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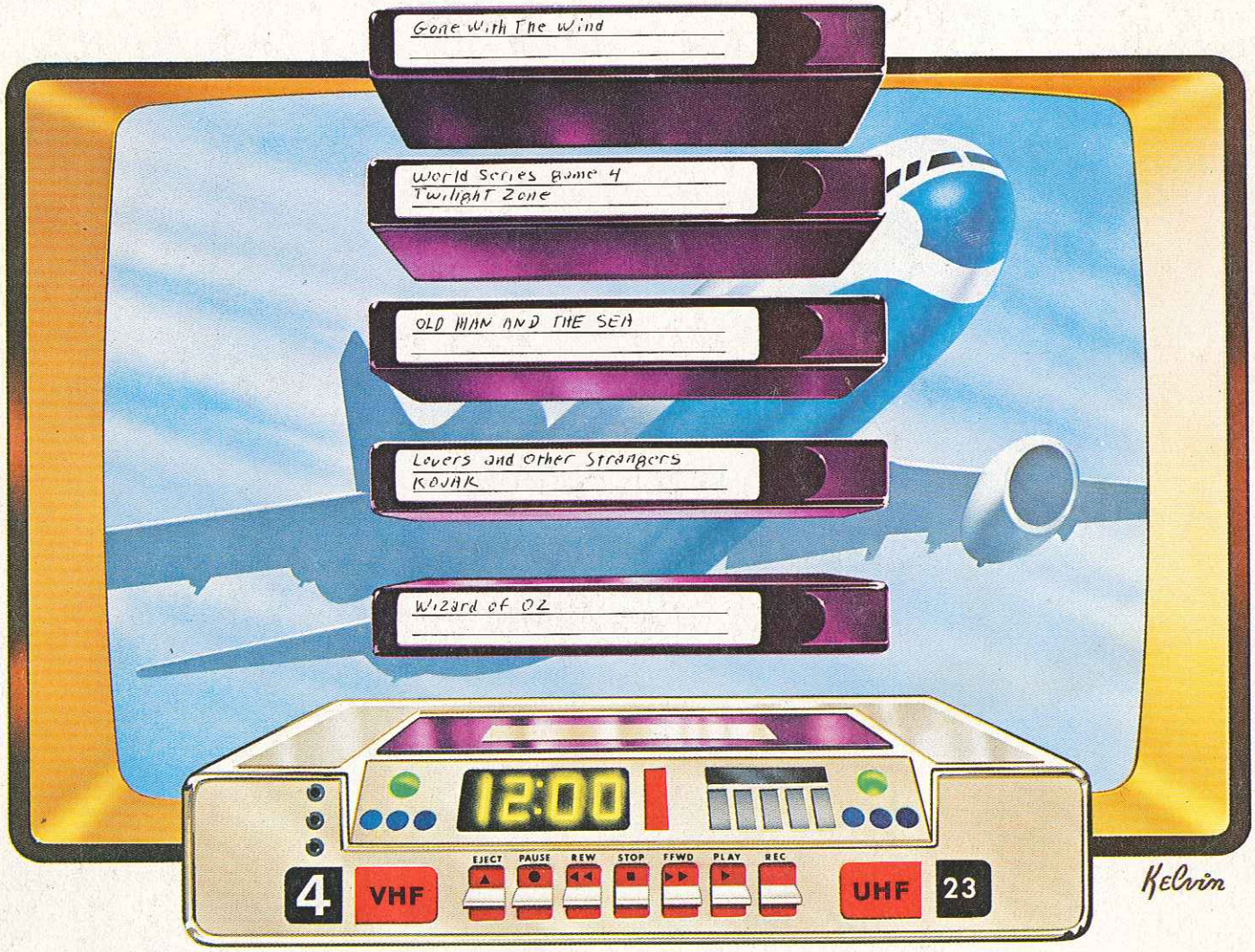

