

The logo graphic consists of several overlapping, curved lines in a light blue color, creating a sense of motion or a stylized 'I' shape.

Intermec



**White
Paper**

**IT PAYS TO UNDERSTAND THE
TOTAL COST OF OWNERSHIP
FOR MOBILE COMPUTERS**

Intermec

Introduction

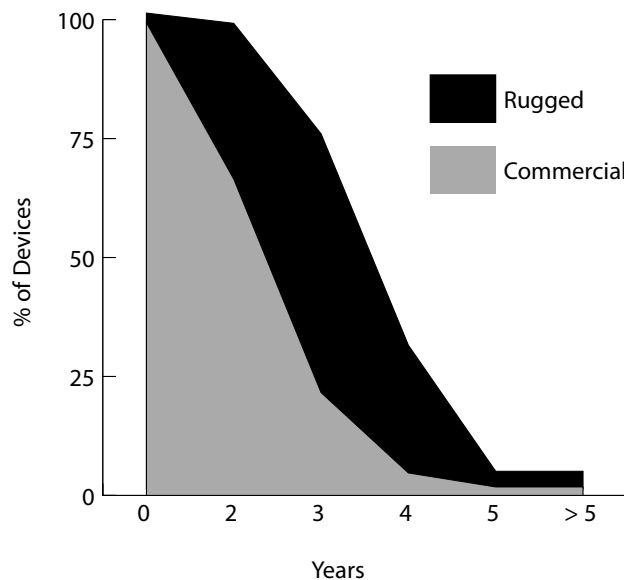
As companies make decisions on IT investments, one of the chief, and seemingly simple questions, is how much does it cost? How do you differentiate the features and resulting value derived from various vendor offerings? How do you assess the cost of deploying and sustaining these products in a mobile enterprise environment? Most of the time, it is easy to calculate the purchase price of the hardware and license fees. However when the initial cost analysis is complete, companies often find themselves wondering why, even after successful project implementations, their IT operations, support and software maintenance costs keep going up. Many hidden and ongoing costs are not factored in when a project is originally evaluated.

Because this scenario is all too common, a methodology for assessing total cost of ownership (TCO) has been designed to properly state the costs of an IT investment. When evaluating your mobile workforce automation project, conducting a complete TCO analysis will show the hidden costs inherent in selecting a low-cost, non-enterprise class device. It will also demonstrate how an industrial mobile computing solution designed for everyday mobile environments prove to have value beyond durability.

To begin, enterprises that use low-cost non-rugged mobile computers pay a high price in repairs, increased support needs and lost productivity. These costs exceed any purchase price savings within just two years according to an important 2004 study by Venture Development Corporation (VDC). Over the life of the system, down time typically costs enterprises that use non-rugged computers approximately four to five times more than the purchase price of the devices.

Studies from leading analysts show that for every dollar spent on capital computing equipment, it costs four to six dollars of additional investment to cover sustaining and intangible (such as human capital) costs. These costs have been documented at 10 to 40 percent higher for organizations that use consumer-grade mobile computers compared to those that use ruggedized devices for enterprise applications. That is why the majority of companies who consider total cost of ownership when planning a mobile deployment bought ruggedized mobile computers instead of consumer-grade devices, according to VDC.

Figure 1: Percent of Devices Remaining in the Field



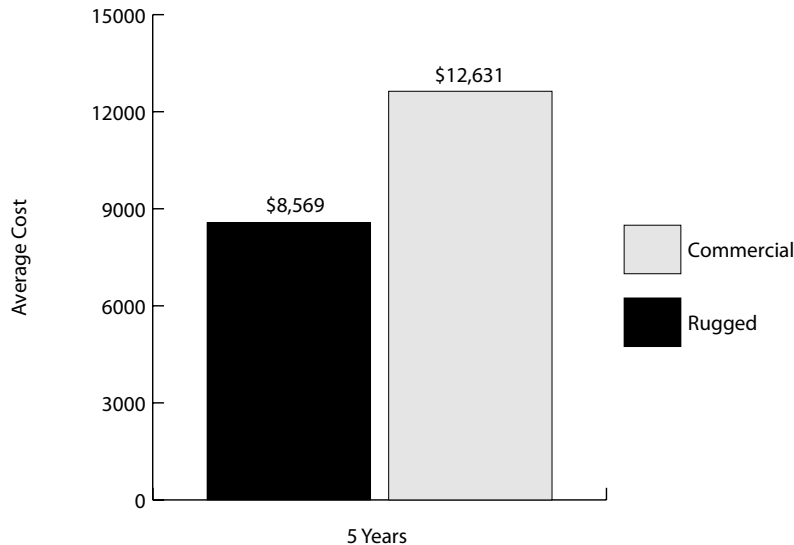
Source: Venture Development Corp.

