	8240	8DC0
02A8	22D8	00EE	A36D	FA1E
02B0	F065	A334	F01E	00EE
02B8	0000	123E	22C4	6060
02C0	F018	12C2	6300	6408
02C8	A33F	4500	12D2	633A
02D0	A367	D346	00EE	5555
02D8	A38E	FD1E	F065	8A00
02E0	A385	F01E	F065	40DD
02E8	1242	22AC	6310	6400
02F0	600C	80D2	4004	6408
02F8	4008	6410	400C	6418
0300	6003	80D2	4001	6318
0308	4002	6320	4003	6328
0310	D346	00EE	2324	6040
0318	F015	F007	3000	131A
0320	2324	00EE	6D00	22D8
0328	7D01	4D10	1330	1326
0330	00EE	0101	1010	1E78
0338	0808	1818	7E7E	1818
0340	2424	3C24	2466	6618
0348	1866	667E	2424	7E66
0350	4224	1818	2442	7E52
0358	5252	527E	4242	7E42
0360	7E14	7C26	643E	287C
0368	243C	2424	7C00	0611
0370	161C	2227	2D0C	0D0E
0378	0F08	090A	0B04	0506
0380	0700	0102	0300	

CONCENTRATION (image)

This is the start of the Concentration game.

SECRET NUMBER

The computer is thinking of a secret (random), 3-digit, decimal number. You try to guess what it is, with the help of "clues" from the computer. Simply enter your 3-digit guess, shown upper left. The computer's clue, shown bottom left (momentarily), is a number calculated as follows: starts with 0; adds 2 for each correctly guessed digit in the correct position; then adds 1 for each guess digit which is present in the secret number but in the wrong place. The number of tries you took is shown bottom right.

0200	6E00	A3F0	22A0	22A0
0208	22A0	6500	6000	6100
0210	6200	F255	22AE	6534
0218	22D0	A3F6	22E2	22E2
0220	22E2	6500	22AE	A3F6
0228	F265	A3F3	F255	6500
0230	22AE	6402	6D00	A3F3
0238	22F4	A3F3	F255	8500
0240	A3F0	22F4	A3F0	F255
0248	9500	1300	9510	1252
0250	9520	7D01	4400	125C
0258	74FF	1236	6508	22D0
0260	6534	22D0	7E01	6534
0268	22D0	4D06	1288	4E63
0270	1282	6130	F115	F107
0278	3100	1276	6508	22D0
0280	121A	A3F0	652C	22AE
0288	6108	6002	F018	6F10
0290	71FF	FF15	FF07	3F00
0298	1294	3100	128A	0C00
02A0	6409	C00F	8405	4F00
02A8	12A0	F055	00EE	6600
02B0	3500	12C6	A3F3	F265
02B8	F029	22CA	F129	22CA
02C0	F229	22CA	00EE	A3F0
02C8	12B6	D565	7508	00EE
02D0	6618	3508	12DA	FD29
02D8	12CA	A3F6	FE33	F265
02E0	12BC	F00A	400F	1282
02E8	6109	8105	4F00	12E2
02F0	F055	00EE	F265	8300
02F8	8010	8120	8230	00EE
0300	7D02	1254		

T.V. TYPEWRITER

Starts with cleared screen and a cursor in the upper LHS corner. Enter a 2-digit number (character code) from 00 to 2F (total of 48 codes), noting the characters produced by each. The cursor can be moved by entering a 2-digit control code. The first digit specifies the direction: C (left), D (down), E (up), F (right). The second digit specifies how many dot positions to move. A mistake can be erased by positioning the cursor on top of the offending character and re-keying its code.

```
0200   6A00  6B00  602F  0266
0208   DAB5  F00A  0277  8100
0210   F00A  8101  602F  0266
0218   DAB5  8010  62C0  8122
0220   41C0  1234  4016  1250
0228   4020  1254  0266  DAB5
0230   7A04  1204  8200  64F0
0238   8242  640F  8042  42C0
0240   8A05  42D0  8B04  42E0
0248   8B05  42F0  8A04  1204
0250   A25C  1256  A25D  DAB5
0258   7A06  1204  F8A8  A8A8
0260   A850  0000  0000  9630
0268   810F  2203  7EC1  9380
0270   10CE  027E  7EC1  9896
0278   3048  4848  4897  3039
```

```
0280   F6CE  B7DA  E92E  F492
0288   B75A  F248  B7FA  B6DE
0290   F6DE  93DE  5EDE  BBDE
0298   C546  492E  F6DA  56DA
02A0   BFDA  B55A  4BDA  F11E
02A8   0024  2A22  88A8  8000
02B0   0BA0  0380  1550  1110
02B8   0820  1C70  419E  FFFE
```

