TRENDS IN HF COMMUNICATIONS [U]

P.L. 86-36

by

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EO 1.4.(c)
P.L. 86-36
SWITCHBOARD:

Past, Present, and Future [U]
We forgot to have our CRYPTOLOG subscriptions moved. Will someone tell us?
OUT OF MY DEPTH [U]
EXPLORING

A DOS DISKETTE (U)

by \[ P13 \]

INTRODUCTION

Many data systems professionals will go through an entire career using a personal computer and handling small diskettes without really having an idea of how data is organized on them. There is nothing magic about it and, in fact, it isn’t really difficult to understand where and how information is being stored and what it looks like on the disk.

This paper will attempt to explain how a 5 1/4 inch floppy disk is organized under PC-DOS 1.1, written by Microsoft for the IBM-PC. We will be using an IBM-PC and two double-sided double-density disk drives.

Most information was obtained from the Peter Norton book, Inside the IBM-PC, one of the most useful books on small computers I have found, and the IBM DOS 1.1 manual--very useful both as to information and as a cure for insomnia.

The diskette data displays were obtained through the use of the Peter Norton utility DISKLOOK.

Microsoft went to great lengths to have the software overhead take up as little room on the diskette as possible. This, obviously, makes good sense. A small computer isn’t much good to you if the operating system takes up the entire disk. As a consequence, the directory and allocation table look rather cryptic, but once explained they are easily understood.

LOOKING AT THE DISKETTE

Formatting

When a user removes a blank diskette from the box for the first time he has two choices. He can use it as a frisbee or he can turn it into a reliable storage medium for use in his personal computer. We will address the second possibility with the full knowledge that we do not exclude the first possibility at any step of the process.

When you run the FORMAT program, as you already know, the diskette under DOS 1.1 is divided into 40 tracks per side, 8 sectors per track, with a boot record, directory, file allocation table, and, optionally, an entire operating system. Ok, let's format it.

Exploration

We'll now take our formatted diskette and place it in drive "B"—the one on the right. In the left drive we'll place the Norton Utilities and type in DL for DISKLOOK. This assembly language program will allow the user to look at the floppy diskette in the right drive sector by sector.

After DL is typed a self explanatory list of options comes up on the screen. We choose one that allows us to select a particular sector, side, and track. We'll start by looking at the 'Boot Record', which is on the first sector of the disk.
The next two sectors contain what is known as the File Allocation Table (FAT). We will skip the FAT for a moment and proceed to sector 4, still on side O.

Looking at the directory (Figure 2), we do see some sort of information in the first couple of lines, and we'll get to that shortly, but for the most part we see rows of F6's and, every so often, an E5. When we formatted the sectors 4 through 11 have the directory. This area contains all the information necessary for the operating system to retrieve files requested by the user, to sort them by time and date, if required, and to perform other operations as needed.

So as the prompt comes up, we type in 0 for the side, 0 for the track, and 1 for the sector. Zero for the side? Real people start counting at 1, computer people start at zero. OK, why didn't we start at track zero? There is no track zero! Tracks on the PC were numbered by a computer person who skipped class the day they learned how to count. Tracks start at 1, everything else at 0.

As soon as this information is entered, the screen display comes up with 6 columns of hexadecimal numbers on the left, and a few readable words and other symbols on the right. This is the sector we requested, and is a display of the Boot Record.

Looking at the boot record (Figure 1), you can see rows of hexadecimal numbers broken into six columns with an ASCII translation next to each row. Since the boot record is in machine language we would not expect to see many ASCII characters and, in fact, we don't. Look down, now, at the 13th row and below. There we do see a translation and we probably recognize it. We are, of course, looking at the error messages that we get when we have put a non-system diskette in drive A and attempted to boot up. To keep the boot record as small as possible, Microsoft wrote the program in machine language but the messages to the user had to be in ASCII characters.

This record serves one purpose. It instructs the operating system in read only memory (ROM, as it is known to its friends) to go to the location on the diskette containing the rest of the operating system and read it into memory. If the system is there, it is read in; if not, control returns to the boot record and an error message is printed out.

The Directory

The next two sectors contain what is known as the File Allocation Table (FAT). We will skip the FAT for a moment and proceed to sector 4, still on side O.

Sectors 4 through 11 have the directory. This area contains all the information necessary for the operating system to retrieve files requested by the user, to sort them by time and date, if required, and to perform other operations as needed.
With this information, we'll try to understand the directory.

Starting at the first line of Figure 2, we can see some readable characters. The first ten bytes contain the hex equivalent of the ASCII characters for PROJECT.BAK. We can see this translation on the right. So, bytes 0 through 10 show that the first entry in our directory is PROJECT.BAK.

The first few lines of the directory do appear to be telling us something. Microsoft organized the entries in the following manner:

BYTE

0 - 7  File name (an E5, at offset 0, indicates that the file has been erased).

8-10  Filename extension

11  File attribute 02 = hidden file, 04 = system file, 00 for all other files.

12-21  Reserved; this implies that in a future version of this operating system some or all of these bytes will be used to further describe the file.

