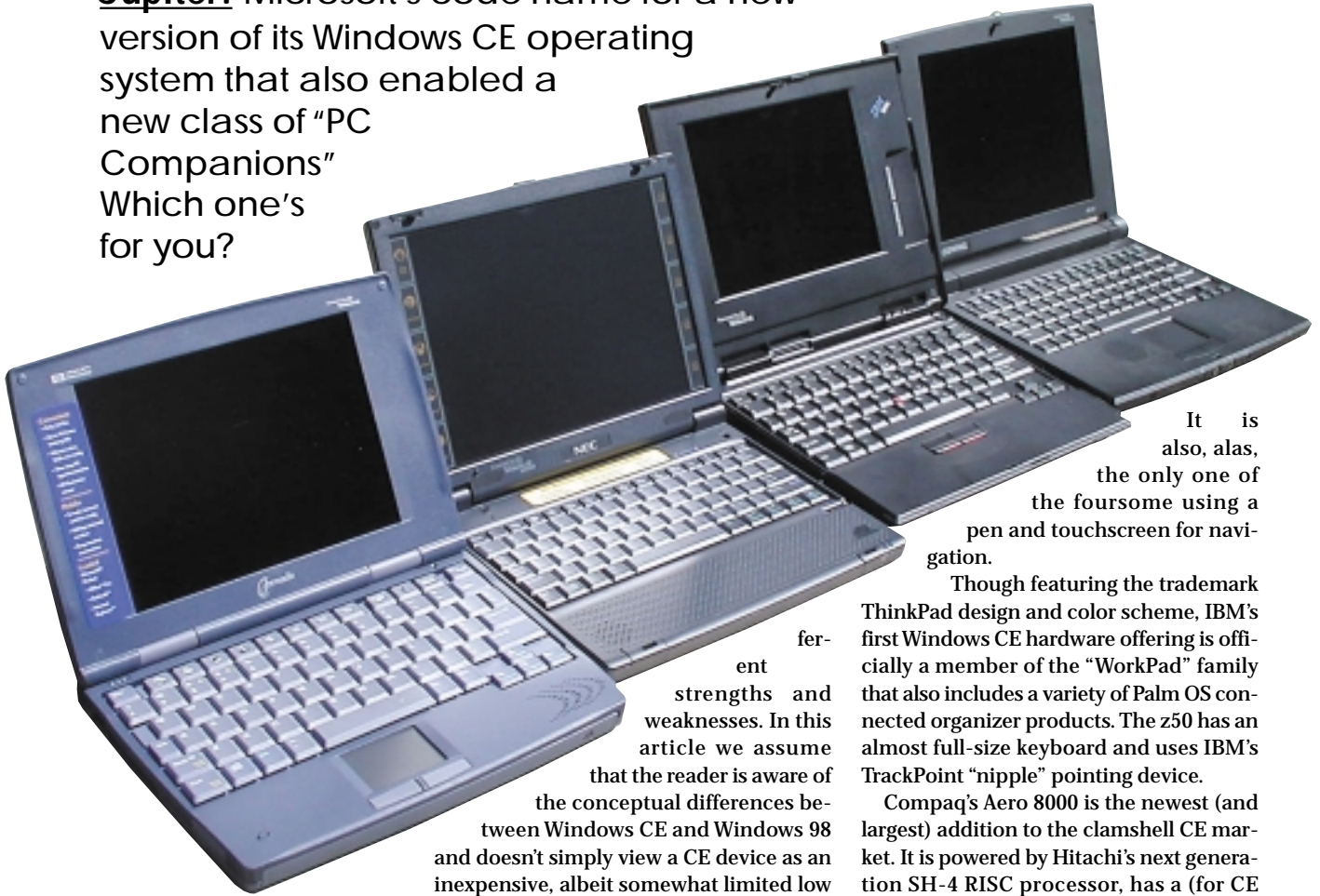


Jupiter Class

Jupiter: Microsoft's code name for a new version of its Windows CE operating system that also enabled a new class of "PC Companions" Which one's for you?



It is also, alas, the only one of the foursome using a pen and touchscreen for navigation.