TANK BATTLE

Use keys 4 (left), 9 (up), 6 (right) and 1 (down) to move your tank about. Fire a shot with key F. Hit the randomly moving hostile enemy vehicle and you score 10 points. If you allow the target to collide with your tank, 5 shots will be forfeited. After each round, the score (left) and remaining number of shots are shown.

```
0080   76FB  6020  8065  4F00
0088   6600  1354
```

```
0200   6E00  6DA0  6A01  6906
0208   6804  6709  6619  6410
0210   630C  6200  6106  A092
0218   FA55  23A4  6040  F015
0220   F007  3000  1220  23A4
0228   22DA  2332  A092  F565
```

```
0230   227E  2296  22BC  3F01
0238   22E4  3F01  22BC  3F01
0240   22BC  3F01  224C  4F01
0248   1336  1232  A092  F565
0250   4600  3500  1258  135C
0258   E7A1  6209  E8A1  6204
0260   E9A1  6206  EAA1  6201
0268   4200  00EE  227E  8120
0270   236A  237C  6C01  6200
0278   6F00  A092  F555  A3CF
0280   4109  6000  4104  6013
0288   4106  600D  4101  6006
0290   F01E  D347  00EE  600F
0298   E09E  00EE  450F  00EE
02A0   650F  76FF  A092  F555
02A8   7403  7303  236A  236A
02B0   236A  A0A3  F555  A3E9
02B8   D341  00EE  A0A3  F565
02C0   4500  00EE  A3E9  D341
02C8   236A  6C02  238E  4BBB
02D0   12DA  D341  A0A3  F555
02D8   00EE  6500  6000  A097
02E0   F055  12D4  A09D  F565
02E8   350F  1314  A3EA  D345
02F0   3200  1302  C103  A099
02F8   F11E  F065  8100  C20F
```

```
0300   7201  236A  A3EA  6C03
0308   72FF  6F00  D345  A09D
0310   F555  00EE  C407  A3EF
0318   F41E  F065  8300  A3F7
0320   F41E  F065  8400  A3EA
0328   D345  6020  F018  650F
0330   130E  6500  130E  4C01
0338   1080  4C02  1352  A0A3
0340   F565  4500  1080  A3E9
0348   D341  6F00  D341  3F01
0350   1080  7E0A  6040  F018
0358   00E0  121A  00E0  23A4
0360   6060  F018  1364  6E00
0368   1354  4109  74FF  4104
0370   73FF  4106  7301  4101
0378   7401  00EE  4400  7401
0380   4300  7301  4338  73FF
0388   4418  74FF  00EE  6B00
0390   4400  139E  4300  139E
0398   433F  139E  441F  6BBB
03A0   6F00  00EE  6308  6408
03A8   A0A9  FE33  F265  23BC
03B0   6328  A0A9  F633  F265
03B8   23C2  00EE  F029  D345
03C0   7306  F129  D345  7306
03C8   F229  D345  00EE  0110
03D0   547C  6C7C  7C44  7C7C
03D8   6C7C  5410  00FC  786E
03E0   78FC  003F  1E76  1E3F
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03F0   1B28  3830  2010  0000
03F8   0000  081B  181B  13D4
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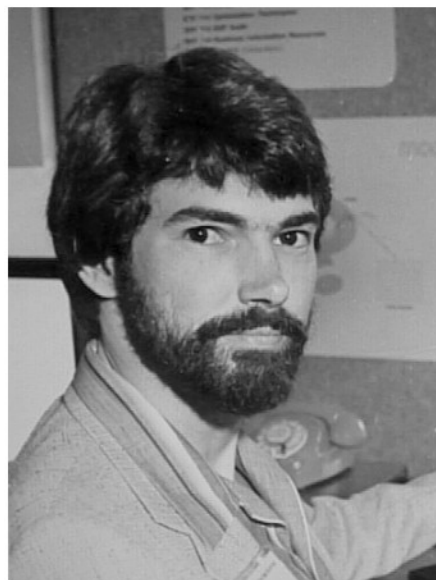
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