In just two years, ruggedized mobile computers provide a total cost of ownership advantage over consumer-grade devices that offsets the implementation cost difference, according to VDC. Durability is a big reason. After two years, 35 percent of consumer-grade devices had been replaced, compared to only 2 percent of ruggedized; after year three 80 percent of the original consumer devices had been replaced.

Meanwhile, ruggedized users could look forward to, on average, another two full years of reliable performance. See Figure 1 for a year-by-year TCO comparison between ruggedized and consumer devices.

After five years, organizations with ruggedized PDAs saved an average of \$1,610 per device compared to organizations with consumer models. Ruggedized devices held the TCO advantage in all eight operational areas studied, and the benefits were most pronounced in supply chain (\$4,062 saved per device) and field service, maintenance and repair (\$3,765). To learn more about the report, visit www.vdc-corp.com/industrial/reports/03/br03-12.html

Figure 2: 5-year Average Annual TCO, Per Device, in Supply Chain Environments



Source: Venture Development Corp.

So what accounts for TCO costs? What can be done to control them? This is the value of a total cost of ownership analysis. TCO provides a more complete measure of an IT investment and provides visibility to activities throughout the lifecycle. TCO is not about cutting cost. It focuses on finding the best computing value for enterprise operations. Acquisition costs are often very misleading. While a low-cost mobile computer may appear to be the best purchase, lack of integrated features and frequent downtime can quickly eliminate the price advantage, and cost you many more dollars in lost opportunity. Costs must be considered in parallel with service levels, business performance, quality and strategic mobility. It can be hard to see how these hidden costs affect TCO but this white paper will help. Taking the time to learn about and evaluate TCO is well worth the effort.

What Comprises TCO?

TCO is comprised of both direct and indirect expenses. Direct expenses are easier to identify. They are often budgeted, sometimes during project planning, and generally tracked and budgeted in subsequent years. Indirect expenses are more difficult to quantify. They often fall outside the scope of the IT department. However, it is these expenses that often add the greatest burden to a project. If a slightly higher but strategic investment can be made on direct expense, the indirect expenses can be substantially lower.

There are different direct expenses associated with acquiring and deploying mobile computers and for sustaining operations. Examples of direct expenses for acquisition and deployment include:

- Hardware and accessories – mobile computers, docks, scanners, radio cards, expansion sleeves, power supplies, protective cases, extra batteries, etc.
- Software – connectivity to host applications, middleware, security/VPN, vertical application, back-up/recovery tools, device management, etc.
- Services – integration, project management, device logistics management, curriculum development, training, help desk support, etc.



- Operations – airtime fees, ASP fees, IT technical support time, help desk, consumables (paper, batteries), etc.
- Maintenance – software and hardware maintenance, hardware service and repair, extended warranties, spares, spares logistics (shipping, activation fees), software modifications and testing (to support new hardware).

Examples of indirect expenses for sustaining operations include:

- Downtime – includes training time plus the time end users spend to backup, restore, synchronize and service their devices. Device failures result in troubleshooting time, re-entering lost data, and lost work due to non-working devices.
- IT support – help desk, troubleshooting, spares management and logistics, new application testing, change management, and device management.