22-23  Time the file was created or last updated. Time is mapped according to the following rules:

| hour (binary number of hours 0-24) |
| minutes (binary number of minutes 0-59) |
| seconds (binary number of two-second increments) |

24-25  Date the file was created or last updated. Mapping is done as follows:

<table>
<thead>
<tr>
<th>year</th>
<th>month</th>
<th>day</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 14 13 12 11 10 09 08 07 06 05 04 03 02 01 00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

year = 0 - 119 (1980 - 2099)
month = 1 - 12
day = 1 - 31

26-27  Cluster number of the first cluster in the file.

28-31  File size in bytes. The first word contains the low order part of the size. Both words are stored with the least significant byte first.
We first switch them.

Bytes 26 and 27 give the starting cluster.

We will look at that further when we examine the FAT but suffice it to say right now that this file starts at cluster 2.

Bytes 28 - 31 contain the file size with the first word containing the lower order part of the size and both words stored with the least significant byte first. This is

Now the first seven bytes represent years past 1980. In our case 0000100 represents 4, indicating that the file was made in 1984. The next four digits, 0111, represent the month: 7 (July). The last digits 00100 represent the day, 4 in our case.

For the file PROJECT the time is written as 914D. This can be represented as 1001 0001 0100 1101. Referring to our file description on page 14, the first thing we do to translate this is to reverse bytes 22 and 23. So we would get 0100 1101 1001 0001. Now, the left-most five bits represent the time. This means we have:

\[(0 \times 2^4) + (1 \times 2^3) + (0 \times 2^2) + (0 \times 2^1) + 1\]

which equals 9 AM; if it were 9 PM, we would get 21 (2100 hours).

The next 6 bits represent the minutes. Using the same logic as before, we get 44. The last bits give the number of 2 second increments, 10001 would give us 17 indicating 34 seconds.

Well, that's how the time is represented—somewhat confusing but it does minimize the space needed and that is important to an operating system.

Bytes 24 and 25, which contain an E408, represent the date, and again, we'll examine this closely:

We first switch them.

08E4 = 0000 1000 1110 0100

Now the first seven bytes represent years past 1980. In our case 0000100 represents 4, indicating that the file was made in 1984. The next four digits, 0111, represent the month: 7 (July). The last digits 00100 represent the day, 4 in our case.

So, now we know that PROJECT.BAK was placed on the disk on July 4, 1980 at 9:44 in the morning.

Bytes 26 and 27 give the starting cluster. We will look at that further when we examine the FAT but suffice it to say right now that this file starts at cluster 2.

Bytes 28 - 31 contain the file size with the first word containing the lower order part of the size and both words stored with the least significant byte first. This is
Since there are a total of 640 sectors per diskette, there are 320 clusters. How many bytes do we need to represent a cluster? Clearly 1 is not enough, it could only represent numbers from 0 to 255. Two would be fine (up to 64k could be represented) but this takes up too much room. Microsoft settled on 1.5 - 12 bits. So, when we talk about offsets in the file allocation table we are talking about groups of three hex characters (a byte and a half!). Since a nibble is half a byte, how about a 'chomp' for a byte and a half?

Let's first look at offsets 0 and 1 in the FAT in Figure 3. Remember, when we talk about an offset in the FAT, we are talking about 1 chomp—a byte and a half. We see FFF for offset 0 and then another FFF for offset 1. The first FFF tells the operating system that we have a double sided diskette. If it were single sided there would be an FFE. The FFF at offset 1 is a filler reserved for future use by IBM or Microsoft.

As mentioned above, the first cluster of our first file is #2, which corresponds to track 0, sectors 3 and 4, of side 1. These relative correspondences can be found in the IBM DOS 1.1 manual, Appendix A. After the operating system has read that cluster, where does it go next? Does our file continue at
As you can see the FAT is quite important. It is so important that there are two copies of it on the diskette, one in sector 3 and one in 4. If one cannot be read, for whatever reason, hopefully the other one can be. Both the FAT and the directory are read into memory when the system is brought up and are kept there.

Looking at the FAT again, it does appear that the clusters were assigned in order. Suppose we were interested in the 15th cluster. We count in 14 (remember, with an odd number—15—we subtract 1) groups of 3 hex digits at a time. We come to OFFF. The digits are unscrambled according to the above formula, and we come up with OOFF OFFF. Since 15 is odd, we are interested in the second of the two words. OFFF is clearly too large a number to represent a cluster and, yes, as you have probably deduced, it indicates an end of file. The 15th cluster of PROJECT.BAK is the last cluster of our file. There is no 16th cluster.
Removing Files

Suppose that for reasons of privacy we decide that we don't want anyone to see the file PROJECT.BAK so we erase it. Looking at the revised directory (Figure 4), there is an E5 in place of the first character of the file name but it doesn't appear that anything else has changed.

If we look at the FAT (Figure 5) it appears that the sectors that were being used for PROJECT.BAK are now available. They, of course, are the ones starting at offset 2 (chomps), and continuing for the entire line.

Looking through the diskette (which we will do shortly) you would find that PROJECT.BAK is still there and, in fact, has not been touched.