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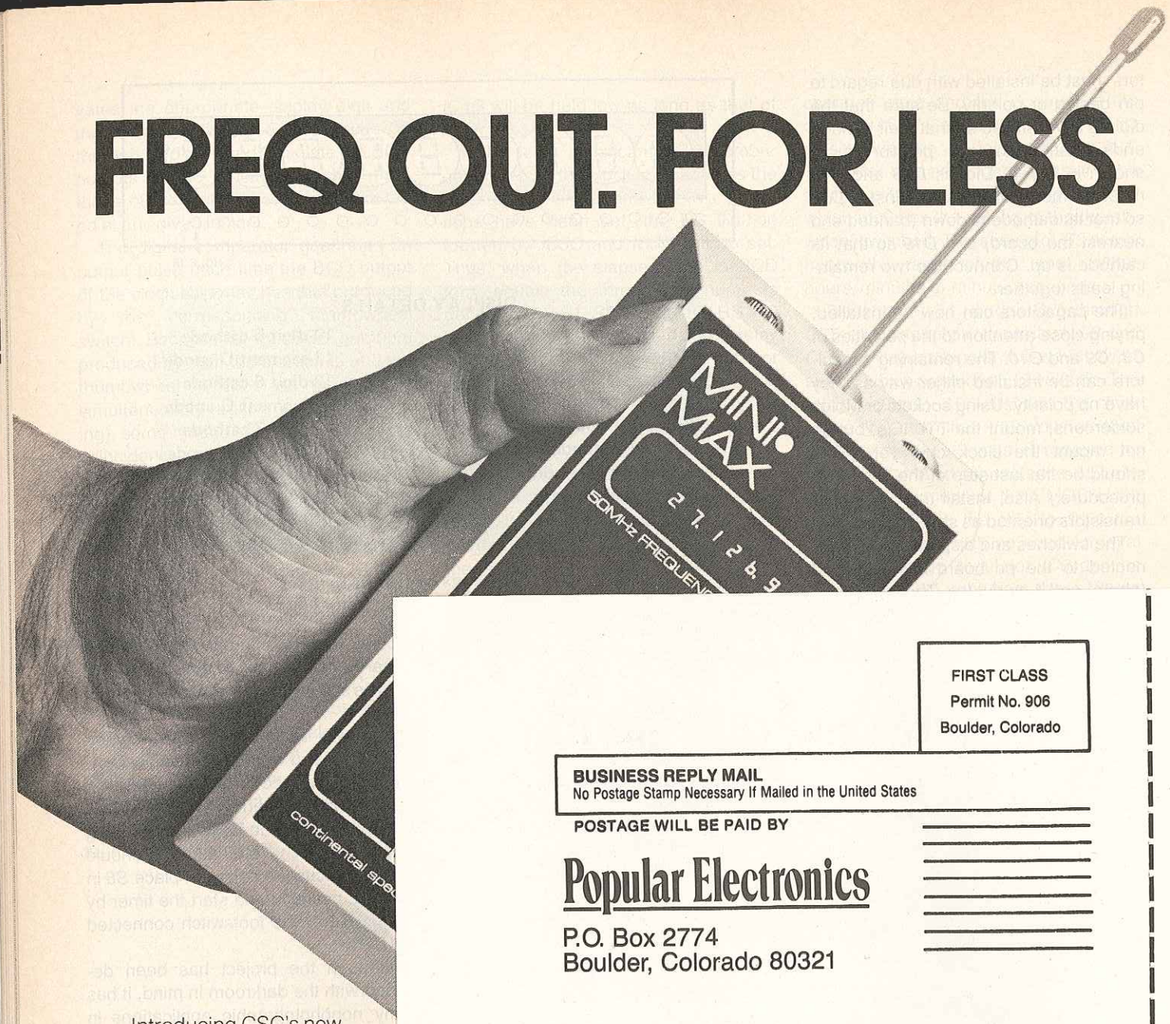

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Personal Computers for Small-Business Applications

More and more "home" computers are being used for commercial purposes. Here's why.