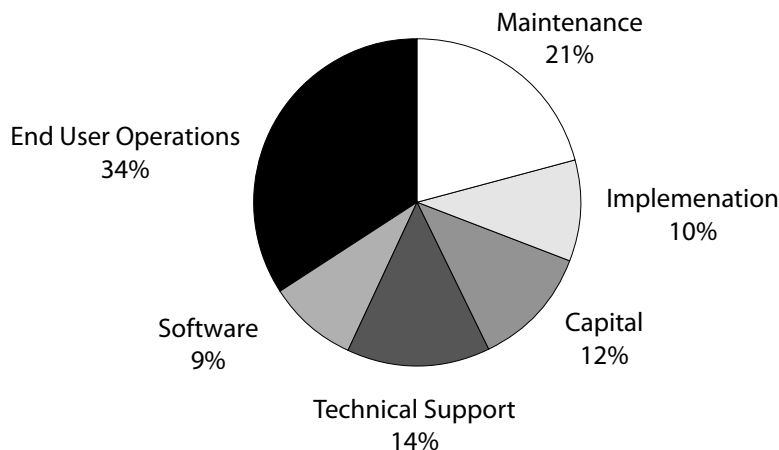
These expenses will be explained further in following sections, along with strategies for minimizing them.

Hard Benefits from Tough Terminals

Few aspects of a mobile computer deployment are as easy to understand – and to misunderstand – as purchase price for the units. While device selection is important, it makes up 20 percent to 25 percent of the annual TCO for a mobile user (See Fig. 3). By comparison, downtime costs non-rugged users approximately four to five times more than the purchase price over the life of the system, according to VDC research. Therefore it is critical to look for ways to reduce the remaining major contributors to cost. By making a wise hardware decision, you can positively impact those other key areas.

For example, VDC found that users of consumer-grade mobile computers had failure rates nearly twice as high as ruggedized devices in the preceding 12 months. Consumer-grade devices were also out of service significantly longer than ruggedized models when downtime did occur. The result is downtime expenses that were about a quarter to a third higher for commercial device users in the environments studied. The research did not take into account lost revenue opportunities, billing delays, late deliveries and other customer service problems that downtime can produce. By considering the financial, productivity and support implications of increased downtime, you can make device decisions that will lower the total cost of ownership.

Figure 3: What Contributes to TCO?



Note in Fig. 3 that end-user operations add the most to total cost of ownership. End-user operations puts a cost on the time and effort required to maintain mobile computers on a daily basis and keep them in good repair. It measures the effects of downtime, how the computer impacts productivity (e.g. time required to upload and download data) and the cost to develop and support operations. There are significant differences in these TCO factors between consumer and ruggedized devices. Ruggedized devices have the advantage because they are designed for specific mobile enterprise tasks, with important communications and peripheral support built in, in contrast to general-purpose PDAs designed

for mass-market appeal for use in the carpeted comfort of office settings. More information on how differences in features provide benefits will be presented in later sections.

One way to make the percentages and predictions about TCO seem real is to consider what would happen in your operation if a mobile computer failed. Say, for example, a service or delivery driver fumbled the computer while getting out of his truck, leading to a five-foot drop that made the device unusable. Would the driver need to return to the distribution center for a spare? Consider how much the driver is paid by the hour and what the trip back to the Distribution Center will cost, in addition to any overtime required to complete the route that day. Consider, too, what the event could “cost” in terms of customer dissatisfaction. Is it OK for deliveries to be late? Perhaps other drivers could be dispatched to help cover the route. Their overtime should be calculated and added to the cost of the device failure. Do drivers need to carry separate pagers or cell phones in addition to their computers for these communications? How much do you spend to buy and support these devices? These are the types of costs and questions that must be considered specifically for your operation to get a true sense of what product features and TCO aspects are most important to your business.

Krispy Kreme Goes Mobile

For example when Krispy Kreme was looking to change to direct store delivery automation, it studied these types of considerations. The planned implementation was changed dramatically as a result of the review. A mobile computing deployment was in progress when a new CIO joined Krispy Kreme and conducted a review of current projects. Concerns about support costs, device reliability and ease of use led him to cancel the project and retain Krispy Kreme’s paper-based delivery system. Soon after, Krispy Kreme conducted a thorough review of its operational requirements and implemented Intermec®’s 740 mobile computers. By carefully matching the device to the environment, Krispy Kreme rolled out the system to its first 90 routes without generating an appreciable increase in technical support calls.

