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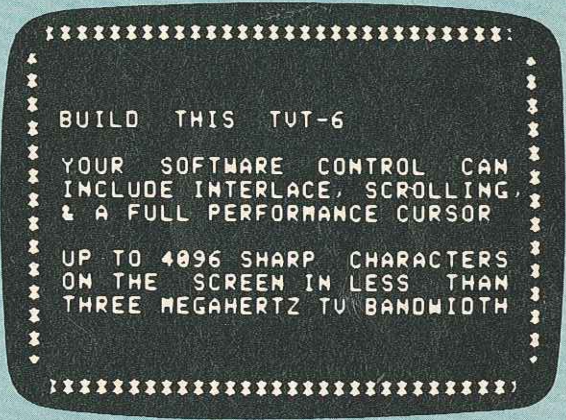

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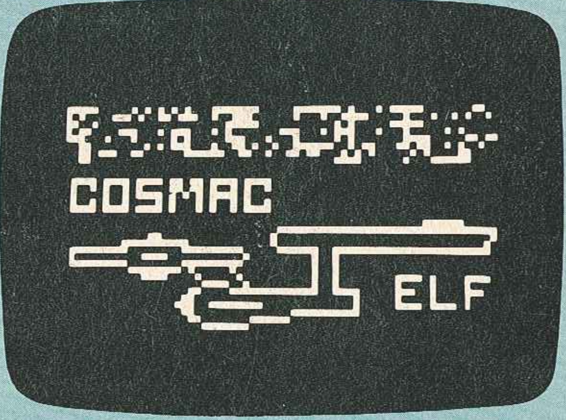

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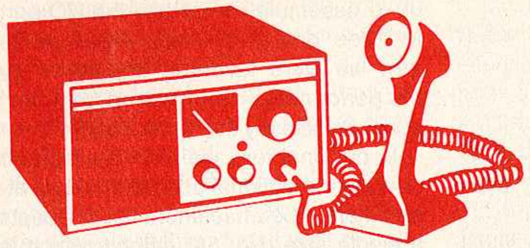


CB Scene

By Ray Newhall, KWI6010

THE ANATOMY OF CBRS

ALL OF US who have traveled the green stamp with wheels on our CB rigs (driven on turnpikes with mobile CB radios in our cars) know that CB makes driving safer, provides additional security in case of vehicle breakdown, and is *fun* to use. It keeps the driver awake and busy on the road and it makes the trip seem shorter. But does its usefulness to highway users account for the CB fever that has spread throughout America? Why have ten million people shelled-out $100, $200, or $300 each for CB rigs during 1976? What prompted nearly a million new CB license applications to flood FCC offices during the single month of January 1977?

The sociologists who keep watch on the habits of the public are eyeing the CB syndrome and believe it is more than a fad which will soon pass on. They consider that it may signal an entirely new shift in sociological behavior. One Columbia University psychologist recently remarked to an FCC assemblage that the growth of CB may be one of the most healthy sociological events since the demise of the telephone party-line. For the first time in forty years there are extensive personal "one-to-one" communications occurring between people who are total strangers.

Oddly enough, this new form of personal communication we call CB has characteristics which are distinctly different from our more traditional communication forms. It is *not* "face-to-face" and projects an aspect of anonymity. Opinions exchanged through this media are apt to be more candid and open in nature because there is no fear of "peer disapproval" or reprisal. It is a medium in which the young and the old can communicate on common grounds and with similar interests; a far cry from the tragically common communication failures which occur between parents and their teenaged children.

Most CB'ers have given a great deal of thought to the selection of their CB handles. Handles serve a far greater purpose than to provide temporary identification between strangers on "the party line." They also serve a somewhat paradoxical purpose of revealing much of a CB'ers personality while concealing his true identity. I know several people who are making collections of the most unusual handles they hear. Some of the oddest ones are those "pairs" of handles used by a CB'er and his XYL or other members of his family.

The CB "lingo" is also unique. Although it is colorful and mystic to newcomers, it is concise and descriptive to those familiar with it, serving a true communication need. Its use gives CB'ers the feeling of belonging to a group, just as Hams are joined by their knowledge of Morse code. In fact, it is sometimes implied that one who doesn't bother to learn the CB language is not too welcome on the band.