Though featuring the trademark ThinkPad design and color scheme, IBM's first Windows CE hardware offering is officially a member of the "WorkPad" family that also includes a variety of Palm OS connected organizer products. The z50 has an almost full-size keyboard and uses IBM's TrackPoint "nipple" pointing device.

Compaq's Aero 8000 is the newest (and largest) addition to the clamshell CE market. It is powered by Hitachi's next generation SH-4 RISC processor, has a (for CE standards) huge 10-inch color screen, and is the only CE device on the market with a SmartCard slot.

So which one should choose? Cost really isn't an issue. There seems to be an unwritten law that the list price of all "premium Jupiters" must be US\$999. You may find a better price online or at a discount store, but by and large, the price of entry is a grand. Which means that if you're willing to pay that price, one of these four must make it to the top of your list through features and performance.

Keyboard and typing

If you type a lot, the size and quality of the keyboard is of utmost importance. It's, after all, one of the primary reasons why the buying public rejected the first generation of tiny handhelds and why the current generation is so much larger. When evaluating a keyboard, there are several things that

different strengths and weaknesses. In this article we assume that the reader is aware of the conceptual differences between Windows CE and Windows 98 and doesn't simply view a CE device as an inexpensive, albeit somewhat limited low budget alternative to a "real" notebook.

The clamshell "Jupiter" devices reviewed in this comparison represent four leading computer vendors' current thinking of what a state-of-the-art Windows CE clamshell computer should be. There are a couple which were not included in this review. The Samsung eGo-Note isn't available in the US in any noticeable quantities, and we were unable to procure a Sharp Mobilon Pro in time for the review.

Anyway, let's take a quick pass at the four contenders before we go into a more detailed evaluation.

HP's Jornada 820 is a remarkably compact design using a touchpad for navigation. The 820 is widely available in major office supply chains and is the only "Jupiter" using the vaunted StrongARM processor.

NEC's MobilePro 800 is an equally compact design featuring an 800 x 600 SVGA screen capable of displaying 65,000 colors.

As if it weren't difficult enough to figure out just exactly where Microsoft is headed with the many flavors of its Windows CE operating system, even devices in the same general class of machines come in a variety of shapes and flavors. A few retain the small form factor of the original handheld PC (most notably Hewlett Packard's 680LX), others have branched off into the vertical market (most of Sharp's products), or explored daring new designs (such as the Vadem Clio).

By and large, though, the latest generation of handheld PCs are remarkably conservative. They are simple clamshell computers that look almost identical to small Windows 98 notebooks. Same looks, same size, same weight. That, however, is where the similarity ends for Windows CE and Windows 98 are entirely different animals, serving different purposes and having dif-

HPCs

matter. For touch typists, by far the most important consideration is the size and spacing of the keys. The distance between the centers of the letter Q on the upper lefthand and the letter P at the upper righthand side of a standard keyboard is 6.75 inches. If it's much less, everyone has a problem. So size matters. Then there's key travel and the general "feel" of the keyboard. These are much more subjective qualities.

Sizewise, all four contenders do well. The HP Jornada and the NEC MobilePro 800, at 90% scale, have the smallest keyboard with keypitches of 17.5mm. Both offer good tactile feedback, but the HP offers more key travel, the individual keys are deeper, and the HP's traditional "diamond" layout of the cursor control keys, shared by the Compaq and IBM as well, is general preferred over the NEC's in-line arrangement. The IBM WorkPad and the Compaq Aero at 95% scale, have almost full size keyboards. Both are perfectly suitable for extended typing. The WorkPad's keyboard, especially, is virtually identical to that on the entire ThinkPad line of notebooks. It also offers a bit more key travel than the Compaq, making it the overall winner in this category.

Pointing devices

A keyboard, of course, is only one part of interacting with a computer. The other is cursor control. In this area, the four devices represent three different schools of thought. The Compaq and the Jornada have touch pad (Compaq calls its a "TrackPad") and buttons for left and right mouse clicks. The WorkPad uses the ubiquitous TrackPoint "nipple" which I personally prefer over touch pads. The only disadvantage is that it can occasionally deflect your fingers when you type fast. The WorkPad also has a comprehensive control panel that lets you adjust sensitivity, pointer speed, and a variety of other pointer properties. The Compaq has a TouchPad control panel for adjust-