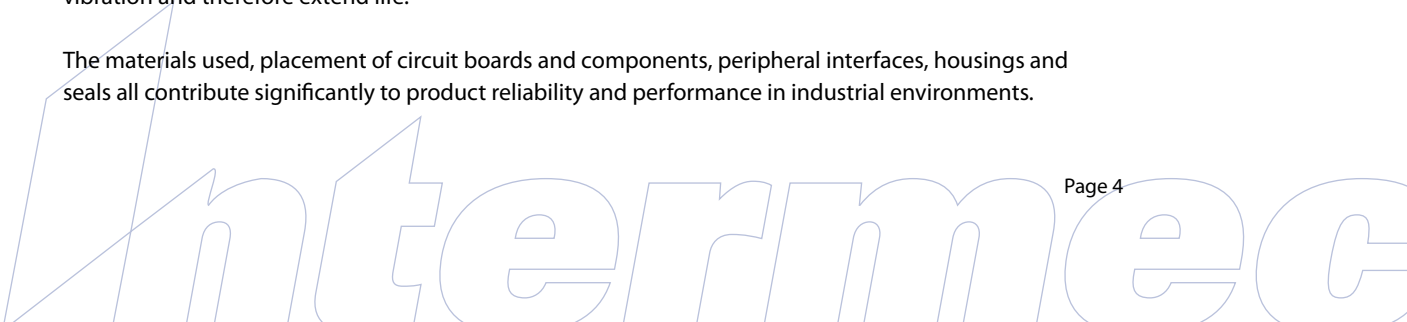
“We are admittedly a late adopter of handheld technology. We were not going to implement handheld computers until the technology was mature and stable enough for us to be able to support them with a small IT staff,” said Krispy Kreme CIO Frank Hood. “We analyzed the top five things that could go wrong with the mobile computing device, and evaluated providers based on how they did on those criteria. These were things like how easy is it for a driver to replace a memory card, and how is the battery life. There are a lot of things like that that helped us find the best choice.”

At Krispy Kreme and every other enterprise mobile computing user, devices are dropped, cords are yanked and screens are scratched every day. Whether or not these activities cause damage or failure is directly related to the type of device used. Recall that only two percent of ruggedized devices had been replaced after two years of use, compared to 35 percent of consumer units in the VDC study. The following sections explain how mobile computer design and features contribute to total cost of ownership and system success.

Built to Last

One of the most striking findings in handheld TCO research is the life span of the devices. On average, ruggedized computers last five years; 80 percent of consumer devices have been replaced after three. Product design is a major reason for the difference, and accounts for many of the TCO advantages. PDAs are designed for mass-market appeal and usually compete on their weight and ease of being carried in a pocket or purse. Ruggedized computers are developed for specific enterprise worker and activity needs. For example, computers used on forklifts or trucks may have specially-designed mountings that reduce vibration and therefore extend life.

The materials used, placement of circuit boards and components, peripheral interfaces, housings and seals all contribute significantly to product reliability and performance in industrial environments.



Don't Try This With Your PDA



This Intermec handheld computer used to accompany a Mockler Beverage driver on his route every day — until he accidentally ran it over with his truck. After returning to the distribution center, Mockler personnel were able to retrieve the memory card, intact, with a pair of needle nose pliers. None of the driver's activity data for the day was lost. "I was amazed and relieved," said Mary Lewis, information systems manager at Mockler. "It only took me five minutes to recover the data."

