A Vocal Hex Dump For The KIM-1

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This article describes a program for the KIM-1 that begins at a given RAM address and pronounces the contents of successive locations, with appropriate pauses inserted for naturalness, just as a person would read off a list of hex words. It uses what is almost certainly the least expensive speech synthesis equipment and software now on the market; for about $100, the single-board computer owner can experiment with computer-generated speech. The program given here is concerned with removing a little of the drudgery from proofreading programs in RAM. The program runs on a KIM-1 to which has been added a 6522 VIA and at least 1K of expansion RAM.

Personal computers surely are the ultimate in modern versatility, making everything from dungeons-and-dragons to home automation to self-instruction in computer science available to nearly everyone. But no matter how much fun it is to use the polished end result of one's programming, the checking of machine code to see if it was entered correctly remains pure drudgery, and the cleverest technology isn't likely to ever place it on a level with playing a rousing game of motorcycle racing with the computer. For those of us with video terminals but no printer, it can be especially irritating; one's eyes move up to the screen dump, down to the written program, up and down, kind of like watching a vertical tennis game, until the eyes have had it.

It would help to have someone read off the code from the screen so the programmer can keep his eyes on the paper. But another person isn't always available, and anyhow this is just the kind of work that computers were invented to handle, right? The only trouble is, most speech synthesizers are expensive, and are usually for the S-100 bus, not directly usable with the KIM or similar single-board machine. Now, thanks to Texas Instruments, Inc. and Dave Kemp of East Coast Micro Products, these objections have been neatly removed. The T-I Speak and Spell™, an inexpensive ($50 range) pre-programmed speech synthesizer computer was developed to teach kids to spell.[1] Its internal ROMs contain the coding to vocalize hundreds of words plus several phrases, the letters of the alphabet, and the numerals. But it's more than a toy. The device has an internal edge connector intended for plugging in additional vocabulary ROMs, and the various control lines that operate the speech synthesizer are available there. East Coast Micro Products market a small interface kit, model SP-1[1], that plugs onto the edge connector, and performs the level shifting and parallel-to-serial conversion needed for interfacing the synthesizer to a computer. The whole thing fits into the battery compartment of the Speak and Spell™, making a very neat package. Along with the interface board, you get extensive support software, a detailed explanation of how the synthesizer works, and five demo programs written for the SYM computer. The software includes a program for pronouncing individual hex characters whose ASCII representation has been placed in the accumulator, and uses the 6522 VIA that the SYM uses for I/0.

As mentioned at the start of this article, my immediate goal in purchasing the SP-1 was to use it with a KIM to read out memory words. The listing gives the resulting program. The user begins execution at BEGIN, types the first RAM address on the TTY, and the program reads 256 locations out on the Speak and Spell™. If you're checking fewer locations, just hit the reset key when you're through. If your program is longer, type in the next location and it will read you 256 more.

The comments in the listing should be self explanatory for the most part. Label references not defined in the listing (such as FPNT, OUTSPE, etc.) are mostly labels in the SP-1 software. GETBYT is a routine in the KIM monitor.