Style
Processor
Speed
ROM
RAM
OS

Microphone
PC Card
CompactFlash
SmartCard
IrDA port
Serial port
Parallel port
VGA-out port
USB port
PS/2 port
Expansion/dock
Modem

Power
Battery life

Screen size
Resolution
Backlight
Colors

Pen interface
Keyboard keys
Keyboard
Keypitch
Cursor control

Size
Weight

Dock





Cost

Software

Accessories

Website

Dhystone
Whetstone
Bizstone
Graphstone
Thinkstone
Memstone
Average
VAX MIPS
PCM Scroll

	 Compaq Aero 8000	 HP Jornada 820	 IBM WorkPad z50	 NEC NEC MobilePro 800
	Clamshell	Clamshell	Clamshell	Clamshell
	SH-4	StrongARM	NEC VR4121	NEC VR4121
	128MHz	190MHz	131MHz	133MHz
	16MB	16MB	20MB	24MB
	16-64MB	16MB	16-48MB	16-48MB
	CE 2.1	CE 2.1	CE 2.1	CE 2.1
	yes	yes	yes	yes
	1	1	1	1
	2	1	1 Type II	1
	yes	no	no	no
	4Mbps	4Mbps	4Mbps	4Mbps
	yes (DB9)	yes	yes	yes
	no	no	no	no
	yes SVGA	yes 1024x768	yes	yes
	no	yes	no	yes
	yes	no	no	no
	opt.	yes	yes	yes
	56K v.90 int.	56K v.90 int.	33.6Kbps	56K v.90 int.
	Li-Ion 10.8V/1.6AH	Li-Ion 7.2V/3.2Ah	Li-Ion 11.1V/1.5Ah	Li-Ion 11.1V/1.4Ah
	up to 7 hrs	10-15 hrs	8 hrs	8+ hrs
	10.0"	8.2"	8.2"	9.4"
	800 x 600	640 x 480	640 x 480	800 x 600
	yes EL	yes	DSTN	yes
	256	256	65,000	65,000
	no	no	no	yes
	83	77	77	78
	95%	90%	95%	90%
	18.0mm	17.2mm	18.0mm	17.2mm
	TrackPad	touchpad	TrackPoint	pen
	11.0 x 8.6 x 1.0	9.7 x 7.0 x 1.3	10.2 x 8.0 x 1.0	9.6 x 7.4 x 1.1
	2.9 lbs	2.5 lbs	2.6 lbs.	2.56 lbs.
	no		option	option
	\$999	\$999	\$999	\$999
	Audible player QuickViewPlus PowerPoint editor Expense Force Citrix client	CE 2.2 Java Rex sync bFax Pro	bFax Pro Pocket Streets IBM Mobile Connect bUseful Backup	
	Ext. battery Vertical dock Parallel adapt.	Extended battery Cables Memory	16 hr battery Port replicator 340mb Microdrive	
	41.49	37.70	27.56	27.18
	26.91	16.70	31.84	33.83
	70.46	28.84	36.77	40.71
	18.43	15.78	15.36	10.79
	33.96	13.45	18.30	18.61
	41.84	43.26	24.64	26.52
	38.85	25.96	25.75	26.27
	108.95	98.98	72.36	71.35
	211.76	47.25	38.15	44.21



▲ The Compaq Aero 8000 is the largest of the four, but looks sleek and elegant. Its large screen and keyboard make it easy to use. SmartCard slot is unique.



▲ Above: the Aero's audio connectors and recording trigger are conveniently located on the front.



▲ Above: left sideview shows standard size VGA-out and serial connectors. Below: right sideview reveals PS/2 port, SmartCard slot, RJ11 jack, and PC Card slot.



ment of double click sensitivity and pointer speed (missing on the HP). The HP, however, has a well thought-out touch pad control panel. The MobilePro, finally, is the only one of the four with a pen, scoring big points with us (after all, we're Pen Computing Magazine). While the value of a pen interface on a clamshell computer isn't nearly as compelling as on a pen tablet, it *does* eliminate the dreaded loss-of-cursor syndrome common to almost all non-TFT displays. The NEC doesn't have a mouse pointer, so you can't lose it. Bottom line, if you like a pen interface, the MobilePro 800 is your only choice. Of the remaining three, it's a matter of personal choice, though we definitely give the edge to the WorkPad's TrackPoint and somewhat less-easy-to-lose cursor.