The differences in environment and usage conditions help explain why TCO for mobile devices is 50 percent higher than for PCs, according to Gartner research. It also explains the following recommendation from Gartner's Ken Dulaney: "*Enterprises should consider industrial forms of PDAs whenever application conditions involve the potential mistreatment of units. Failure to follow this best practice will lead to failure rates in excess of 20 percent per year.*"

For workers who operate in extreme temperature environments or humid or dusty conditions, inadequate seals on consumer devices can cause condensation on electronics or other damage to internal components. IP and NEMA ratings denote that the computer has been certified to withstand potentially harmful conditions, such as liquid, electrostatic discharge, moisture or dust that could impair performance. Intrinsically safe models provide additional protection against hazards related to combustible or explosive dusts or gases.

Drop-test ratings provide an indication of how the computer will perform after being

dropped. This is an important consideration for industrial applications, where a five-foot drop to concrete is likely, compared to office applications where a PDA is more likely to drop onto a conference table or carpeted floor. If you need to use a docking system for secure mounting while driving, or recharging throughout the day, look for devices rated for high insertions that have been tested and certified by the manufacturer for use with the docking system.

Screens, keyboards and peripheral designs also contribute to reliability, ease of use and TCO. Ruggedized computers are available with a variety of keyboard and screen configurations, to best meet the data entry and presentation needs of mobile workers and handle the high volume of repetitive entries, both on screen (e.g. signatures) and keypad (e.g. enter buttons). This is a notable difference from the one-size-fits-all PDA approach, which forces companies to change their work processes to accommodate the screen size. Ruggedized computer screens remain readable in bright sunlight, are sealed to prevent moisture damage when used in cold and wet environments, and can handle temperature changes (for example, going from a refrigerated foods truck to a sunny delivery dock without fogging) provide the performance that mobile workers need.

Characteristics and features like these improve the uptime of rugged devices, and therefore the productivity of their users. Durable, rugged product design is needed to overcome the common bumps, drops, vibration and spills that routinely occur when mobile computers are heavily used throughout the day.

Peripheral Issues: Does the Computer Play Well with Others?

Cables that connect the mobile computer to scanners, portable printers and other peripherals are a common point of failure. When cables break in the field, the peripheral will likely be unavailable for the day, and the organization will incur a repair or replacement cost. The questions raised earlier about costs resulting from lost time and maintaining spares inventory apply here too. It is not unusual for organizations to replace peripheral cables annually because of normal wear. While worn or broken cables are not an especially challenging problem to fix, they are a drain on the bottom line.

Ruggedized computers can mitigate this problem because bar code scanners, imagers, wireless modems and other peripherals are often integrated into the computer itself. Besides being more reliable, because less handling is required, integrated peripherals also provide better buyer protection. Peripherals that are integrated with the mobile computer would be covered by the device warranty, but external peripherals and their cables would not. VDC found that 82.3 percent of ruggedized computer failures were covered by a manufacturer's warranty, compared to only 66.3 percent for consumer devices.

Many organizations avoid cable quality issues by using a Bluetooth wireless connection between the mobile computer and peripherals. However, some of these benefits are lost if users have to remove another PC Card or unplug a peripheral to free a slot for a Bluetooth card. Additional PC Card slots and interface ports may slightly increase the initial purchase price of a mobile computer, but provide valuable flexibility when processes change or new peripherals are added.

The ability to support multiple forms of wireless communication without switching wireless cards is a valuable feature. Some mobile computers can simultaneously support Bluetooth, 802.11b-standard wireless LAN, and wide-area wireless network communication. Users never have to take time to swap radios, or risk being out of coverage because the proper radio isn't inserted in the computer. Multiple, internal radio support also reduces handling and the potential for lost or damaged cards. Adding wireless communications to a mobile computer can also enable organizations to eliminate separate pagers or cell phones, which can provide tremendous savings by eliminating entire categories of devices and their associated wireless subscription fees. A wireless LAN connection enables the computer to be used for voice-over-IP (VoIP) telephony, while a wide-area wireless connection enables cell-phone, text messaging and similar services.

Power is a Struggle that Rugged Computers Win

Integrated peripherals also make more efficient use of battery power, which is a critical success factor in any mobile computing application. Wireless communications, bar code scanning and portable printing all place an additional burden on batteries. Mobile devices designed for these activities have power management advantages that can help ensure batteries will last the length of the shift, even when peripherals are heavily used. Power management tools can optimize the performance while decreasing wasted energy.