BY PORTIA ISAACSON

ALTHOUGH there are no industry statistics on the percentage of personal microcomputer (μC) sales that are made to businesses, computer store owners generally agree that more than 50% of their local sales are for business purposes. [Among POPULAR ELECTRONICS subscribers, a recent study revealed that primary uses are: business, 37.1%; home, 31.3%; both, 29.6%. This includes computer store *and* mail-order purchases. And "business" here combines commercial, industrial and engineering uses.]

Lower cost is the major reason for a business man to choose a "personal-use" μC. A typical business μC system with 32 kilobytes of memory, dual floppy disks, and a hard-copy terminal can be bought for about $6000. A similarly configured commercial μC system can cost as much as several times that price.

Differences in Price. There are several reasons why a commercial μC system (that is, business systems not sold through computer stores or by mail) costs more than a personal μC system. The major ones include small-industry pricing methods, lower sales overhead, less-stringent quality control measures, and less investment in software. Let's examine these in greater detail.

The personal μC industry was originally created around the S-100 bus. (The S-100 bus, as are other types, is a

set of electrical, mechanical, and logical specifications for the interconnections between the various plug-in subassemblies that transmit or receive data over the bus.) At this writing, there are more than 30 companies manufacturing computers using the S-100 bus and more than 150 companies with plug-in board subassemblies compatible with the S-100 bus. There are also some companies with S-50, IEEE and other bus systems. Since the competition centered on the S-100 bus and others is fierce, prices for personal-use computers and subassemblies are quite close to the lowest they can be set for the companies to realize a profit. Competition, therefore, tends to hold down prices for a personal-use computer, whether used at home or by the businessman.

Another reason for the price difference is the method of marketing used. A traditional commercial computer company might make several calls on a customer at the customer's location before making a sale. Following the sale, the customer will probably require assistance in using the system. These extra services cost money and raise the manufacturer's operating overhead.

A personal-use computer, in contrast, is marketed in a retail store where a salesperson's time is used much more efficiently, or by mail. Both methods of selling low-cost μC's make it possible to have a much lower markup and still realize a profit. Even such large companies as IBM have recognized the efficiency of the computer-store approach to marketing. IBM has opened several retail outlets for its small business computers, calling them "demonstration centers."

Though it is true that traditional commercial computer companies have more rigorous quality control, the experience of business users of personal-use computers has been very positive. This is supported by the fact that many computer stores offer a maintenance contract at nominal additional cost. Under the terms of the contract, the computer store agrees to repair any failure in the customer's system at the customer's location. Prices for the typical maintenance contracts are very competitive with those of the traditional commercial computer companies.

Business Hardware. A data-processing application typically requires a central-processing system, memory, dual-disk drives, and a hard-copy printer. (A CRT terminal might also be used for data observation and manipulation.) The central-processing system and its associated memory make up the nucleus of the system, while the disks are required for random or rapid sequential access of the data. Dual disks are necessary for reasonable copying operations capability. A hard-copy printer generates the necessary paper forms.

A typical μC configuration may use an 8080 microprocessor unit (MPU). With seven central registers, eight-bit-wide data paths, eight-bit integer arithmetic, and an instruction execution time of 2 to 9 μs, the 8080 can directly address 65K of memory. In terms of path width, instruction execution time, and memory size, the 8080 is roughly compatible to the IBM S/360 Mod 30, the workhorse computer of the 1960s. A 32K memory is usually sufficient for most business applications. In fact, 32K is the typical memory used in many IBM S/360 Mod 30 installations.

In personal or hobby μC systems, BASIC (the most commonly used high-level language) typically occupies 12 to 20K of memory, while the remainder of the memory is used for applications programs. Memory expansion to 65K is possible if an application requires it. Memory management software to support the use of greater than 65K of memory is not currently available. The memory speed is on the order of 500 ns access time, which is five times the speed of the S/360 Mod 30 system.