Screens and color capabilities

Which brings us to the foursome's screens. All offer vast amounts of colorful real estate compared to the dinky 480 x 240 monochrome LCDs of first generation HPCs. The HP and the IBM offer full 640 by 480 VGA resolution, providing a profoundly more satisfying CE experience. NEC and the Compaq went even further and equipped their Jupiters with 800 x 600 SVGA resolution. Who'd have thought. Unfortunately, that's pretty much where the good news ends. Whereas virtually every notebook on the market today sports a bright, vibrant, blindingly fast TFT screen, all four Jupiter class flagships are saddled with old-fash-

ioned passive screens of various quality.

The NEC's large 9.4-inch 800 x 600 screen is acceptably readable—especially considering the touch screen overlay—but it lacks a contrast control, relying on six levels of brightness adjustable via the keyboard. 9.4 inches is probably also about as small as an SVGA screen should be; icons and text gets pretty tiny and hard to read. On the plus side, the MobilePro supports 65,000 colors, though only with software specially written for extended color support. The HP's 8.2-inch VGA screen has both brightness and contrast control through an "HP settings" control panel that can be called up by pushing one of the function keys. There are preset "indoors," "outdoors," and "power saving" modes as well. It's a decent screen, but limited to 256 colors. The IBM is the only one of the four to offer buttons to control the screen. There are six levels of brightness and 24 levels of contrast. Rich deep colors and the ability to display 65,000 made the IBM a favorite in the office. If only it were a bit larger—at a mere 8.3 inches diagonal it looks positively lost in the beefy WorkPad's screen bezel. The Compaq, finally, has the biggest screen ever on a CE device. Its brightness and contrast are keyboard controllable. Colors aren't as rich and deep as on the IBM and it only displays 256 colors, but if you need real estate, the Aero 8000 is it. One annoying trait shared by all four is that any touching or bending the screen results in weird discolorations. Bottomline: despite being great improvements over earlier CE device screens, all four LCDs are compromises. None is nearly as bright or fast as a regular TFT and none is suitable for multimedia.

Battery life

Apart from price, the reason most often given for not including TFTs in CE devices is power consumption. That's a valid point as superior battery life is one of the major advantages of CE devices over standard notebooks. Whereas Windows 98 notebooks rarely last longer than two or three hours on a charge, and sometimes much less, even the biggest CE devices last at least seven hours, and as much as 15 hours on a charge. That's a big difference. The days where you could simply pop a couple of AA alkalines into an H/PC are long gone. Today's big H/PC Pros all have Li-Ion battery packs integrated into the overall design of the housing. Compaq, IBM, and NEC elected to go with relatively modest power packs operating at around 11 Volts and providing roughly 1.5 Amp hours each. This allotment powers the big Compaq for up to seven hours, and the WorkPad and MobilePro for

eight hours or more. HP chose a different route. Almost half the bottom of the Jornada is taken up by a monster 7.2Volt/3.2Ah power pack. We're taking notebook specs here, and as a result the Jornada leaves the others in the dust with battery life of up to 15 hours.

Biggest H/PCs yet

Speaking of size, the other three easily could have accommodated larger batteries as well for this latest generation of CE devices has grown quite a bit. The Compaq sports an almost standard size footprint of 11 x 8.6 inches and at 10.2 x 8.0 inches, the WorkPad isn't much smaller. The MobilePro and the Jornada are considerably more petite (9.6 x 7.4 and 9.7 x 7.0), but none are really "handhelds" anymore. All weigh at least 2.5 pounds, with the Compaq weighing in at almost three pounds. You want a big keyboard and a big screen, you have to pay the price in size and weight. That said, though there are now several "B5" class Windows 98 mini notebooks which are as handy or even handier than the "Jupiters" presented



▲ The IBM WorkPad z50 looks and feels just like a ThinkPad, from its color scheme to the large keyboard to the TrackPoint. The screen is bright but just a bit too small for the device. Audio is superior.



▲ Above: left sideview shows standard size VGA-out, CF Card slot, IRM and serial ports. Below: right sideview shows RJ11, audio, and PC Card slot.



here, the CE devices are still significantly smaller and lighter than a standard notebook.