So, as you can see, when a file is erased the FAT is changed to indicate that the area taken up by that file is now available. The first character of the file name is changed to an E5. But that's it. The file is still there! If you create a new file, chances are that you will write over the old one but if you erase the file, and then remove the diskette from your computer, you have not done much of anything to assure privacy. If someone decides to go searching through the disk, the FAT could not be used but the name in the directory could probably be recreated and the file could be found. There are, in fact, programs that could make very educated guesses as to what the FAT probably looked like and recreate it for you.

Editing Files

Suppose we decide to edit the first of the two files on our diskette and, in fact, make it longer. What happens? I'll take a file known to be longer, give it the same name as the first file now on the diskette and we will see what happens.

Looking at the new directory (Figure 6), it would appear that the date and time have changed and the file size is bigger. The starting cluster did not change.

Now let's look at the FAT (Figure 7). The starting cluster is the same as before but look at offset #15. Remember we used to have OFFOFF, which translated to an end of file. If we look at the entry there now, by using our calculations we see that this new longer file takes up the same spaces that the older shorter one did, and then routes itself around the second file, JULY.BAK. This is an interesting and important feature of DOS 1.1. A less sophisticated operating system, such as the UCSD p-System would always look for a contiguous area large enough to hold the entire file. If such an area were not found, the user would get an 'out of space' error when, in fact, there may very well be more than enough room. DOS, however, would not do this.
Figure 6 - The New Directory

Side 0, Track 0, Sector 4
1st sector of Directory
50524F4A 45435420 42414500 00000000 00000000 00002791 PROJECT BAK.............
84080200 808E0000 324A554C 59202020 42414500 00000000 2JULY BAK.............
00000000 000A08A4 E3081000 80100000 E5F6F6F6 F6F6F6F6 F6F6F6F6 F6F6F6F6

Figure 7. The New FAT

Side 0, Track 0, Sector 2
1st sector of File Allocation Table
FFFFFF03 40000560 00078000 09A00000 0000DE00 000F5000 ....@..................P...
11200113 4000FF6F 01178001 19A0011B 0011DE00 011F0002 ....@..o...............E
21200223 40022560 02278002 29A002FF 0F000000 00000000 1 ..#%.*...)
00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000

Figure 7. The New FAT
In the case of Wordstar there actually is a mode which will allow you to write programs but, to allow this, Wordstar has to sacrifice some of its versatility.

In Wordstar and most other wordprocessors, the typist does not push the carriage return except at the end of a paragraph. As we can see from the above quote, after the word 'comparing' (Figure 9, line 2) there should be a carriage return and line feed. At the beginning of the 5th column in the second row we see an E7. As before, we strip away the leftmost I, giving us a hex 67 which is an ASCII 'g' that we expected. Next to that is a hex 20, a space, and then an 8D.

If you have ever wondered why you couldn't use a standard wordprocessor to write Pascal programs, you are probably beginning to see the problem. Since each byte is eight bits and ASCII character representation only requires the least significant seven bits, the wordprocessor has the remaining 128 characters that it can put to very good use. The compiler cannot always recognize these characters.

In the case of Wordstar there actually is a mode which will allow you to write programs but, to allow this, Wordstar has to sacrifice some of its versatility.
CONCLUSION

There you have it—a walk through a DOS 1.1 diskette. There was nothing very hard or complicated about what was seen or done and, hopefully the reader has gained some information about an object that is very important in their professional life—a 5 1/4 inch diskette.

BIBLIOGRAPHY

Microsoft, Disk Operating System, IBM Corp.
Boca Raton, FL 33432, 1982.

Norton, Peter, Inside the IBM-PC, Robert J.
Brady, Co., Bowie, MD 20715, 1983.

-----. The Norton Utilities, Peter Norton,
Santa Monica, CA 90403, 1983.
Many people tend to think that human factors specialists produce nothing but reports, papers, and advice (usually too late and largely unheeded!). A recent article in the Human Factors Society monthly Bulletin vividly counteracts this limited impression.

"...Buried within human factors R&D work are lots of products that have value, that will solve real problems, and that can and will command the respect of the 'hard' disciplines....For too long we have too often been known as the discipline that produces nothing more than long, boring, cumbersome technical reports. And you know about technical reports—they usually end up on the shelf, never to be read."

A survey made by the author, William B. Askren (Air Force Human Resources Laboratory, Wright-Patterson Air Force Base) revealed a wide range of practical "products" within various projects carried out by his organization and others. He lists them as follows, in order from concrete to less tangible:

- prototypes, mockups, drawings
- handbooks, training curricula, training manuals, users' guides
- algorithms, models, task analyses
- classification schemes, software, methodology, questionnaires, analysis formats
- requirements, regulations, standards, specifications
- costing data, human capacity information, evaluation criteria
- proposals, recommendations, plans, alternatives
- definitions, descriptions, examples, illustrations
- hypotheses, concepts, relationships

Askren continues, "I would propose that it is incumbent upon those of us engaged in human factors R&D projects or application efforts to help our customers define their research requirements in such a way that specific products are identified. Secondly, each product should be made a separate deliverable to the customer. If a technical report is to be prepared as part of the effort, it should be thought of as an adjunct to the products."