Battery recharging wastes productive time during the day. When batteries discharge completely, users could lose everything on the device – the application, security settings and data stored in RAM, instead of in solid state storage media such as a Secure Digital (SD) card. Power management features and industrial size batteries greatly reduce this risk.

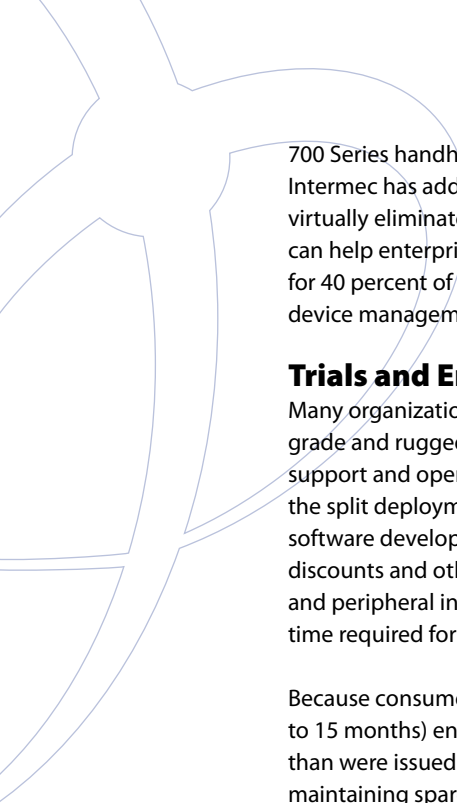
Recharge time is an important consideration. High-volume operations may not provide the opportunity to recharge batteries during the day, except perhaps during a lunch break. In this situation, a battery that can be fully recharged quickly would be highly advantageous. An investment in this feature would add to the purchase price, but would quickly be recovered by preventing productivity losses from dead batteries. For remote mobile workers without access to recharging capabilities, dead batteries could represent a lost day of work. Issuing spare batteries could prevent the problem, but at a high price.

Purpose-built Systems Improve Usability, Support

By using devices and applications purpose-built for specific enterprise operations, rather than PDAs and their small-screen versions of desktop software, organizations benefit from improved ease of use, reduced training and support requirements, and optimized device management. For example, applications can be locked down so that mobile workers can only access the screens and features necessary for their job function, which prevents crashes and potential data loss. Wireless devices can also be locked down to prevent non-business phone calls, e-mailing and Web browsing.

Device management can be a significant factor in TCO. Device management tools for enterprise-class mobile computers can remotely administer devices and automate software distribution, patch management, upgrades and security updates. Other features let administrators monitor device and user performance, and isolate a lost or stolen device to disable access to the network. For example, Intermecc





700 Series handheld computers are now supported by Wavelink's Avanlanche management system, which Intermec has added to manage device specific settings and configuration. The application reduces and virtually eliminates the need to physically touch a device to update or manage it. This kind of functionality can help enterprises significantly lower their administrative and technical support costs, which account for 40 percent of the TCO for mobile devices. To learn more, Intermec offers several white papers about device management that are available free at www.intermec.com/About/WhitePapers.

Trials and Errors: Why Split Deployments Give the Best of No Worlds

Many organizations are tempted to hold their program costs down by purchasing a mix of consumer grade and ruggedized computers and issuing them to workers based on job activity. Because ongoing support and operations costs for mobile computers are higher than the initial acquisition cost, the flaw of the split deployment approach quickly becomes clear. Split deployments require additional, redundant software development and user training. It may also cause organizations to lose volume purchasing discounts and other economies of scale related to standardization, device management, spares inventory and peripheral interoperability. Split deployments also can significantly increase the complexity and time required for device management.

Because consumer-grade devices have such short model lives (they are typically in production only 11 to 15 months) enterprises frequently must complete large-scale implementations with different versions than were issued to the original users, which creates the unwanted hybrid environment. Securing and maintaining spares is also challenging. Remember that 35 percent of consumer devices fail within two years of deployment for enterprise use, which indicates a hybrid environment is highly likely as replacements are introduced.