Performance

What about performance? The general answer is that today's CE devices are much faster than earlier units, but that the standard Windows 98/Intel camp has advanced at an even faster pace. Two years ago, the

190MHz StrongARM processor used in the Newton MessagePad 2000 (and in today's HP Jornada 820) was one of the fastest processors in the world, bar none. However, while the StrongARM remains a potent little chip, today's mobile Pentium processors can run rings around it. The truth is that the RISC processors used in CE devices have lost ground, and that lost ground is compounded by the generally sluggish performance of some of the major CE software components (especially Pocket Internet Explorer). How do the four Jupiters in this review compare?

Both the WorkPad and the MobilePro use 131MHz versions of NEC's VR4121 processor, the Jornada, as stated above, uses a 190MHz StrongARM (and is the only CE device currently doing so), and the Compaq uses a 128MHz version of Hitachi's advanced SH-4 chip. The SH-4 is the most modern design of the bunch, and it literally flattened the competition in our perfor-

ably a screen driver bug in our late preproduction unit. In everyday use there was we experienced an amazing performance parity; none of

Synch CE 2.0 by Starfish for synchronization with a REX, Jetcet Print v2.0 from Westtek, Sprynet for Windows CE, the Microsoft Virtual Java Machine, the HP Show VGA-out display optimizer, and a trial version of Image Expert CE. The Jornada also comes with the OmniSolve calculator, bFAX Pro, bFIND, and a number of HP utilities.

The NEC MobilePro's bonus CD contains JetCet PowerPoint and Print, the full version of ImageExpert CE, Puma Intellisync, dbExplorer to backup and restore files, databases, and registry settings, bSQUARE bFAX Express,

and Connect Force, an Internet connection setup wizard.

The (beta) CD that came with our WorkPad contained a detailed, browser-based online user guide, and IBM's Global Network Dialer for Windows CE and Mobile Connect Clients.

The Compaq Aero offers Compaq Utilities that include database backup and restore, an asset viewer, a launch key utility, and the aforementioned BackLight utility; FaxPlus by CyberQuest, Network Explorer, the versatile CoolCalc calculator, Audible Player, and the Citrix ICA Windows CE Client and Remote Application Manager.

All four also come with InkWriter which is somewhat of a surprise as only the pen-based MobilePro can really take advantage of this wonderful application.



the devices felt significantly faster than any other.

Connectivity

The same doesn't hold true when it comes to connectivity. Though all four sport the CE standard serial, fast IrDA, and VGA-out ports as well as a PC Card slot, there are significant differences when it comes to additional connectivity and expansion. The Compaq Aero shines with two CompactFlash slots and a standard 9-pin DB9 serial port as well as a PS/2-style port and—a first in CE device—a SmartCard slot. However, the 8000 lacks an USB port, an increasingly important consideration. The Jornada and the MobilePro have the USB port whereas the IBM WorkPad trails the field sans USB port and as the only Jupiter with a dated 33.6kbps modem instead of the others' 56kbps implementations. The now discontinued LG Express remains the only CE device ever to have offered a parallel port.

Software

Moving on to software, all four come with the standard H/PC Pro edition of Windows CE which includes Pocket versions of Word, Excel, PowerPoint, Access, Outlook, and Internet Explorer. Since they are the same in each device, we won't spend any time discussing them. Let's just say that of the six, Word, Excel, Access, and Outlook are quite good whereas PowerPoint (barely more than a viewer) and Explorer (unbearably slow) are in dire need of a major overhaul.

All four come with bonus software CD of varying value.

The HP Jornada's comes with Outside In by Inso (an email attachment viewer), True-

Audio capabilities

Like all CE devices, our four Jupiters devices have voice recording capabilities. They all use the same Microsoft voice recorder application. None of the units fared particularly well. The MobilePro's speaker is weak and barely audible. Recording is limited to a maximum of 11,025 Hz. The Jornada audio output is much more powerful, but recordings are inexplicably noisy even at 44,100 Hz. The IBM WorkPad offered recording at sampling rates of up to 44,100 Hz in 16bit mono or stereo. Compaq has always provided excellent audio subsystems into its CE devices. The Aero isn't quite up to par. Sound reproduction at its highest sampling rate of 22,050 Hz was loud