I heartily agree, and I believe a large part of the problem arises in the total ignorance on the part of most people about the meaning of "human factors" and what its practitioners can do. At our Agency in particular, most people (if they have heard of human factors at all) seem to think of it as concerned with the "subjective" aspects of terminals, furniture, etc. Human factors is everything that is left over when you take away "hardware", "software", and "cost"!

Human factors, these people think, is restricted to "vague", "emotional" things like whether a chair is "comfortable", a screen is "readable", or a console is "attractively styled". We really need to do a strenuous job of education to demonstrate to people that human factors can provide concrete, useful products that make a difference to the success of a project. In fact, at our Agency, a great many things that should be done with the advice and aid of human factors specialists are being done by engineers and technicians without the faintest regard for any but technical considerations. Many things that are defined as "hardware" and "software" are really basic human factors issues and problems. For example, what about control of the cursor on a VDT? Our managers define this as "software" or "hardware", because it is implemented in a board or program. But isn't the behavior of the cursor a central issue for the USER of a system? I think cursor behavior is a HUMAN FACTORS issue, not just "software" or "hardware. What do you think?"
SOME RECENT ARTICLES AND PUBLICATIONS

Readability of Text Scrolled on Visual Display Terminals as a Function of Window Size
R.L. Duchnicky and P.A. Kolers

ABSTRACT: "Readability of text scrolled on visual display terminals was studied as a function of three different line lengths, two different character densities, and five different window heights (either 1, 2, 3, 4, or 20 lines). All three variables significantly affected reading rate, but to markedly different extents. Lines of full and two-thirds screen width were read, on average, 25% faster than lines of one-third screen width. Text appearing at a density of 80 characters per line was read 30% faster than text in a format of 40 characters per line. Text appearing in windows four lines high was read as efficiently as text in 20-line windows, and text in one- or two-line windows was read only 9% more slowly than text in 20-line windows. Comprehension of the passages did not vary as a function of window size, indicating that subjects maintained a constant level of comprehension by varying their reading rate. Implications of the results for mixing text and graphics and for limited-capacity electronic displays are discussed."

Ergonomics in Technical Communication
Peter Martin

ABSTRACT: "The technical communicator must be a 'human engineer' because a communication, like a computer system, can be a technical success but a practical failure if its design discourages its use. Four parallels between technical communication and user-friendly systems are discussed: (1) Its overall structure should be apparent to the user; (2) it should be congenial without being chatty or too personal; (3) its nomenclature and syntax must be consistent throughout all functions; and (4) its logic must not trap users in loops but should lead them straight to their goals."

Not Seeing is Relieving: Invisible Writing With Computers
Stephen Marcus and Sheridan Blau

ABSTRACT: "Word processors with adjustable video screens are used to test students' writing facility with and without visual feedback. Lack of visual feedback seems to have a salutary effect in forcing concentration onto emerging thoughts rather than words and sentences. It also prevents interrupting the train of thought to edit and correct every few sentences. 'Local editing' is regarded as counter-productive because it deals with individual words and lines instead of reorganization and reorganization. For some students, however, the lack of feedback per se was disturbing and thought disrupting."

(Note: This is a really intriguing paper, with some provocative concepts. Especially interesting are the subjects' quoted comments on the inability to see what they had written, and the effects on their thinking. MED)

A Study of Revising and Editing at the Terminal,
Jean A. Lutz

ABSTRACT: "This paper presents the results of a comparative study of experienced writers editing and revising at a word processor and with pen and paper. Seven writers performed four writing tasks, each of which provided summaries of interviews with the subjects after each writing task. Results suggest that the word processor directly alters a writer's composing style."

(Note: This is another highly interesting paper. It brings up a point that I have never seen expressed before, but which seems to agree with my own subjective experience over many years of composing, revising my own writing, and editing others' writing both on paper and at a terminal. It appears likely that the terminal provides a somewhat smaller, more linear, and more restricted psychological 'window' into a document than a book or sheets of paper. It functions more like a tape and less like a random access memory. This is no problem for most writers with their own compositions, since they have a relatively clear concept of the structure at a high level. When editing others' papers, however, or using reference materials, the smaller mental 'window' can be a hindrance. Even in my own writing, I often prefer to print out a draft and make final revisions on paper to get a feel for the document as a whole. If the terminal does, indeed provide a smaller, more linear psychological 'window' for the user in contrast to printed books or pages, there are important implications for automation of some of our analytic tasks. I recommend this article. MED)
Wayne,

Have you ever considered the endless number of unusual experiences, both humorous and serious, that have befallen TDYers all over the world? They would make for a very entertaining book. How about a Cryptolog feature called something like "Can You Top This?" If people responded to it, it could ultimately make for a very intriguing collection of anecdotal tidbits. Attached is a case in point.