The SP-1 software is set up to use the 6522 Versatile Interface Adaptor on the SYM board, so unless you want to re-program extensively, your best bet is to add a 6522 to your KIM; you ought to have one anyhow if you're a serious KIMmer. Mine was already present on a VIDEO PLUS™ board that I use with my system[1]. If you don't have a VIA in your system, I suggest you refer to the articles listed in the footnotes[3,4]. It should not be hard to provide one. The SP-1 software resides entirely in the KIM on-board memory with one exception: the speech data dictionary provided with the software requires 770 bytes of continuous memory in addition to the 478 bytes required by the SP-1 support software and by the vocal dump routine. None of the code is self-modifying, so you can relocate it at will, even into EPROM where it will become a valuable utility. The only memory that has to be RAM is the twelve-byte frame buffer which I located between $17A0 and $17AB. If you do relocate, take care to adjust the entries in TABLE. These are address pointers to entries in the speech dictionary supplied with the SP-1. The accompanying program listing assumes that the dictionary resides between $2000 and $2302 in expansion memory.

```
              0010              .BA $100
              0020 ADLO         .DE $A
              0030 ADHI         .DE $B
              0035 SPNT         .DE 2
              0040 GETBYT       .DE $1F9D
              0050 FPNT         .DE 4
              0060 SPINIT       .DE $200
              0070 OUTSPE       .DE $2D0
0100- 20 9D 1F 0080 BEGIN       JSR GETBYT   ;GET START
0103- 85 0B    0090            STA *ADHI     ;ADDRESS
0105- 20 9D 1F 0100            JSR GETBYT    ;FROM
0108- 85 0A    0110            STA *ADLO     ;KEYBOARD
010A- A9 A0    0120            LDA #$A0      ;SET FRAME
010C- 85 04    0130            STA *FPNT     ;POINTER
010E- A9 17    0140            LDA #$17      ;TO
0110- 85 05    0150            STA *FPNT+1   ;$17A0 (12 LOCS NEEDED)
0112- 20 00 02 0160            JSR SPINIT    ;SET UP TIMERS
0115- 20 2D 01 0170            JSR PAUSE     ;PAUSE BEFORE SPEAKING
0118- A0 FF    0180            LDY #$FF      ;USE Y TO COUNT LOCS.
011A- C8       0190 LOOP       INY           ;DUMPED
011B- 98       0200            TYA
011C- 48       0210            PHA
011D- B1 0A    0220            LDA (ADLO),Y  ;GET CURRENT CONTENTS FOR DUMP
011F- 20 31 01 0230            JSR SAY       ;PRONOUNCE CONTENTS;
0122- 20 2D 01 0240            JSR PAUSE     ;THEN PAUSE
0125- 68       0250            PLA
0126- A8       0260            TAY
0127- C9 FF    0270            CMP #$FF
0129- D0 EF    0280            BNE LOOP      ;LOOP 256 TIMES
012B- F0 D3    0290            BEQ BEGIN     ;GET NEW START
012D- A2 20    0300 PAUSE      LDX #$20      ;SET POINTER FOR PAUSE
012F- D0 0E    0310            BNE SP1       ;BRANCH TO SPEECH PAUSE
0131- 48       0320 SAY        PHA           ;SAVE CONTENTS
0132- 29 F0    0330            AND #$F0      ;GET HIGH-ORDER NYBBLE
0134- 4A       0340            LSR A         ;FORM INDEX
0135- 4A       0350            LSR A         ;INTO ADDRESS TABLE
0136- 4A       0360            LSR A
0137- 20 3E 01 0370            JSR SPEAK     ;SPEAK FIRST CHARACTER
013A- 68       0380            PLA
013B- 29 0F    0390            AND #$F       ;GET LOW-ORDER NYBBLE
013D- 0A       0400            ASL A         ;FORM INDEX
013E- AA       0410 SPEAK      TAX           ;AND FALL THROUGH
013F- BD 4C 01 0420 SP1        LDA TABLE,X   ;TO SPEAK IT
0142- 85 02    0430            STA *SPNT
0144- BD 4D 01 0440            LDA TABLE+1,X
0147- 85 03    0450            STA *SPNT+1
0149- 4C D0 02 0460            JMP OUTSPE
014C- 00 20 49 0470 TABLE      .BY 0 $20 $49 $20 $76 $20 $9F $20 ;ADDRESS
                                TABLE FOR
014F- 20 76 20
0152- 9F 20
0154- DB 20 11 0480            .BY $DB $20 $11 $21 $52 $21 $86 $21 ;
                                SPEECH DICTIONARY
0157- 21 52 21
015A- 86 21
015C- B7 21 DA 0490            .BY $B7 $21 $DA $21 $16 $22 $36 $22
015F- 21 16 22
0162- 36 22
0164- 61 22 8E 0500            .BY $61 $22 $8E $22 $B5 $22 $D0 $22 $FD $22
0167- 22 B5 22
```

The SP-1 utilities can be used for many other
purposes. A great deal of information and some
references concerned with speech synthesis using
Linear Predictive Coding techniques are given in the
literature supplied with the kit. With this material,
you can make your KIM as talkative as you wish!

```
016A- D0 22 FD
016D- 22
                   0510              .EN
```

```
LABEL FILE:  [ / = EXTERNAL ]

/ADLO=000A    /ADHI=000B /SPNT=0002
/GETBYT=1F9D /FPNT=0004 /SPINIT=0200
/OUTSPE=02D0 BEGIN=0100 LOOP=011A
PAUSE=012D    SAY=0131   SPEAK=013E
SP1=013F      TABLE=014C
//0000;016E;016E
```

Footnotes
1. Speak and Spell is a trademark of Texas Instruments, Inc.
VIDEO PLUS is a trademark of The Computerist, Inc.
2. East Coast Micro Products, 1307 Beltram Ct., Odenton,
Md. 21113.
3. See **6502 User Notes**, No. 13, p. 16 for information about
adding a 6522 I/O board.
4. See **MICRO**, No. 17, pp. 27-39 for a general description of
the 6522.   ©