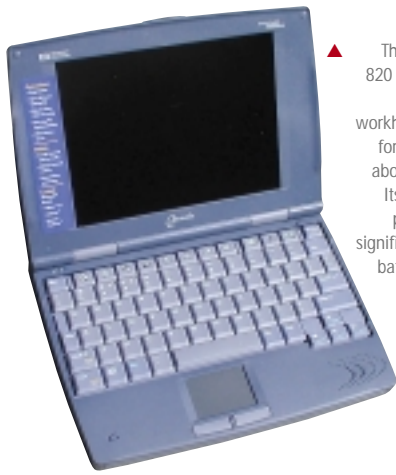
▲ The elegant NEC MobilePro 800 is the only contender with a pen interface. Its combination of advanced features and thoughtful design details are indicative of NEC's considerable CE experience. Silkscreened application buttons provide extra functionality. Only the audio system disappoints.



▲ Above from left: IR, mini VGA, serial, and USB ports. Below from left: RJ11, stylus, CF slot, lock slot.



mance benchmarks (using BSQUARE's bUSEFULAnalyzer), outright winning five of eight tests. Average performance of the Compaq Aero 8000 is almost 50% better than that of the other three. Inexplicably, though the big Compaq won the Graphstone benchmark, its text scrolling performance was abysmally slow—quite possi-



▲ The HP Jornada 820 is a compact, no-nonsense workhorse suitable for working just about anywhere. Its large power pack provides significantly longer battery life than the others.



▲ Above: rearview shows RJ11 jack, USB, VGA-out, and IrDA ports. Below: left sideview shows PC Card slot and door that covers access to backup battery.



enough, but quite noisy. Only the Compaq and the IBM offer external recording buttons, and the clear audio winner is the IBM WorkPad.

Different personalities

By now it should be evident that these four CE clamshells, although based on the same OS and offering the same application suites, are also remarkably different. Even though all are clamshell, their individual "look and feel" shows distinct personalities, much more so than is the case with Windows notebooks. The NEC MobilePro, for example, comes across as a delicate, finely crafted, elegant instrument and from the polish and perfection of every detail, it is clearly obvious that NEC has been in the CE market since Day One. The Jornada looks more plasticky and nowhere near as elegant as the MobilePro, but it, too, shows that HP has several years of Windows CE experience. In addition, it has the no nonsense appeal of most of Hewlett Packard's technology and the huge battery is a plus.

Compaq and IBM are newcomers to the world of Windows CE, and their approach is distinctly different. IBM's offering, though assigned to the WorkPad line, has a distinct ThinkPad look to it. That's primarily because it actually shares its housing with the new ThinkPad 240 that made its debut in Japan. The z50 isn't the most elegant design and the little screen looks positively lost in the big WorkPad, but it's a competent device and there are still places where nothing but IBM will do. The Compaq Aero almost looks like it belongs to a different class.

It's the biggest, most conventionally elegant H/PC Pro and looks just like another hi-tech notebook to anyone who doesn't know better.

Which one is for you?

There isn't an easy answer. Unless in the desktop PC and notebook markets which are so mature that you can essentially select by price alone, the handheld PC arena is still young and manufacturers experiment with designs and features. As a result, each of the four Windows CE clamshells we reviewed has a distinct character and a distinct set of features, strengths, and also

weaknesses. For example, if you want a pen interface, only NEC has it, and the MobilePro also offers the most efficient packaging. HP's Jornada has superior battery life and that could tilt the scales in its favor. IBM's WorkPad z50 has the best audio subsystem and an excellent keyboard, and no one comes close to Compaq in terms of screen size and a general "grown-up" feel. And it's the only one with a SmartCard slot, something to consider if data access security is an issue.

So it shouldn't come as a surprise that each of the four editors in the Pen Computing office had a different favorite. ☺

If you have one of these . . .



you're gonna need this.

So you think your handheld allows you to be completely mobile. But you still need to print those contracts, invoices, quotes, or directions. With the Pentax® PocketJet® 200 you can print directly from your handheld PC and add only one pound to your load! This full-page printer produces crisp text and graphics at speeds up to three pages per minute. And for complete wireless printing, an infrared option is available.

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