The CB Radio Service as we see it today is a unique and useful "game" for young and old alike, and it serves the need of a mobile community. However, it is far from the type of personal radio service the FCC had in mind when the Citizen's Band was first authorized. CB was originally conceived as a two-way radio service for use by families and small businesses. Until recent years, there were only a few channels for communications between different station licensees. As the CBRS has developed today, it is not too effective for its original purpose in heavily populated areas. Yet, the need for such a service still remains!

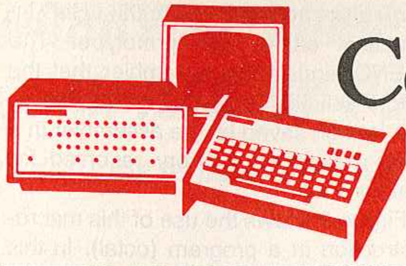
GMRS, The Other CB Service. The CBRS (formerly the Class D service) is not the only personal radio service available to the general public. The General Mobile Radio Service (GMRS), formerly called Class A, was the first CB radio service. It was authorized in the early 1950s. Eight pairs of uhf frequencies were allocated above 460 MHz. The Class B service authorized low-power mobile two-way radio in the same frequency spectrum. Neither of these two CB services was used extensively because, until recently, we have not had the radio technology to mass produce suitable transceivers at a price the personal user could afford. In fact, the Class B service was abandoned because it had not found any practical personal application.

However, the GMRS service is still available and has now become a high-quality, practical CB service for personal-use radio communications, although equipment cost is substantially higher than Class D gear. The new 460-MHz police communications equipment operates on assigned frequencies very close to the 462/467-MHz GMRS frequencies, and this equipment can be used. It is now feasible to mass-produce solid-state equipment to operate on uhf. On GMRS you may operate up to 50 watts input power and raise your antenna up to 200 feet in height. Line-of-sight FM transmission is most normally used. Repeaters and auto-patches are currently permitted, just as the Hams now use them on the 2-meter band.

In the Chicago, Cleveland and Dallas areas, to name but a few, GMRS "CBers" have banded together to set up community repeaters. They use 15-watt mobile units or 2½-watt hand-held transceivers to reach the repeaters for reliable rebroadcast to other stations as far as 25 to 40 miles away. In this way, they can contact their families or offices through the repeater, or they can dial direct landline calls to business associates by use of a touch-tone pad on the back of their mikes. Tone-encoded squelch circuits are said to work so well that these FM transceivers will be activated only by those calls intended specifically for them.

As a matter of fact, this columnist just mailed a Form 400 for a GMRS license to the FCC this morning. I have a standard CBRS AM unit in my car for use on the road, but it is not too practical to call my home (located in a densely populated Eastern Seaboard area) unless I'm rather close by. I operate a small consulting service and I intend to use GMRS radio to keep in touch with my customers from my car while I am within 25 miles of my home.

GMRS is not for everyone, but it does meet the needs of those who want high-grade personal and business communications. The cost is from two to five times as much as the current prices of CBRS equipment; more if you hang on all these accessories. But for many people it serves a practical purpose and in many cases may eliminate the need for telephone answering service or even a secretary. ◇



Computer Bits

By Hal Chamberlin

ASSEMBLERS

ACCORDING to a recent magazine survey, one of the most popular applications of personal computers is software development, or simply writing programs. As anyone who has been bitten by the programming bug undoubtedly knows, each new program is always bigger and fancier than the last. Beyond a certain point in program complexity, however, the use of an assembler program is almost mandatory to eliminate most of the drudgery associated with hand coding in octal or hex. This is particularly true when one wishes to make a "small improvement" to a hand-assembled program which otherwise requires it to be rewritten.

Functions of an Assembler. Using an assembler in machine language program development has three important advantages over hand coding. First, an assembler allows the programmer to use operation mnemonics such as "LDA" for the "load register A" operation rather than the octal code 072 (8080 microprocessor). When looking at a program you wrote several weeks ago or one written by somebody else, the LDA is much more meaningful than the 072, which in turn makes the program easier to understand.