For most data processing applications, the most important decision will be the choice of a disk since the disk is approximately half the cost of the entire system. Disk performance ground rules are the same in low-cost computing as they have been in other forms of computing. Data processing applications tend to be limited by the disk, which determines the amount of data that can be accessed at one time and also determines the speed at which it can be accessed. Since the disk is largely mechanical, it will also be one of the least reliable components in the system. Another reason for caution in the selection of a disk is that, in mixed vendor systems, the system software comes from the manufacturer of the disk.

Floppy-disk sizes popularly used today are 8″ (20.3 cm) and 5¼″ (13.3 cm). Dual 8″ floppy-disk drives, which store 500 to 600K total, have a 100-400–ms access time and 32-60K byte/second transfer rate. They cost about $3000, including the required disk controller. Dual 5¼″ floppy-disk drives in contrast, store about 150 to 630K and have an average access time of 780 ms. This type of system has a transfer rate of 16-60K/second and it costs about $1800, including the controller. Many personal computer makers offer these disk systems.

We can expect to see some significant increases in the amount of storage we can obtain per dollar in the near future. In fact, Motorola is already delivering its 5¼″ dual-floppy disk drives that can store 630K for about $1900, including controller. We can also expect to see hard disks for low-cost computers.

Most computers use the standard RS-232C serial interface for terminals and printers. This is the same interface used by time-sharing terminals, minicomputer terminals, and some printers. Since any terminal or printer that uses the RS-232C interface can be used with hobby computers, a wide selection of these terminals is available.

At the low end of the printer category useful in a business environment, is an impact printer that uses roll paper at 120 characters/second and sells for about $750. The Digital Equipment Corp. DECwriter Model LA36 terminal accepts continuous forms, prints at 30 characters/second, and costs about $1500. The Texas Instruments Model 810 impact printer prints 150 characters/second and costs $2100. For word-processing applications, the Diablo terminal plots and prints at 30 characters/second and costs $3000.

If a printer is chosen, a CRT terminal is also needed. It should be noted that the terminal and/or printer can be one of the most costly components in a computer system. And since the printer is largely mechanical, it may also be a source of maintenance problems.

Most personal computers sold to businesses are fully assembled, burned in, and tested. Such purchases are usually made through computer stores rather than mail order houses because of the convenience of having local support services. Where an owner or employee is also a computer enthusiast, a kit route may be taken, of course.

Business Software. When comparing the capability of personal-use computers to larger computers and time-sharing services, the most obvious shortcoming of the personal-use computer is in the software area. There is less business/industry application available compared to that from traditional computer makers.

BASIC is the language most often used in programming personal-use computers for small business applications. Fundamentals can be learned in a few hours. COBOL, FORTRAN, PL/I, and APL are among the most popular languages used by the traditional computer makers. They're more difficult to learn, however. The use of BASIC is growing, here too, since it is a terminal-oriented language and is well-suited to time sharing.

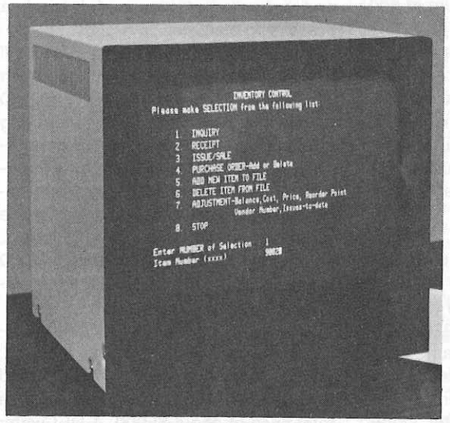
Fortunately, many of the available BASIC's have been extended especially for business applications. These usually include formatted input/output, disk-file manipulation (including random access), decimal arithmetic, string processing, subroutine parameter passing, and chaining of programs. The cost of a BASIC interpreter is about $100.

