

New technology may some day make your heart's desire a reality, but compromise is still the name of the handheld game By Peter Savage

The Perfect Handheld: Dream On

It's 2004, and you reach in your pocket for your incredible handheld device. It's slim, weighs negligible grams, and is not much bigger than the cellphone you just put aside forever. Is it a phone, a handheld PC, or a wireless PDA? You don't really care, because it does everything.

It has a large, bright backlit color screen. If you want to make a phone call or send an e-mail, there's a thumb keyboard. Just click on a phone number, and a phone connection is automatically made. You can read private or corporate e-mail, receive instant messages in several formats, surf the Web, or download music or films, all at broadband speeds. The processor is dazzlingly fast, and there's a gigabyte or more of storage. The power source is good for several days.

There's also a touchpad area, which reads your handwriting, a digital tape recorder, and voice recognition software that actually works. Your handheld "talks" wirelessly with printers, video, and still cameras, and almost any other device. When you take it on the road, it connects seamlessly with data or phone services, everywhere you go, worldwide. The browser is secure enough for you to shop online worry-free with a credit card. No one else can use it, because it recognizes your fingerprint.

Best of all, it's a no-brainer. It requires almost no configuring or expert knowledge to set up. It's no harder to use than a CD player or portable radio, monthly operating costs are minimal, and it only costs you US \$300. You'd never dream of leaving home without it....

Well, dream on.

While you can find some of these useful features in handheld devices on the market even today, it has proven extremely difficult to shoehorn all of them into such a small gadget. As a result, current devices embody many design compromises.

Sales of handhelds that go beyond functioning as simple PDAs have been lackluster: the simple ones make up 90 percent of sales. Only early adopters of technology are willing to brave the hassles of what's on the market right now. Add that to a slower post-dot-com economy over the past 18 months, and you can see why shipments of handheld devices have consistently failed to meet optimistic projections.

The way forward is dictated by the answers to two questions: what do people really want in a handheld? And how can designers meet those needs?

If there were a simple answer to what people really want in an enriched handheld, some savvy manufacturer surely would have built it by now. But different people want different things, which is why there are about 120 competing models on the market. Some want a smart phone that can double as a PDA. Some want a handheld PC that can make a phone call, but is best at wireless communication. Get away from the business user, and you find customers wanting to add Web browsing, streaming video, MP3s, games, connectivity with the global positioning system (GPS), and many other applications.

But do consumers really want one device that does it all, or might they feel more comfortable with two? Perhaps an ideal handheld would be a PDA with most of the fancy functions thrown in, but with phone applications and networking activities left to a better cellphone. When users wanted to be fully connected, they'd carry both—though they'd need them to be compact. And for local wireless access to other devices, both would have to be Blue-

tooth-enabled. If Joe were going to the beach, he'd just take the phone.

Palm Inc. (Milpitas, Calif.) has accepted this idea with its late-October launch of the Tungsten T PDA, although it's clearly intended for ordinary users. "We went back to the drawing board for the mobile professional," says product strategist Eric Klein. It uses a faster chip from ARM Ltd. (Cambridge, UK), and, as part of its claim to expandability in the sense that it can talk to cameras, printers, and so on, the wireless Bluetooth is built in.

Not all agree. "Over time, a single device is going to be more attractive, as we solve the design problems," insists Dennis Boyle, a studio leader at the design consultancy Ideo (Palo Alto, Calif.). Ideo was involved with the design of the Palm V and the Handspring line of PDAs.

Thumbs, pens, and voices

What's the ideal input device for a handheld?

Many long for a keyboard. But common sense tells you a device the size of a cigarette packet can't have a proper keyboard. One of the most-hailed products of recent months has been Handspring's Treo communicator, from Handspring Inc. (Mountain View, Calif.), which features a fully functioned, if dinky-sized, thumb keyboard meant to be struck by the thumb. Its influence can be seen in the new Palm Tungsten W, available early this year, which features a strikingly similar keyboard. Some keyboard devices look like folding clamshells, others are soapbar-shaped. Many devices rely instead on a "virtual keyboard," which projects keys on the display that you tap on with a stylus. The tiny scale of the keys displayed is a major drawback.

Then there's the stylus and pad. This is one of the most common input methods, and is widely accepted by the 25 million or so users of Palm OS devices. But Palm's Klein concedes that users only spend about 20 percent of their time poking a stylus at the Graffiti writing area. That's why Palm's new Tungsten T features a body that can be telescoped open to reveal a Graffiti area, when needed.