The second and most important advantage is that the addresses of sections of code and data items can be given *symbolic names* and referred to by name. Again, a name like TAXTAB used to refer to a table of tax rate data is more meaningful than its address which might be 005:120. The most important benefit of symbolic names comes when a program is changed for some reason. With a hand-coded program, some of the addresses used in the program would probably have to change as sections of the program and data are shuffled around to make room for additions. Then, every reference to addresses that were changed would also have to be changed. The result is that, in a large program, a considerable number of changes may be necessary for what would otherwise be a minor addition. With symbolic names, the assembler can do all of the address shuffling when the program is reassembled and the programmer need be concerned only with the additions. The concept is analogous to solving an equation in general using symbols and algebra and then substituting actual values into the *solution* rather than solving the equation for each set of values needed.

A third advantage is that the use of an assembler tends to develop good program documentation habits which adds to the value of a program. All assemblers allow the latter part of each statement to be used for comments. A well-written program has an English explanation of what the machine instructions are accomplishing as comments on nearly every statement. A neat assembly listing of a program is also much easier to reproduce and read than hand scrawls on coding sheets. Conversely, buying a machine language program without documentation in the form of commented assembly listings is like buying electronic equipment without a schematic.

Using the assembler program itself is generally quite simple. First the assembly language program which is called a *source* program is converted into machine readable form. Such a form may be ASCII characters on paper tape, audio or digital cassette records, floppy disk sector records, or even ASCII data in memory depending on the system and assembler used. Usually some kind of program editor is used to aid in entering and editing the source program. Next the assembler is loaded and executed. During execution, the assembler will scan the source program and produce a *listing* file containing a copy of the source program along with the octal machine codes and an *object* file containing only the machine codes.

The assembler may also flag some statements as having errors. Common errors that an assembler can catch include using non-existent instruction mnemonics and undefined symbols. The latter is the case when a reference is made to a symbolic address but an actual address is never assigned to the symbol. These and other errors detected by the assembler are usually caused by typing mistakes. After editing the source program to eliminate errors and reassembly, the object program is ready to be loaded into memory and executed.

Types of Assemblers. Although all assemblers perform basically the same function, there is considerable variety in the implementation and use details. Perhaps the most distinguishing characteristic is the number of scans or *passes* over the source code done by the assembler.

A classical assembler makes two passes over the source program. During the first pass, all symbol definitions are searched out and placed in a *symbol table* maintained by the assembler. During the second pass, the mnemonics are translated into their octal equivalents and the listing file and object file are generated. The two passes are needed because a reference to a symbolic address may occur in the program ahead of the definition of the symbol. This is called forward referencing. If the assembler is to know what octal address to substitute for the symbol, it will have to see the definition first.

Several attempts have been made at one-pass assemblers and a couple of these are available on hobbyist systems. The advantage of a one-pass assembler is increased assembly speed since the source file, which may be many thousands of characters in length, needs to be read only once. Often however the one-pass assembler imposes

```
        .MACRO
*       MACRO DEFINITION FOR A DOUBLE PRECISION ADD FROM MEMORY
*       MACRO-INSTRUCTION
*       ADDS THE CONTENTS OF $ADDR AND $ADDR+1 TO REGISTERS B AND
*       C WITH THE RESULT IN B AND C, CONDITION FLAGS UNAFFECTED

$LBL    DPAD $ADDR              DOUBLE PRECISION ADD PROTOTYPE

        PUSH H                  SAVE H AND L
        LHLD $ADDR              GET TWO BYTES TO ADD IN H AND L
        DAD  B                  ADD THEM TO B AND C
        MOV  B,H                COPY RESULT INTO B AND C
        MOV  C,L
        POP  H                  RESTORE H AND L
        .MEND
```

Fig. 1. Example of macro definition.

restrictions on program organization and the free placement of symbols. This is due to the "look ahead" problem mentioned earlier. Sometimes a one-pass assembler is "faked" by a two-pass one. In this case the source file is read for the first pass and then saved in memory for the second pass which is invisible to the user. The difficulty with this approach is that a large amount of memory is needed to assemble a reasonably large program.