A few application packages are available. They include general ledger, payroll, inventory control, word processing, accounts payable, and accounts receivable. The prices of these programs vary greatly, but $1000 to $2000 is typical. Application software packages are available from the manufacturers in some cases. For the most part, however, they are offered by individual computer stores. Significant additional offerings can be expected soon, primarily packages for particular types of small businesses, such as medical clinics, personnel agencies, real-estate firms, lawyers, motorcycle shops, and astrologers.

If a business requires custom software for its own particular needs, the programs are usually written by the computer store or a consultant. Custom software can be very expensive, naturally. Since it is not uncommon for a consultant to charge $1000 per week for writing programs, the cost of custom software can easily exceed the cost of the hardware.

Presently, the availability of software is the primary factor limiting the use of personal computers in business applications. Many more programs are needed than just the standard business bookkeeping applications. Nearly an endless number of programs are needed to fill the requirements of specialized types of businesses. For example, a personnel agency needs an application package to maintain a file of job applicants and to search that file on command for applicants with certain job qualifications. A multiple-doctor clinic needs a program that can schedule appointments, answer inquiries, and each day print the doctors' schedules. A ready-mix concrete company needs a billing program that will take into account different mix formulas delivered to different customers. The list goes on and on.

Programs for personal computers in business applications are and will likely continue to be written by independent consultants, computer stores, and business persons with programming ability. It's expected that there will be a growing number of companies to serve as a distribution center for these independently produced programs in much the same way that book companies publish the work of independent authors and recording companies distribute the works of many independent musicians. Here, the original author of the program will be paid a royalty on each sale, while the distribution company will market and support the software nationally.



Typical video display as used in small business systems. This is usually the entry point for the system operator. It is from the data seen on the screen that the operator selects the program, or part of the program, he wishes to run.

Maintenance. While a computer enthusiast may enjoy spending many hours getting an ailing computer back to working order, a business must get its computer operational as soon as possible. Since most businesses do not have the wherewithall to perform their own computer repairs, they must look to the computer store to provide the necessary service. (As a rule, the only service a personal computer manufacturer provides is through the mail or by phone, which is a time-consuming procedure.)

The degree of service offered by computer stores varies greatly. Some stores offer repair service only in the store, charging by the hour (typically $20 or so) or by the type of board (usually a fixed percentage of the initial cost of the board). Some stores make service calls at the customer's location.

Many computer stores sell maintenance contracts on business computers. Such a contract is similar to a health-care plan: for a fixed annual fee of, say, $1000 to $1500 for a $10,000 business computer system, repairs and/or replacements will be effected in a timely manner at the customer's location.

A well-tested and burned-in personal computer is very reliable. One company that has 200 business computers in the field reports that, on the average, the cost of customer service for a system over a year's time has been $90. As a result, many customers dropped their maintenance contracts.

The Role of the Computer Store. Without the computer store there would be virtually no business market for personal computers since typical businesses need help from the planning stages right on through to a maintenance contract.

Many computer enthusiasts are happy enough to master the enormous amount of information that must be assimilated before the various sections of a computer are selected. A hobbyist usually purchases one section at a time, testing the system as he builds it. Typically, there is no particular end use in mind and, therefore, no particular requirement for the size of his computer system—it just grows as his budget and new applications allow. Business, on the other hand, has a specific use or uses for the computer. Business executives want to be sure that the computer system selected will not only work, but do the required job. Thus, the computer store's first service to the business is to answer the question, "Will a personal computer do the job I want done?" If that answer is yes, the store proceeds to

configure (choose the parts of) an appropriate system. Some typical important considerations are the amount of disk storage, the size of memory, and the speed of the printer. The computer store must consider the business application very carefully in making these decisions.

The next service performed by the store is to put the computer system together. Some stores actually do the assembly from kits. If various boards are purchased assembled from manufacturers, the computer store will burn in and test the system before delivery to uncover any infant mortality problems.

Probably the most important service provided by computer stores to businesses is ongoing repair service. Businesses usually cannot do their own repairs, and service from manufacturers by mail is obviously not a satisfactory route to take.