It isn't cost effective to conduct a trial using low-cost consumer computers with plans to switch to ruggedized devices if the project is approved. In this scenario, the trial could provide proof of concept but will not yield meaningful information about the device, such as its reliability, ease of use or battery performance. Software developed for the trial may have to be redeveloped and debugged for porting to the new devices. Running pilots with minimal investment can also erode user confidence: if low cost devices run slow or continually break down, users will not trust the system and may not gain the benefits necessary for the project to go forward.

If project plans call for new features or applications to be added after the initial rollout is complete, it is best to plan for these changes in the initial deployment. For example, if a field service organization plans to add invoice printing to its application after the initial scheduling and dispatch application is deployed, it might be best served to order computers with a Bluetooth radio preinstalled for communicating with portable printers when they are added later.

Conclusion

The total cost of ownership differences between ruggedized and consumer mobile computers are undeniable. Hopefully this paper has provided some insight as to why, and helped to identify the most relevant TCO considerations for your mobile work environment. Gartner ([www.gartner](http://www.gartner.com)) and VDC (www.vdc-corp.com) offer extensive information, research and guidance about TCO for enterprise mobile computing. Intermec's Web site (www.intermec.com) includes many additional resources, including full case studies on Mockler Beverage and Krispy Kreme, plus white papers on planning a mobile computing project, assessing the need to upgrade mobile devices, and strategies for device management.

Intermec Technologies Corp. is available to help you with all aspects of planning and implementing a mobile computing system. Intermec, a UNOVA Inc. (NYSE:UNA) company, is a leader in global supply chain solutions and in the development, manufacture and integration of wired and wireless automated data collection, Intellitag® RFID (radio frequency identification) and mobile computing systems. Intermec's 700 Series was named the 2003 Best Industrial Class PDA by Pen Computing Magazine. Intermec

earned recognition as manufacturer of the #1 PDA, handheld and vehicle-mounted computers used in manufacturing by VDC, which also named the 700 Series the top PDA used in field service. The company's products and services are used by customers in many industries to improve productivity, quality and responsiveness of business operations, from field sales and service to supply chain management and enterprise resource planning.

To learn more about how companies can benefit from Intermec's supply chain technologies, contact Intermec Technologies Corp., 6001 36th Ave. West, Everett, WA 98203 USA; telephone 800-347-2636; or visit Intermec's web site at www.intermec.com/. To learn more about UNOVA, visit www.unova.com



North America
Corporate Headquarters
 6001 36th Avenue West
 Everett, Washington 98203
 tel: 425.348.2600
 fax: 425.355.9551

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 tel: 905.673.9333
 fax: 905.673.3974

**Europe/
 Middle East & Africa**
Headquarters
 Sovereign House
 Vastern Road
 Reading RG1 8BT
 United Kingdom
 tel: 44.118.987.9400
 fax: 44.118.987.9401

Asia
Asia Regional Office
 26-16 International Plaza
 10 Anson Road
 Singapore 079903
 tel: 65.6324.8391
 fax: 65.6324.8393

Intermec International, Inc.
 14 Floor, IBM-Pacific Century Place
 2A Workers Stadium
 Chaoyang District, Beijing 100027
 P.R. China
 Tel: +86 (010).6539 1012
 Fax: +86 (010).6539 1025

Australia
 Level 7, 200 Pacific Highway
 Crows Nest, NSW 2065
 Australia
 tel: 61.2.9492.4400
 fax: 61.2.9954.6300

South America & Mexico
Intermec South America Ltda.
 Rua Samuel Morse 120 9 andar
 Brooklin CEP04576-060
 São Paulo, SP
 Brazil
 tel: 55.11.5502.6770

Intermec Technologies de Mexico
 Av Tamaulipas #141, Primer Piso
 Col. Hipodromo Condesa
 Mexico, DF, 06140 Mexico
 tel: 525.55.211.1919
 fax: 525.55.211.8121

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 (toll free in N.A.)
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Service and Support
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 (toll free in N.A.)
 tel: 425.356.1799

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