E. Leigh Sawyer

1961. End of a lengthy TDY to sites in Europe. Ready to go home. Pan-Am flight out of Orly. All on board. Capacity load of passengers, freight, mail, and fuel. 707 trundles out to end of runway. Swings around for takeoff. Final checks. Can see all sorts of funny control devices in wing sliding back and forth, going up and down, and so on. Observe that wing is remarkable hunk of engineering. All set now. Jets on full power. Brakes released. See man near runway with hands over ears. Must be dickens of a noise out there. Pretty close to rotation now. Plane lifts off. Strange thing. No familiar clunk noise as soon as wheels leave runway. Stranger thing. Angle of climb barely perceptible. Terrifying thing. Plane airborne 10 to 15 seconds and still only 20 feet off the ground. More terrifying thing. Plane is yawing badly left and right. First reaction is rapid calculation of ongoing insurance and special flight insurance to know how much wife will get. Total acceptance. This is where I buy the farm. For the next half hour, pilot earns pay for next five years. Wins fight to claw plane up to 2,000 feet. Intercom comes on. Pilot's voice. Cool, confident. The father image ("Daddy's taking us for a ride today"). "Lost engine on takeoff beyond rotation. Airplane didn't want to fly. Sorry for inconvenience. Will circle Orly for next hour dumping fuel." Landed safely. Passengers wined and dined during engine change. Duty free liquor store open. Most of passengers were floated on board three hours later. Seemed very carefree. I passed out before takeoff. Woke up over middle of Atlantic. Pilot comes to mind. Pushing 60. Gray hair. Probably logged over 1,000,000 miles. Thank you, pilot, God bless you.
**Introduction**

Relevancy of the topic. The subject matter of this paper is particularly relevant for at least three related reasons. First, personal computers are relatively new at NSA. In fact, they arrived on a large scale less than a year ago beginning around November 1983. Second, they are numerous. It is estimated that there are over 2,000 personal computers at NSA at present. Third, because they are new and because there are a lot of them, questions are being raised regarding their usefulness and their capability of being applied to every day agency problems as well as their effect on the organizations that have acquired them.

Currency of the data. Since they are so new at NSA, it is not illogical to assume that any study concerning personal computers that is undertaken at this time will find the data in a state of flux. It is, therefore, worthwhile to note that all the data that was gathered for this study is current as of April 1984 and is subject to change.

Definition by features of 'personal computer'. In order to properly discuss any subject, it is useful to define it in sufficient terms so that any misunderstanding resulting from its mention will be minimized. Accordingly, for the purposes of this paper, we define 'personal computer' to be a single user micro computer programmable by the user, and with a price under $10,000. The three essential features in this definition, as discussed below, effectively define the set of 'personal computers' to include systems such as IBM PC, IBM PC/XT, TRS 80, and Apple II, to mention just a few.

On the other hand, examples of systems not members of the set include the Hewlett Packard 9845, Wicat Systems 150WS, and the Xerox 860. The first does not meet the set criteria since its cost is in the $30,000-and-above range. The second is a multiuser microcomputer system with a base price in excess of $10,000 and thus it fails to satisfy two out of the three set criteria. The last system does not qualify as a member of the set since it is a dedicated word processor and not programmable by the user.

Single user. The 'single user' feature means that the resources of the computer are not shared and are for the exclusive use of a single user under normal circumstances. Although there is at least one operating system for microcomputers out on the market that is advertised as a multiuser system (Venix, a UNIX look-alike), the vast majority of personal computers are not equipped with the required hardware or software to handle more than one user at a time.
Average cost under $10,000. Although the 'price under $10,000' feature seems arbitrary at first glance, there is some supporting evidence for such a choice. In the April 1984 issue of PC WORLD, 46 personal computers were compared in terms of cost and hardware features. They ranged in price from a low of $1995 to a high of $14,995. It is notable, however, that only one system out of the 46 reviewed cost more that $7300—the GRiD Tempest, a briefcase portable with 256K of RAM, 384K of bubble memory, and a 300/1200 bps modem to list just a few features. The average cost for all 46 personal computers reviewed was $3723—well under $10,000.

Programmable by user. The 'programmable by the user' feature was included as part of the definition to exclude turnkey systems dedicated to a specific function—such as standalone word processors. Normally, these kinds of microcomputers do not have the software necessary to allow the average user to write and execute programs on them.

Collection of the data. An informal phone survey was used to determine the organizations within A Group that have personal computers. A questionnaire was then prepared that covered the following topics:

1. type and quantity of personal computers;
2. off-the-shelf personal computer software used;
3. applications on personal computers;
4. operational policies regarding personal computers;
5. problems and concerns relating to personal computers; and
6. personal computer hardware and software support.

The questionnaire was then applied in personal interviews arranged with each organization in A Group that was determined to have personal computers. A total of 34 organizations were interviewed.

Although the results of the interviews revealed a fairly large proportion of interesting and innovative applications using personal computers, a detailed description of these applications is beyond the scope of this paper.

Topic arrangement. The topics covered in this paper are roughly the same as those covered in the questionnaire. Section 2 covers the distribution of personal computers in A Group. Sections 3 and 4 deal with off-the-shelf and custom software and the way in which they are applied. On the other hand, the final sections deal more with the human aspect: section 5 examines operational policies for personal computers, section 6 takes a look at users' problems and concerns, while in section 7 user support for personal computers is investigated.
Current and proposed quantity of personal
computers. In Figure 1, the data show that A
Group currently has a total of 92 personal
computers with another 129 systems proposed
for the next six-month to one-year period. It
should be pointed out that some organizations
indicated that they would like to acquire a
quantity of agency standard terminals (AST) in
the coming year. Since, however, the AST has
not yet been officially selected, it remains
an unknown and for this reason data of this
type were not included with the data for pro­
posed acquisitions.