Nearly all computer stores, certainly the older ones, originally saw their market as being only the computer hobbyist. However, when disks became available for personal computers in 1976, business applications rapidly became common. At first, computer enthusiasts started applying personal computers to business problems. Then computer stores started developing standard business software packages for less knowledgeable users with some stores starting to specialize in the business customer.

The physical appearance of some stores started to change, too. Instead of a tile floor and a repair counter in plain view, stores were remodeled to have carpeted floors and no service counter with IC's in view.

With the appearance of the disk drive on the consumer market, computer store owners and personal computer makers have been developing standard business software packages for the businessman. The most common commercial business applications for personal-use computers are bookkeeping and word processing.

The bookkeeping functions include general ledger, accounts receivable, accounts payable, and payroll. Different types of small businesses can make use of the same application software.

Use of Personal Computers in Business. Word processing is useful to many different businesses, including large companies. In word processing, the computer is used with a typewriter-like terminal to edit manuscript and print form letters.

Here are some examples of how personal computers have been used successfully in the small-business world.

Savings and Loan. A savings and loan association is an excellent example of a business that has a wealth of applications ideally suited to a μC. Two Dallas, Texas savings and loan associations recently installed μC's for their daily operations of taking deposits, paying interest, and making home loans. Software was developed by a consultant and a former savings and loan data processing manager.

The first of these companies to install a μC was a medium-sized operation with $100-million in assets and about 50 employees. Most of its data-processing needs were satisfied by an on-line system provided by a service bureau. However, there were enough small applications not being performed by the service bureau to easily justify the μC. In fact, the savings and loan estimates a $7000 annual savings based on just those applications initially delivered.

The μC system uses an 8080 microprocessor with 32K of main memory, dual 8″ floppy disks that store 512K, and an extended BASIC interpreter, all for a total price of about $5000. A DECwriter LA36 was leased, with maintenance, for $86 per month to take care of input and output requirements.

Application software was written entirely in BASIC in less than four weeks. The package comprised eight different applications that consist of about 2700 BASIC statements.

One application for the μC system is the preparation of new account letters and closed account stuffers. Form letters are stored on the disk and written on demand to a list of names and addresses entered in a different disk file. The new account letters give the company a marketing advantage as well as a dollar savings on the required twice-yearly audits.

Employees of the savings and loan, including secretaries, accountants, and tellers who use the μC system have accepted it as a working member of their team. One reason for this was the use of a "people-oriented" user interface that gently guides the user through the programs. Each program was almost completely self-instructing.

The second Dallas savings and loan company to install a μC was a medium-size association having 35 employees. It uses an in-house IBM System/3 for most data-processing functions. Several applications, however, were found to be more suited to the μC. The system identical to the one described above, uses most of the same software and has six additional applications. Including the hardware and the software, the system cost less than $9000.

Before the μC was installed, the association's employees spent two days to prepare 30 required reports on loans sold to the Federal Home Loan Mortgage Association. The reports are now prepared in only two hours.

A card file that used to keep track of the due date on 10,000 insurance policies was replaced by a seven-page BASIC program that performs the function of the card file and also sorts the policies by insurance agents. Fewer checks are written, fewer errors are made, and a substantial amount of money is saved.

Before the μC was installed, the payroll was done manually by the controller. Now the controller still makes up the payroll, but he has a computer to assist him. The payroll program used consists of 750 BASIC statements, can handle up to 250 employees, and maintains a pass-word-protected file of information on employees. The 800 bytes of data maintained on each employee can be displayed and modified as required.

Possibly the most interesting application is a program that selects packages of loans for resale. A buyer of a loan package can specify a wide variety of parameter ranges that must be satisfied by the loans in the package. For example, all loans in a package might be required to be between 8½% and 8¾% and also satisfy several other conditions. In fact, any combination of 12 unique types of constraints can be applied to a given package.

