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Innovations



Keeping people on the go in touch —
Today's business professionals are becoming more mobile, a fact that is driving the requirement for a personal device that can organize, compute and communicate information — anywhere in the world. The device must be hand-held and easy to use. And, it must have fully integrated hardware and software.

The move of personal computers from the desktop to the laptop to the notebook has pushed the technology envelope. As the personal computer merges with a new device, known as a personal digital assistant or a personal communicator, a new set of innovative technologies is required.

(See article on page 10.)



IBM INTERNAL USE ONLY

Keeping people on the go in touch

By Brent A. Beatty and Frank J. Canova Jr.

Emerging computer technologies enabled the personal computer to move from desktop to palmtop. Now, new communication technologies are enabling computers to become more interconnected, making it possible for mobile workers to keep up with information as they travel. Thus, a new form of mobile computer that offers both "wired" and wireless connection to other systems is emerging — the personal communicator.

Customers want these new handheld personal communicators to be, above all else, "novice-friendly" — just like a household appliance. To meet this need, new technologies such as micro-miniature power supplies; lightweight, rugged LCDs; single-chip microprocessors with integrated supporting functions; and miniature communication devices must be defined and fabricated. This article discusses the hardware and software technologies that IBM has developed to meet the needs of the new mobile worker.

A glimpse at the future

The personal communicator's physical appearance does not resemble a personal computer at all. In fact, the IBM Personal Communicator, featured in a technology demonstration at 1992 Fall COMDEX,** looks more like a cordless phone than a computer. The difference is that the Personal Communicator — with a real computer inside — makes information available at the touch of a button, without the need for complicated commands, cables and protocols. In every respect, the IBM Personal Communicator is intended to be "novice-friendly."

Just how novice-friendly is this new device? Here's just a glimpse at what you can expect.

Your morning starts with a cup of coffee over your day's agenda, which you access with the Personal Communicator. Noticing that your secretary sent you a last-minute addition, you touch the name on the meeting announcement

to check the person's address. An address book entry appears automatically. You notice the location is across town, and you know you may be a little late. By touching a dial button, you can call automatically. You can also receive the fax being sent for you to review. Momentarily, the Personal Communicator receives the fax transmission. You check the fax and use the LCD touch screen to make notes on it. Before the drive to work, you check the world news service.

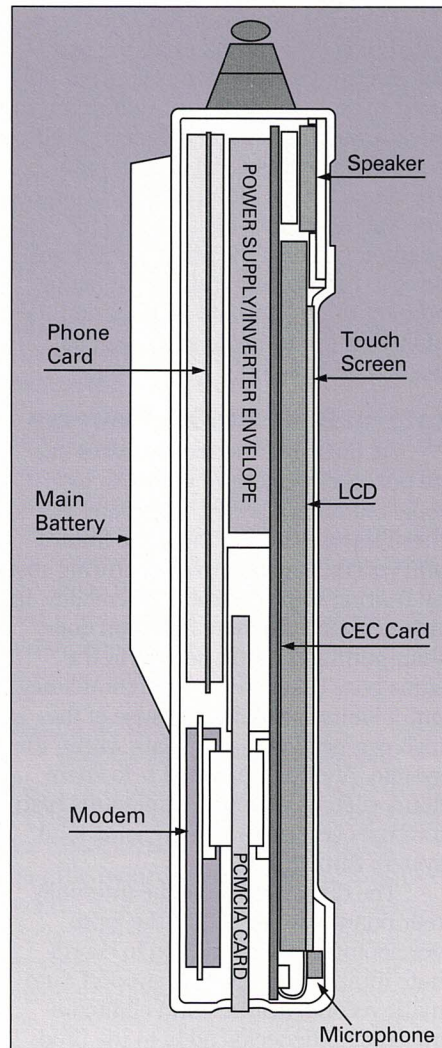


Figure 1. Inside the Personal Communicator.

Sound far-fetched? It's not. With all the new technologies available today, the Personal Communicator is on the verge of becoming a reality.

Features

Cutting-edge communication technology is obviously key to making the Personal Communicator successful, but built-in applications and high integration are also essential. The COMDEX technology model contained the following features:

- 16 MHz 8086-compatible system-on-a-chip
- Cellular transceiver, compatible with Advanced Mobile Phone System (AMPS), including earphone and microphone for voice calls
- 2400 baud data modem, 9600 baud fax modem, including Microcom Network Protocol 5 (MNP5) error-checking and compression
- 1MB of pseudostatic RAM
- Up to 2MB of application ROM
- Fine-pitch LCD with a CGA resolution of 640 x 200
- Pressure-sensitive touch screen
- Miniature power supply with backup battery support
- High-efficiency backlight power supply
- Personal Computer Memory Card International Association (PCMCIA) Type II expansion slot
- Hand-held, 16-ounce, highly integrated package

Figure 1 shows a cross-section view of the Personal Communicator's components.