The distribution by Office is as follows. A0
currently has two personal computers and
would like an increase of two in the next year
for a total of four. Al has at present 28 and
desires 22 additional units for a total of 50.
There are currently 14 personal computers in
A2 and 28 new units are desired for the coming
year for a total of 42. A3 would like to in­
crease its current six units by three for a
total of nine. A4 presently has two personal
computers and would like 14 units in the com­
ing year. A5, with four personal computers at
present, would like to add 32 new units in the
coming year. Finally, A6 currently has 36
personal computers and would like 10 addi­
tional units in the coming year.

Numerical comparison of users to personal
computers. The data indicate that throughout
A Group there is an overall user-to-personal
computer ratio of 3.39 to 1 with 312 users for
92 personal computers. As shown in Figure 2,
these data are broken down by Office with the
greatest concentration of users and personal
computers appearing in A1, A2 and A6. The to­
tals are as follows:

A0: 3 users, 2 personal computers (1.5 : 1)
A1: 141 users, 28 personal computers (5 : 1)
A2: 50 users, 14 personal computers (3.6 : 1)
A3: 12 users, 6 personal computers (2 : 1)
A4: 3 users, 2 personal computers (1.5 : 1)
A5: 7 users, 4 personal computers (1.8 : 1)
A6: 96 users, 36 personal computers (2.7 : 1)

Types of systems and their distribution.
The data in Figure 3 show that there are only
five types of personal computers in A Group
that satisfy the criteria outlined in Section 1.
3 above. These are: IBM PC (74 units), IBM
PC/XT (9 units), Apple II (2 units) and Tri-in­for­mation Systems
BTS 2000 (2 units).

Typical equipment configurations. In in­
vestigating the equipment configurations for
each of the five types of personal computer,
it will be noticed that color monitors are
conspicuously absent. One of the main reasons
for this absence seems to be that color moni­
tors currently are TEMPEST approved only for
zones 4 through 5. Another general trend due
to the TEMPEST character of the equipment is
the almost total lack of hard disk drives.
There are only seven personal computers in A
Group with hard disk drives at present.
configurations include 2 floppy disk drives and a printer—usually a dot matrix graphics printer. Typical equipment configurations for each of the five types of personal computer are listed below.

IBM PC. Most of the IBM PCs have 2 floppy drives, 1 printer, a monochrome monitor and 128K, 256K, 384K or 512K of RAM—depending in part on how they were acquired. Those units acquired through the PCIC come with 512K of RAM, while personal computers acquired by sole source or competitive bid vary in the amount of memory and type of peripherals according to the organization's requirements at the time. IBM PCs used only as dumb terminals do not, in general, have printers.

IBM PC/XT. As a general rule, the standard configuration for IBM PC/XTs is 512K of RAM, 1 floppy drive, 1-10M hard disk drive, 1 printer and a color monitor. As indicated elsewhere, seven of the nine IBM PC/XTs have color monitors.

Radio Shack TRS80. Aside from the usual personal configuration of 2 floppy drives (one has 3 floppy drives), 1 printer and a monochrome monitor, the TRS 80s have either 48K or 128K of RAM.

Apple II. While both Apple IIs have 2 floppy drives and a printer, one has 48K of RAM and a monochrome monitor and the other has 184K of RAM and both a color and a monochrome monitor.

BTS 2000. Both BTS 2000s have 64K of RAM, 2 floppy drives, 1 printer, a monochrome monitor, and 3 communications ports.

Functional break-down. The question posed here was how many personal computers are being used solely as dumb terminals as opposed to stand-alone computers. As indicated in Figure 4, there are personal computers in A1, A2, and A3 that are used only as dumb terminals. 86% (or 79) of the current personal computers in A Group are being used only in stand-alone mode, while 14% (or 13--8 in A1, 4 in A2 and 1 in A5) are being used as dumb terminals.

Present and future acquisition methods. Three principle means of acquiring personal computers have been used in A Group:

(1) PCIC;
(2) sole source procurement; and
(3) loan from another organization.

Use of personal computers on a daily basis. The data in Figure 5 indicate that the average time per day that personal computers are used in A Group is 5.77 hours. Personal computer usage broken down by Office is most in A1, A2 and A4. It should be noted that a contributing factor to the high daily average in A1 is the fact that six personal computers are being used as dumb terminals 24 hours per day. The Office averages are as follows:

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Data base applications. For the purpose of this study, a data base on a personal computer is classified as small (less than 50,000 bytes), medium (50,000 to 175,000 bytes), and large (over 175,000 bytes). The software used in this type of application is Lotus123, Multiplan, and SuperCalc—the spreadsheet packages. In general, these applications are relatively small.

Tracking systems. The software used in this type of application is dBaseII, Microsoft Access, and SuperCalc—the database packages. In general, these applications are relatively large.