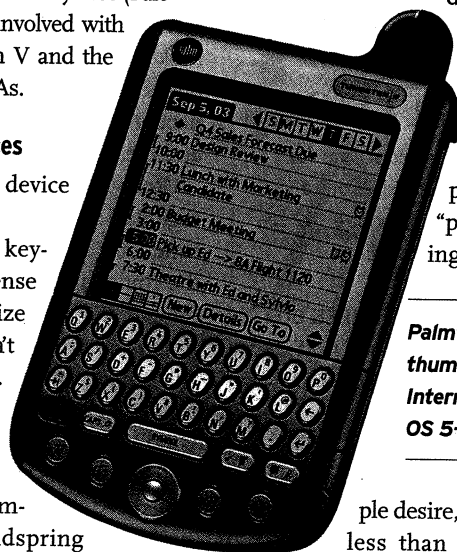
How about voice recognition? Apart from users with some form of physical disability, voice

recognition has never been popular. Only the most patient, or needy, users persist with it. "The software just doesn't have enough intelligent context to parse your words in the real world," says Jason Leigh, senior scientist at the Electronic Visualization Laboratory at the University of Illinois at Chicago (UIC). Comments Ideo's Boyle: "Ninety-five percent of the time, I'm in a meeting, on a plane, in a car, or with people. Voice recognition is inappropriate."

So-called earbuds for phone functions have sprouted in several recent handheld models. Boyle dismisses these strands of wire as "not good enough. If you want to capture the heart of America," he adds, "you have to have a device you hold to your ear. Bell or Edison, or whoever, got it right!"

We've seen a generation of extremely tiny cellphones in the past couple of years. But "phones have been pushing the limits of what peo-

Palm's Tungsten W—with a thumb keyboard, cellphone, Internet access, and the new OS 5—is coming this year.



ple desire," notes Boyle. Anything less than about 10 by 5 cm is regarded as too small. But it's too big when a handheld becomes a palmtop. "If a device won't fit in a shirt pocket, it's probably going to be tagged as oversized. It needs to slip into your pocket, or be the size of a notebook," says UIC's Leigh. "Clamshell" designs are a way of cheating on size limits, and cramming more into a small form factor.

Years of squinting into tiny monochrome screens have given consumers a hunger for big, bright color screens. Is there an ideal display size? Or pixel density? "The [5-cm]-square screen seems to be the smallest that's useful for e-mail, text, and small Web sites," Boyle says. Palm's latest operating system, OS 5, supports 320 by 320 pixels, while the PocketPC from Microsoft sees a grainier 320 by 240 pixels. On the large end, several manufacturers have introduced new devices based on Microsoft's Tablet PC software. They're not likely to compete effectively with handhelds because of their legal-pad size, and are more of a threat to the laptop segment of the computer market.

Dark Horses

SPLASHPower AND MOBILEWISE. These two companies have developed systems to wirelessly charge portable devices by picking up power inductively. The systems may hit the streets in handhelds as early as this year

Tech Watch

INTEL'S MANITOBA combined Xscale microprocessor, memory, and DSP chip promises to make a big difference for power consumption in smart phones

FINGERPRINT RECOGNITION in handhelds, laptop touchpads, mice, and even USB data storage keys will finally offer security for portable devices without inconvenience

NEW THUMB KEYBOARD technologies from Palm, Handspring, and others will make text messaging and Web surfing on handhelds much easier

Trouble Signs

The lack of widespread (and economical) Generation 2.5 and 3 wireless data connectivity is cramping the progress of **SMART PHONES** in the United States

The issue of battery life won't go away: consumers don't like constant recharging. Many are also critical of **MICROSOFT'S PERSONAL PC** operating system: it's not intuitive

Here designers run up against the problem of power consumption. If they build the screen from LCDs, increasing screen size is certain to diminish the operating time of the device between charges. The way out of this bind is to employ displays that use organic LEDs, such as those under development by licensees of Universal Display Corp. (Ewing, N.J.), Kodak, or others.

Samsung Group (Seoul, South Korea) has a joint development agreement with Universal Display, and last year demonstrated a prototype smart phone using a phosphorescent organic LED display. It consumes about half the power of a backlit active-matrix LCD, says Mike Hack, vice president of strategic product development at Universal Display. "There's room for improvement, maybe down to one-third [the power]."