Built-in applications

The Personal Communicator features a wide range of applications that include the following:

- Phone application that allows the mobile professional to use the cellular transceiver like a standard cellular telephone
- Redial of one of last 10 numbers and quick dial screens with configurable

"labels" that make dialing simpler than does a regular telephone

- Mail application that allows simple connection with a "post office" (e.g., a Lotus cc:Mail** server) via the internal data modem
- Calendar that shows a list of things to do at various times
- Address book that organizes names, addresses and phone numbers in a Rolodex** format
- An editor that allows text entry on a simulated QWERTY keyboard, one of several possible formats that can be used
- Calculator
- Several sample information services: news, sports, weather, stocks and entertainment

Well-integrated communication and built-in friendly software distinguish the Personal Communicator from conventional notebooks or pocket organizers.

Integrated electronics

The Personal Communicator combines a cellular transceiver, data and fax modem, together with a processor, display, touch input and power systems. Packaging all that in one hand-held unit is no small feat.

The cellular subsystem contains a highly integrated RF transceiver with a digital signal processor (DSP) and a microcontroller to manage the cellular connection. At 600 milliwatts, the transceiver adjusts its frequency and power based on commands from the cellular base station. The tricky part is the hand-off from one base station to another. During this interval, a dead zone may occur for several seconds during which no voice or data communication can get through.

Because of cellular hand-offs, special error-detection and correction algorithms are needed. In the COMDEX technology model, MNP5 protocol was used in the data modem, although more advanced methods also exist for cellular communication. The data modem operates reliably at 2400 baud. Because of cellular bandwidth limitations, it cannot exceed 4800 baud. Other digital standards, such as Cellular Digital Packet Data (CDPD), are emerging and will push this limit even farther.

The main processor where the software tools execute is a highly integrated, single-chip system. The integration of chips makes possible the Personal Communicator's hand-held size. Not only does the single chip contain the main 8086-compatible processor, but also all the interrupt, timers, DMA, memory controls, clocks and other support logic that make it like a PC XT.* In addition, all PCMCIA controls are on this chip. PCMCIA option cards, increasingly used in mobile computers, are designed to be very small, lightweight and low power.

Fine-pitch LCD

Because of the Personal Communicator's small size, the LCD display's viewing area is also small — about $4\frac{1}{2} \times 1\frac{1}{2}$ inches. Since the unit will be used in locations where the light is dim (e.g., air planes and cars), it has a backlight so that the user can see the information. The display also contains enough text and icon information so that the user does not have to page through several screens to complete a task.

The device's screen resolution is 640 x 200 pixels — equivalent to a CGA display. The small display size required that the distance from center-to-center of each pixel be smaller than what was available in the industry. Although this requirement presented a challenge, the development team was able to overcome it. The LCD assembly also had to be thin; therefore, the internal lighting source and its light-diffusing system had to be unique — another challenge. (See article on page 13.)

Miniature power supply

When most people think of a battery-operated device, they think that the battery directly supplies the power to the system. This is not the case in most electronic equipment. The battery voltage, which changes as the battery is discharged, must be converted to a very stable voltage, usually 5.0 or 3.3 volts, to run the microprocessor, memory and the other electronic circuitry. The battery voltage must also be inverted from its nominal 7.2 volts dc to 800 volts ac to operate the cold cathode fluorescent backlight.