Text processing. The software being used for this type of application is WordStar, Volkswriter, Easy Writer, Edix, Wordix, and Professional Editor. At least four organizations indicated that they use WordStar as a program editor, while one organization uses it to produce graphics-like charts.
### PERSONAL COMPUTER OFF-THE-SHELF SOFTWARE IN A GROUP

Average Rating by Users on a 1-10 Scale

<table>
<thead>
<tr>
<th>software name</th>
<th>hardware</th>
<th>rating</th>
<th>number of responses</th>
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<tr>
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<td>APPLE</td>
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<td>1</td>
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<td>APPLE PASCAL</td>
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<td>2</td>
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<tr>
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<td>IBM</td>
<td>7.8</td>
<td>2</td>
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<tr>
<td>CP/M</td>
<td>APPLE</td>
<td>7</td>
<td>1</td>
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<tr>
<td>DBASE II</td>
<td>IBM</td>
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<td>IBM</td>
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<td>1</td>
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<tr>
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<td>IBM</td>
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APPLICATIONS WITH PERSONAL COMPUTERS IN A GROUP

(34 divisions or branches interviewed)

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COMMERCIAL

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SOFTWARE

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</thead>
<tbody>
<tr>
<td>multi</td>
<td>9</td>
<td>7</td>
</tr>
</tbody>
</table>

APPLICATIONS

TOTAL ORGANIZATIONS: 20 + 11 + 3 = 34
installation phases; installation personnel; installation schedule; equipment control; identification of standard software package; software distribution plan; identification of IBM PC supplies to be stocked; and training schedule, material, and categories.

Software management; acquisition and distribution of supplies; maintenance; software evaluation; software management; training; and security.

5. Operational policies and procedures

In general, it seems that there is an absence of formal operational policies regarding personal computers due to the lack of large enough concentrations of personal computers in any one organization. The two exceptions in A Group, A4 and A6, are discussed below. The remainder of A Group organizations have in general some informal procedures they follow that deal with security and training, for the most part. Informal security procedures include periodic back up of files, locking up data diskettes at night, ensuring that the personal computer is turned off at night, while training involves either getting a manual and learning by trial and error, using an automated tutorial, if available, or having an experienced user tutor the new user.

On the other hand, both A4 and A6 have formal written operational policies (A4's is still in draft form). The topics covered in the draft version operational policy of A4 are: security, standardized files, procurement of software, supplies, management of hardware, and assistance.

A63, with the largest single concentration of personal computers in A Group, has two operational policies: one dealing with installation and the other with operation. The IBM PC Hardware/Software Installation Plan covers:

- installation phases;
- installation personnel;
- installation schedule;
- equipment control;
- identification of standard software package;
- software distribution plan;
- identification of IBM PC supplies to be stocked; and
- training schedule, material, and categories.

The IBM PC Hardware/Software Policy deals with the following topics:

- hardware management;
- acquisition and distribution of supplies;
- maintenance;
- software evaluation;
- software management;
- training; and
- security.

- security.
6. Problems and Concerns

The final question on the questionnaire asks the interviewee to list any problems or concerns the organization has, in general, regarding personal computers. Out of a total of 34 organizations interviewed, 25 indicated that they had such problems and concerns. A total of 66 problems/concerns were listed for an average of 2.6 per organization. The responses fall roughly into six categories:

- no dust covers are provided or are generally available;
- not enough personal computers are available; waiting for the AST impedes acquisition of personal computers which it may render obsolete;
- there are too many bureaucratic levels to go through in the procurement process;
- supplies are hard to get and there are many delays;
- there is a need for color graphics, but the standard configuration does not have a color monitor; and
- there is no mechanism for upgrading the personal computer hardware.

- software manuals are difficult to understand and use;
- personal computer training and support is not centralized, thus causing the user to waste time and effort learning by trial and error;
- there is an overall lack of planning for training and support and not enough to go around;
- training at the branch and division level needs to be conducted regarding the usefulness of personal computers; and
- software evaluations need to be centralized, published and distributed on a regular basis to the users.

General operation and maintenance of personal computer hardware. Typical problems listed in this category were:

- the keyboard is poorly designed and therefore difficult to use accurately;
- images on the monochrome monitors are fuzzy and difficult to read, which causes eye strain;
- there is not enough space to put the personal computers;
- the graphics printer is too slow; and
- there is not enough memory or peripheral storage for some applications.

Training and support. Among the problems listed were

- the graphics printer is too slow;
- personal computer response time is too slow; and
- there is not enough memory or peripheral storage for some applications.

Acquisition and installation of hardware and software. Sample responses were:

- no dust covers are provided or are generally available;
- not enough personal computers are available; waiting for the AST impedes acquisition of personal computers which it may render obsolete;
- there are too many bureaucratic levels to go through in the procurement process;
- supplies are hard to get and there are many delays;
- there is a need for color graphics, but the standard configuration does not have a color monitor; and
- there is no mechanism for upgrading the personal computer hardware.

Human interface with personal computer hardware and software. Some sample responses in this category were:

- the keyboard is poorly designed and therefore difficult to use accurately;
- images on the monochrome monitors are fuzzy and difficult to read, which causes eye strain;
- there is not enough space to put the personal computers;
- the graphics printer is too loud and disturbs co-workers; and
- several personal computers in the same area give off enough heat to make the room uncomfortably warm.