Displays aren't the only power drains. Web browsing and other wireless-connected tasks can also soak up power. The new Palm Tungsten W will ship with 1500-mAh lithium-polymer batteries, about as big as it's possible to squeeze into a small form factor. Also interesting on the power front, two companies, Splashpower Ltd. (Cambridge, UK) and MobileWise (Los Altos, Calif.), have developed systems to wirelessly charge portable devices. Both use a plug-in module with a dedicated chip that picks up power inductively from a mains-connected charging pad. Both are negotiating with mobile device makers to incorporate the chips directly, and commercial products featuring them are likely sometime this year.

And while consumers favor rechargeable batteries, long-life disposable batteries are found in low-end PDAs. If the life of those batteries could be stretched, they would offer another alternative for manufacturers.

Longer term, it may be necessary to shift to micro fuel cells, as small as batteries, running on tiny ampules of methanol. No fuel cells near commercialization are that small, but engineers at Energy Related Devices Inc. (Los Alamos, N.M.), Smart Fuel Cell GmbH (Munich), and Case Western Reserve University (Cleveland, Ohio) are working on them. Motorola, Samsung, and Toshiba are also believed to have micro fuel cell programs under way. They may be commercial by 2005, or sooner.

Still, some are doubtful about the small devices. David De Muro, manager of advanced development at Motorola, cautions: "There are challenges with the smaller systems, and [the micro fuel cells] may be larger than today's batteries."

How much storage do you need in such a device? As desktop PC users know, however much you have, it can never be too much. Fortunately, the new generation of Panasonic SD flash memory cards already run to 512MB, and a gigabyte version is planned. Palm caters to them with a port in its new Tungsten T device and takes advantage of the fact that they can act as an I/O device layer for yet more peripherals in the bargain.

With wireless handheld devices, the patchwork state of networking is a major issue. "Using handhelds, I find more and more that I'd like to access data all the time, but I can't," complains UIC's Leigh.

Wireless standards are at the heart of this problem. You either have to rely on IEEE 802.11b hotspots, which are common enough in big cities, but disappointingly rare elsewhere—or else subscribe to a telecom carrier's data service for a monthly fee. That may run to \$50 per month (although prices are falling because of poor consumer response), or you may choose the even greater uncertainty of paying "by the byte."

Europe has settled on a single standard, the Global System for Mobile Communications (GSM), which probably accounts for two-thirds of the world's high-speed mobile data users, but there are competing systems in the United

States. The financial plight of the U.S. telecom companies, however, has not helped make so-called 3G (third-generation) phones, which offer high-speed data connections, as well as conventional telephony and messaging, worthwhile.

Rollouts of 3G services are likely to be regional, and gradual. At Motorola Semiconductor Products Group (Austin, Texas), the company is ready to ship its I.300 chip set next year; it's a universal mobile telecommunications system (UMTS) platform and will support wireless code-division multiple access (CDMA) and be compatible with GSM or with General Packet Radio Service (GPRS). "It's scalable to 2.5G, Edge [enhanced data for GSM evolution], or 3G standards, depending on what the carriers want," says Ed Valdez, director of Motorola

Semiconductor's wireless platform marketing. "Edge is a bridging technology, but may become what we think of as 3G [in the United States]," adds Kevin Traylor, Motorola's chief architect for 2G platforms.

Will heat dissipation become an issue in wireless handheld chips? "It's not a problem. You won't see fans or coolers. It's the transmitter that causes the heating," Traylor reassures.

Those who favor two-part solutions see Bluetooth as a key technology, replacing cable with wireless over short distances between intercommunicating devices—PC mice and keyboards are two of many examples. Comfort with such applications will encourage Bluetooth's use in handhelds. And after lengthy teething problems, the software is now reckoned ready for the market. But whether converged or two-part solutions predominate, only the market can decide.

So, is the dream device (or maybe dream twosome) merely fantasy? Not if the issues of power consumption, connectivity, and user friendliness are addressed using recent technological advances and research into consumers' needs. The signs are that manufacturers are learning from past mistakes and will get it right within the next two years. To stay in business, it's imperative they do. ●

To Probe Further

For a look at concepts for future handhelds from a leading designer, see <http://www.ideo.com>

An update on the IEEE 802 family of standards is at <http://standards.ieee.org/wireless>

For alternatives to batteries and chargers, see <http://www.mobilewise.com>