The electronic circuitry used in the Personal Communicator must be very

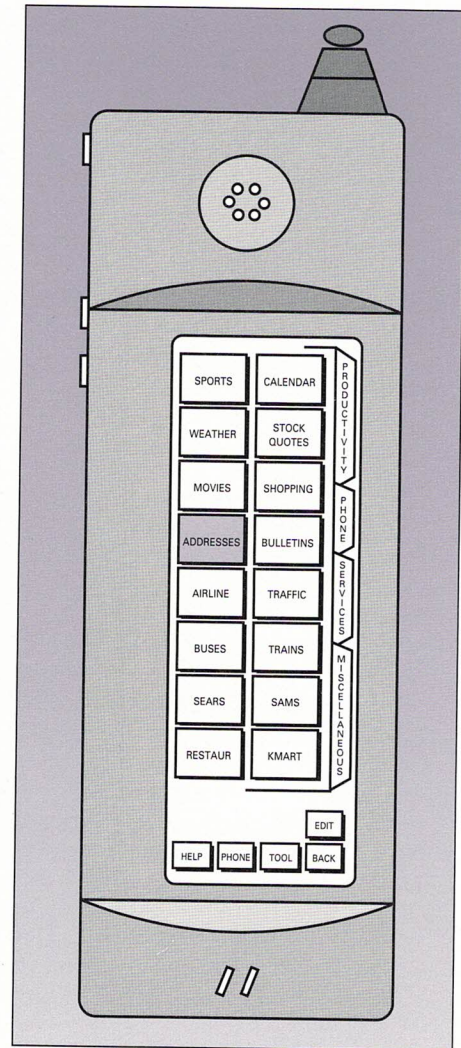


Figure 2. Tools screen.

efficient so that it uses very little power from the battery and does not generate heat. This requires a new type of power supply technology. Just as the microprocessor had to include several subsystems, so does the new type of power-conversion circuitry. New types of chips that contain a very high integration of functions are now available for low-power devices like the Personal Communicator.

Built-in office tools

The tools included in the Personal Communicator are not simply off-the-shelf applications (see Figure 2). Careful consideration was given to how a mobile professional would use them; thus, the tools are completely interconnected.

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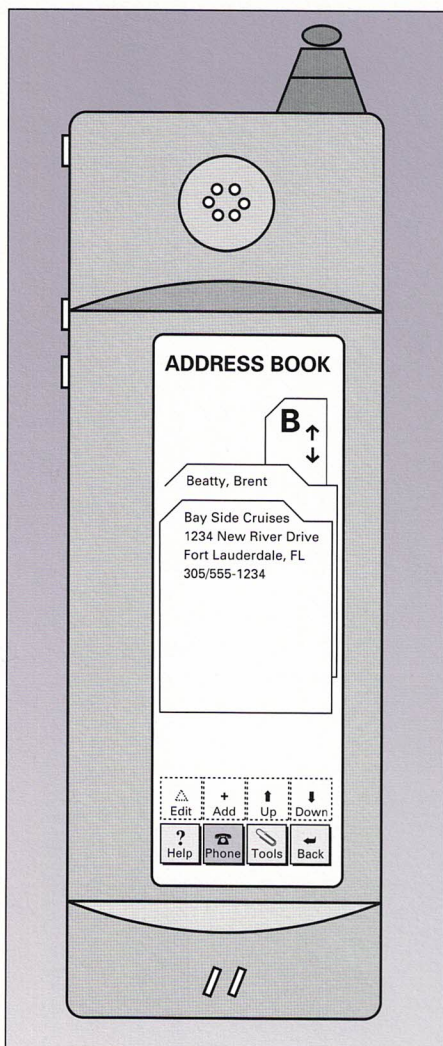


Figure 3. Address screen.

For example, while looking at a name in the address book (see Figure 3), the user can touch the Rolodex card entry and then touch "Phone." This action invokes the telephone tool, which automatically extracts the telephone number from the card, and, if necessary, adds the appropriate area code prefix, and then dials the number of the person whose name was selected. This is just one of ways the integration of software and hardware makes the unit simple to use.

The Personal Communicator's user interface offers unique features. For example, its narrow width enables the mobile worker to hold the unit in one hand and, with the thumb, use the touch screen to "dial" a telephone number — leaving the other hand free to hold notes or even a steering wheel! Another feature enables the user to select a function icon, whose target area is very small, by using the "last touch" approach. With the "last touch" approach, "buttons" on the LCD are highlighted when pressed and selected only when released. This enables the user to adjust the position being pressed and gives high accuracy even when the target area is small.

DOS does not provide enough function for a graphical touch screen interface, and other operating systems, such as Windows** and OS/2, require too much memory for such a small device.

Therefore, a new environment called Navigator, which runs on DOS 5.0, was designed to provide the graphical user interface and base communication functions; it also controls the interaction of various software tools.

Summary

An instant success at 1992 Fall COMDEX, IBM's Personal Communicator showed IBM's vision of how people will stay in touch any time, anywhere and with anybody. Since COMDEX, the IBM Personal Communicator has been demonstrated on television and covered in all the major PC trade magazines. IBM has also demonstrated the Personal Communicator to customers worldwide.