Intermachine communication. This category includes problems expressed concerning networking as well as communications to a host computer. Sample problems listed were:

- networking is not being addressed despite a requirement for it;
- the reliability of file transfer between a host and personal computer is doubtful;
The questions addressed in this section deal with where A Group personal computer users currently get hardware and software support, if any, and the existence of a local, centralized support within A Group.

Sources currently cited by A Group users. Figure 8 shows that seven sources for personal computer support were cited. These include: 'individuals in A Group', A109, A63, 36, the PCIC, T2, and T3. Interestingly enough, eleven organizations (32%) indicated that they receive no support at all. A slightly larger number indicated that A63 provides support--although it should be borne in mind that fourteen of the organizations interviewed are in A6. In other words, it would seem that the role of A63 to provide computer applications support for all of A Group is not yet widely understood—at least in the context of personal computers.

Security. Problems listed under this category included:

- there is a need to have communications hook up to main frames;
- there needs to be an efficient, quick method for inputting large quantities of information from a host computer; and
- there is a need for Xerox 860 compatibility.

The PC users group meets once a month for an hour and is an excellent opportunity for A Group users to exchange ideas and discuss mutual problems. In addition to these services, A63 currently provides personal computer applications development support to A606 and A2.

8. Conclusions

PCs have been in A Group only a relatively short length of time and thus it should be stressed that the situation regarding PCs in A Group is transitory and will likely change in many ways. There is naturally some reticence on the part of prospective users who are used to the power of a main frame to recognize the utility of the PCs. At the same time, in-house training and software evaluation were not initially available to user's on an official basis and are only now starting to develop. As a result, inexperienced users are experiencing some frustration and hence many PCs are not being fully utilized. Other reasons include the fact that most organizations do not have communications to main frames yet although they have a requirement to work with data stored on the main frame.

According to official A63 memoranda dated 22 February and 1 May, A63 is equipped to provide the following support to A Group personal computer users:

- hardware/software consultation,
- software demonstrations and training;
- hardware demonstrations and training;
- off-the-shelf software evaluations; and
- a personal computer users group.

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Use larger forks: doubling the size of forks would double intake. In this regard, forks should be provided in two configurations: one twice the length and one twice the width in order to conform to varied oral specifications. The large fork factor (LFF) when combined with CG/R would materially accelerate consumption time (CT). In short, LFF + CG/R = CT. The same approach should be used for spoons, and, when peas are on the menu, knives. Thus we can also add both large spoon factor (LSF) and a large knife factor (LKF). Therefore, even when a person has soup, and a hot plate with peas, it still obtains that

\[ \text{CG/R + LFF + LKF + LSF} = \text{CT}. \]

Use higher tables or lower chairs. This lessens the distance the arm must travel between plate and mouth. The optimum distance is suggested as two inches, as opposed to the more normal distance of 18 inches. This would increase by a factor of 9 the rate of food intake \((9 \times \text{RFI})\). When combining RFI with increased CG/R and the realization of LFF/LSF/LKF, CT should be reduced to approximately three minutes, a savings of 27 minutes based upon current standards. When calculated against a loss of $300,000,000 per annum for the nonproductive cafeteria time of 15 extra minutes a day beyond the prescribed half hour, the savings of 27 minutes a day would add $540,000,000 of production rate per annum beyond the normal work year of the federal establishment. With perhaps $40,000,000 of this employed to subsidize free antacids, the new cost-out of increased production rates would still be substantial. Let's move out smartly!

It is time to clip the wings of this octopus!

Col D. Latour

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NSA-Crostic No. 59
by David H. Williams

A. Did Dale counterfeit tickets to battle­ground (2 wds)

B. When visiting with a boor, never sing Dorothy's great song (3 wds)

C. Call this Greek by phone on Roman 10

D. Ax me not where to bury this (2 wds)

E. Where the much bejeweled lady wore her sixth ring (4 wds)

Here's another puzzle in the cryptic vein. If you're not familiar with this type of definition, and would like to give it a try, call the author on 1103s, and you'll be sent an explanation of how these clues are put together.

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F. Ease peas are for the doctor
G. Try to use Indian blight in indiscernible circumstances
H. Frank camera
I. "The New Colossus": The other structure with which Alexander Eiffel was associated (3 wds)
J. He wanted Ned, Dee and Sam
K. Cross off King Tut's middle name
L. Ran into little Edward and gave him his share
M. Bury between
N. These reptiles enjoy tea amid the cardinal points
O. Literally, Greek magma
P. In a state of stimulation, it has a fixed period of expiration (3 wds)
Q. Auto pioneer after whom two cars were named — the other one being the Reo
R. That liver I ate made me feel very macho
S. That mineral I bent seemed to go on and on and on
T. This Latin is amid late back type of drug
U. Tossed with rewarding results
V. Enchanted, he marched off
W. Caesar's white road
X. This African grain is not efficient
Y. When I saw rainbow effect on iced screen, I cried
Z. Los Angeles Ram's embraceable one
a. He laughed as he bantered with the African queen

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