Occasionally a "three-pass" assembler is seen. These are really two-pass assemblers with the second pass split in two to accommodate a Teletype with built-in paper tape. These machines cannot punch the object file at the same time as printing the listing file so a separate pass is required for each function.

A *conversational* assembler is another variation. Basically a combination of a simple text editor and a conventional assembler, the conversational assembler is very convenient for experimentation and testing of short programs and subroutines. Operation of a conversational assembler is much like most BASIC language systems. The program is typed in line-by-line and edited using line numbers and simple editing commands. When a RUN command is given, the program is quickly assembled directly into memory and executed. Program size is limited since the source program ASCII text, symbol table, and object program as well as the conversational assembler program itself must all fit into memory at once.

Advanced Assembler Features. As assembly language programming experience increases, some of the more sophisticated assembler features available will be appreciated. Although these features have been rare in hobbyist oriented systems, the assemblers being supplied with recently announced floppy disk systems generally have most of them.

One such feature is *macro-instruction* capability. A macro-instruction (often abbreviated as "macro") is one that may generate many machine language instructions when assembled. When writing a program, macro-instructions may be used just as if the microprocessor actually had them as real instructions in its repertoire.

Macros can be defined by the programmer at the beginning of his program according to his needs. Although exact details of macro definitions and usage differ among various assemblers, a typical macro definition is shown in Fig. 1. The .MACRO on the first line alerts the assembler that a macro definition follows rather than ordinary program instructions. The next line gives the macro *prototype* which defines how the macro-instruction would look in a source program. The symbols preceded by dollar marks are sometimes called "dummy arguments" because, when the macro-instruction is actually expanded by the assembler, they are effectively replaced by the actual symbols used in the macro-instruction. Following the prototype are the actual machine instructions that would be generated when the macro-instruction is used. Note the use of the same dummy argument in the LHLD instruction as in the prototype. The .MEND signals the assembler that the macro definition is complete. The definition is then saved by the assembler in a special table in memory reserved for that purpose.

Figure 2 shows the use of this macro-instruction in a program (octal). In this example all of the instructions generated when the macro was expanded are shown on the listing with a preceding minus sign. Generally the assembler will have a command that would suppress printing of these expansion instructions if desired. With a good library of macro definitions, assembly language programming may become almost as easy as programming in a higher level language.

Another advanced feature is called "relocatable object code" capability. An assembler having this feature supplies additional information in the object file so that it may be later loaded into memory *anywhere* desired completely automatically without difficulty. A special *relocating loader* must be used to interpret this extra information and load the object file into memory. Not only are the addresses of all jump, call, and direct addressing instructions changed, but address constants and other location dependent symbolic references are changed. An additional feature of the relocating loader allows several object files that were generated at different times to be linked together into a single coherent program with all calls and jumps between the separate "modules" properly adjusted. This feature greatly facilitates the use of subroutine libraries without having to copy all of the source code into the program being developed every time a subroutine from the library is needed.

With this little bit of background, the reader should be able to evaluate more fully the assembly language program development facilities of a particular system. ◇

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                       *     EXAMPLE PROGRAM SEGMENT ILLUSTRATING USE OF DPAD MACRO

001:100 116                  MOV  C,M          LOAD ORIGINAL RAW VALUE (16 BITS)
001:101 043                  INX  H
001:102 106                  MOV  B,M
001:103                      DPAD CORR         ADD IN CORRECTION FACTOR
001:103 345             -    PUSH H            SAVE H AND L
001:104 052 200 001 -        LHLD CORR         GET TWO BYTES TO ADD IN H AND L
001:107 011             -    DAD  B            ADD THEM TO B AND C
001:110 104             -    MOV  B,H          COPY RESULT INTO B AND C
001:111 115             -    MOV  C,L
001:112 341             -    POP  H            RESTORE H AND L
001:113 160                  MOV  M,B          UPDATE WITH CORRECTED VALUE
001:114 053                  DCX  H
001:115 161                  MOV  M,C
```

Fig. 2. Example of use of a macro-instruction.

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(Additions to list published April 1977)

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Riverside, CA 92517
Southern California Computer Society
P.O. Box 54751
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St. Louis Area Computer Club
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Greater Boston Computer Users Group
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Dallas, TX 75206

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