Before the μC was in use, up to two days were required to select a loan package. Now the same operation can be done in only 40 minutes, giving the association a significant competitive advantage when several associations are bidding loan packages to the same buyer.

A set of ledger cards was previously used to keep track of real estate owned by the association. All transactions associated with each piece of property were recorded on the cards. Now the μC has replaced the ledger cards and provides timely, accurate reports on the status of each piece of real estate.

A tickler file for loan commitments was needed to plan cash requirements more accurately. The μC proved to be perfect for this application.

The association has calculated that its total saving due to the μC is $450 per month. This compares favorably with the $350 per month μC amortization cost over a three-year period.

Tour Agency. A tour agency that operates dedicated flights out of 16 U.S. airports to exotic vacation spots like the Bahamas, Jamaica, and Acapulco, recently installed a personal μC for business purposes. Bookings are accepted from travel agents from all parts of the country. Each booking involves the date and destination, hotel reservations, meal service, and other travel options. Follow-up paperwork and record keeping is extensive. Confirmations and invoices must be issued, alphabetized manifests are required by the airline, and hotel lists must be drawn up.

Seats can be sold right up to the time of departure, so there is little time for paperwork and error checking. Currently, the agency produces its manifests five days prior to tour departure and implements later changes by telephone. The agency may hold more than 20,000 individual reservations at any one time and may schedule 25 different flights during any one three-day weekend. The entire operation is controlled by five to eight clerks staffing the telephones and controlling the flight boards.

The computer setup consists of a distributed data processing network containing 10 personal μC's and one minicomputer. An IBM Series-1 minicomputer controls a database that contains information on all flights and reservations, while 10 PolyMorphic μC's (eight 8810's and two 8813's) interface with it (using a 9600-baud line) to provide reservation, documentation, accounting, and management information. Six of the 8810's, each with a 90K minifloppy diskette, serve as intelligent terminals (to the Series-1) for the individual travel clerks.

Documentation is by two Texas Instruments Model 810 printers under the control of an 8810 and an 8813 with two diskettes. A second 8813 provides support to the accounting function of the agency, while an 8810 provides on-line management information to the general manager. This terminal can also provide trend analysis and other statistical analyses of the database.

The interface between the personal computers and the IBM computer is a set of microprocessor-controlled RS-232 serial ports. There was no special hardware constructed for the system.

For the individual travel clerks, the system can call up current availability of seating, options, and flights from the database on request and display it on a formatted screen at their location. When the system is first turned on, a list of available services is automatically presented. After signing on with an individual password (used to assign responsibility, prevent unauthorized use of the system, and limit access to some stored data), the operator selects the appropriate function. A formatted screen display is then presented, using software, with a blinking cursor to indicate the entries required. Reservation details are sent to the Series-1, which updates the database and instructs its printer to automatically produce the required confirmations and invoices.

The system provides excellent backup, too. The Series-1 automatically produces a magnetic tape of transactions as they are received from the operators' terminals. If the system "crashes," the tape can be used to recreate the data from the point of failure without having to return to the backup disk produced the preceding night.

If the Series-1 goes down, each μC can conduct limited business by retaining reservation requests on its own minifloppy disk. This allows the agency to continue near-normal operation. When the Series-1 comes back on-line, rapid transfer of information from the μC's to the database can be accomplished.

The system also provides impressive growth potential. The starting six operator positions can be increased to about 18 without changing the configuration of the Series-1.

The Future. Several factors will contribute to the increasing usage of personal computers for small businesses. First, the new and much lower cost threshold for the feasibility of application will open many new areas. More and more packages that include hardware, software, maintenance, and training will be developed for particular types of business applications.

Next, a misconception held by some people that personal computers are not sufficiently powerful or reliable enough for business purposes will be dispelled. As noted earlier, today's personal computer compares quite favorably and closely to the IBM S/360 Mod 30 that was the data-processing workhorse of the late 1960's. And the cost of personal computers is much lower. So we can expect a rapidly increasing use of personal computers by businesses. ◇

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