The broad interest stirred by the Personal Communicator is accelerating the trend in information appliances for people on the go. And, thanks to the latest advances in computer and communication technologies, an entirely new breed of hand-held computers is making the scene. IBM's Personal Communicator is designed to keep the mobile worker in touch — any time, anywhere. ■

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Everyone Sells BRTS lead program open to site employees

The PC Company's Boca Raton Technical Services organization recently announced the *Everyone Sells BRTS* lead program. Through this program, IBM Boca Raton employees can submit external customer leads for BRTS' services. If a lead results in the sale of a service, the submitter will be compensated. The program runs through December 31, 1993.

Who can participate

All active regular, supplemental, co-op and term

employees of IBM Boca Raton are eligible to participate, with the exception of any employee who is already directly compensated for selling BRTS services or who receives leads while representing BRTS at an industry trade show. Contractors are not eligible to participate.

How it works

If you think you have a potential lead for BRTS, at the OV/VM command line, enter **AEFORMS BRTSLEAD**.

Complete and send the form to BCRVMPC2(BRTSLEAD). Or print the form, complete it, and mail it to:

Everyone Sells BRTS
Lead Program
Internal Zip 1801
Boca Raton, FL

For more information

See SITENEWS for September 1, 1993, for more details about the program. ■

New requirements for LCD display technology

By Brent A. Beatty

The popularity of personal digital assistants (PDAs) is growing. More and more, the PDA is being used in business meetings and conferences. Small, light and silent, it is unobtrusive. The PDA's software applications are designed to provide instant access to important names, addresses, telephone numbers, meeting dates, and other information. The amount of information displayed for any one application is limited so that it can be displayed on a low-resolution LCD display. These displays use an LCD with no internal lighting; thus, they are not readable in poorly lighted areas.

Now a new type of device, the *personal communicator*, is on the horizon, and it's driving a new set of requirements for LCD displays (see Figure 1). IBM's Personal Communicator is a PDA — and much more. It can display large amounts of data, both text and graphics. Information must be clearly readable and available at all times, even in poorly lighted areas. The Personal Communicator's high-resolution LCD display with

its own internal lighting ensures that data is readable.

The Personal Communicator also has an integrated cellular telephone. Because of this important feature, the device will probably be operated not just in the office, but also outside the office in hot and cold environments. This wider than normal temperature range presents a new set of challenges. With colder temperatures, the response time of the display increases, and the cold cathode fluorescent backlight requires more voltage to operate. At higher temperatures, the contrast ratio decreases, and the liquid crystals can lose their ability to modulate the light, causing the display to turn dark. All this has been considered in the new design point for the LCD and backlight assembly.

A high contrast ratio is needed if the displayed information is to be readable in all ambient light conditions. The response time for the LCD crystal material must be short in order to allow the information to change rapidly. Thus, a

trade-off is made between the LCD's contrast ratio and response time. Since the Personal Communicator does not use a mouse or a pointing device, the response time can be longer than that of a laptop or notebook. The longer time allows for the higher contrast ratio needed in brightly lighted areas.

The sharpest image with the best resolution is useless if it cannot be seen. To ensure that the Personal Communicator's information can always be seen, the LCD assembly has an integrated backlight. The brightness of a backlight is proportional to the amount of power used by the light and the efficiency of the light diffuser. More power to the backlight means a shorter battery life. The mechanical constraints forced the LCD assembly to be a maximum of 5.4 millimeters. This required the fluorescent tube to be only 3 millimeters in diameter and the light diffuser to be even thinner.

As the market for the Personal Communicator grows, users will demand smaller, lighter, brighter displays. Hence, display technology will become more sophisticated. With high-resolution graphics and text, color will soon be a requirement. Slow-scan tele-video conferencing will be a natural extension to add to the attributes of the Personal Communicator. With Digital Video Interactive** and PCTV available, full-motion TV may not be far behind — driving an entirely new set of requirements for the LCD display, many of which are now being investigated. ■

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Requirement	Specification
Dot Pitch Distance from center to center of each pixel or "dot" that makes up the information on the screen	0.007 in. (0.18 mm)
Dot Spacing Distance between individual pixels	0.001 in. (0.025 mm)
Internal Backlight Cold cathode fluorescent tube (similar to the one in your office)	0.12 in. (3 mm) in diameter; 1.7 in. (44 mm) in length
LCD's Total Thickness	0.21 in. (5.4 mm)
Shock and Vibration	Ability to withstand a 4-foot drop when integrated in a system

Figure 1. LCD display requirements.