

WHITE PAPER  
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## **WANT TO MAXIMIZE THE POWER OF YOUR WORKFORCE?**

**LEARN HOW HANDS-FREE SOLUTIONS CAN  
BRING VALUE IN A CHALLENGING ECONOMY.**



## EXECUTIVE SUMMARY

In these tough times, industrial and logistics environments need to maximize workplace productivity and safety to contain costs while satisfying customers. Increasingly, warehouse operators are discovering that hands-free devices are an effective solution to accomplish these goals. Wearable and voice-enabled mobile computers make warehouse operations hands-free, eliminating time spent picking up and reholstering handheld computers. Interacting with mobile computers using voice also make processes eyes-free, so the worker never loses sight of the task at hand. Together the two can boost productivity in the warehouse by as much as 20%.

Acquisition costs are down significantly for today's hands-free solutions. Voice and wearable technologies are now offered in various cost effective solutions, making them within reach for any size warehouse or operation. Most of today's solutions are open platform, further lowering implementation cost and integration complexity with warehouse management systems and ERPs.

Today's array of voice technology options has expanded the use of voice from cold storage where it was invented to a wide variety of warehouse types, picking environments, and warehouse functions. Specialty retail, general merchandising, restaurant chains, convenience stores, auto parts, healthcare and pharmaceuticals are all turning to voice, and 69% of warehouse operations surveyed are exploring voice in the warehouse.

In a 2007 survey by ARC Advisory Group and Modern Materials Handling magazine, nearly 60% of respondents saw productivity gains greater than 8% in their picking operations when they adopted voice, while another 26% saw productivity gains of between 4% and 8%. Users of voice technology are 50% more likely to have reduced labor costs.

Wearable mobile computers require very little change to existing warehouse operations that currently use handheld computers, so those not in a position to allocate resources to deploying voice solutions may use it to boost productivity and improve safety, whether as a long-term or interim solution while planning the addition of voice.

Choosing the right hands-free solution means careful assessment of products in the market and choosing the product that meets the IT environment as well as the workforce. For wearable computers, key product features to look for include a safe, durable and ergonomic design and excellent battery management backed by solid service and support to ensure availability. Critical voice features include robust noise reduction and a sophisticated, non-speaker-dependent voice recognition engine.

## WANT TO MAXIMIZE THE POWER OF YOUR WORKFORCE?



## LEARN HOW HANDS-FREE SOLUTIONS CAN BRING VALUE IN A CHALLENGING ECONOMY.

These are belt-tightening times. Businesses are scouring their operations to find and eliminate excess without negatively impacting sales and service.

Warehouse processes are a popular target. More effective processes make warehouse and distribution operations more productive and accurate, leading to higher customer satisfaction levels and increased sales. Moving from paper-based to automated data collection such as mobile computers or pick-to-light systems has been a reliable source of such improvements for many operators, boosting productivity and pushing order accuracy up to 99%-plus range.

In a recent study by the Warehousing Education and Research Council (WERC) entitled, "DC Measures 2008", it was found that while the Best in Class Perfect Order Index (POI), a benchmark consisting of four measures: 1. Complete; 2. On Time Delivery; 3. Damage Free; 4. Correct Documentation and Pricing/Invoicing, had reached  $\geq 99.1\%$ , the average POI of all respondents was a mere 87.1%. But it was tough to get past that point – until now. Advances in voice-enabled and wearable computers are closing the productivity and accuracy gap. Voice-enabled and wearable computers eliminate the need to shift focus and hands to interact with handheld mobile terminals, making the work processes faster and less error prone. Voice systems, which recognize spoken words as data entry and provide audio (verbal) directions and confirmations to workers, make warehouse activities both hands- and eyes-free. Use of voice in the warehouse is increasing productivity by 20% or more and pushing accuracy rates north of 99.9%.

### THIS IS WHY TO CONSIDER HANDS-FREE SOLUTIONS NOW:

- **They're cheaper** – Declining hardware costs, open platforms and industry standards are driving down the cost to acquire and deploy voice and wearable solutions. Many users attain return on investment in less than a year.
- **They're open** – Wearable and voice solutions have migrated from proprietary to open platforms, expanding warehouse operators' options and significantly lowering upfront and ongoing costs.
- **They will make your warehouse more effective** –Warehouses that engage in best practices in deploying voice-enabled and/or wearable computers can attain impressive gains in productivity and accuracy.

## A BRIEF HISTORY OF DATA COLLECTION

Adoption of hands-free computer driven warehouse processes is growing rapidly because of the myriad benefits they can deliver. Voice and wearable computers are two of the latest in a long line of data collection innovations that have steadily improved the ability of warehouse operators to quickly and cost-effectively store and move goods.

Wirelessly-enabled mobile computers have matured considerably over the past two decades, becoming smaller, more reliable, open and standards-based. In that time they have helped many operations become far more productive, enabling more picks per worker per shift, and improving warehouses' ability to ship orders complete the first time.

Voice and wearable versions of these devices emerged to meet specific needs. Wearable computers were developed to serve warehouses with heavy two-handed picking volume, such as beverage case-picks, where use of a handheld terminal would slow processes. Soon users saw the usefulness of voice and wearable computers beyond these specific applications.

Voice was first employed 20 years ago for cold storage, where bulky gloves made it difficult to use conventional keyboards and screens could fog up. As voice recognition technology matured, it improved in its ability to distinguish operator speech from ambient noise and to distinguish problematic words such as sound-alike letters of the alphabet. Today's voice systems recognize continuous -- or natural -- speech, rather than requiring an operator to pause briefly between words, for example, "product damaged in shipping" rather than "product...damaged...in...shipping."

Early voice solutions were also vertically integrated -- one vendor provided voice-specific hardware, application software, and the technology required to translate voice into data commands, then implemented and integrated the solution on behalf of customers. Today, voice has migrated to an open platform. As with handheld and wearable computers, businesses using voice can select the hardware, software, voice technology and integrator that best fits their situation and be assured of interoperability. Use of component-based, service-oriented architecture allows applications to be tailored to specific needs without costly and maintenance-consuming custom code. All of that leads to lower cost and more choice.

Many types of data collection hardware and host software are now voice-enabled, so warehouse operators are free to use voice where that's the best data collection input, and other input types when they're best, such as scanning for long data strings or RFID when line of sight is unavailable.

## HANDS-FREE SOLUTIONS CAN TAKE SEVERAL FORMS

These include:

- **Wearable Computers:** Computers worn on the body to eliminate the need to pick up and re-holster a terminal. Wearable computers used without a voice interface are typically worn on the wrist or belt (flipping up for use) and feature a keyboard and screen or touchscreen and a battery pack incorporated into the device or worn on the arm or at the small of the back. Optionally, the user also wears a finger-mounted (“ring”) scanner that plugs into or communicates via Bluetooth with this unit to allow the user to point to and scan bar codes.
- **Wearable Voice-Enabled Computers:** These can be worn on the wrist, if the operator will also need to interact with a screen or keyboard, or on the belt, if voice is the only input or only occasional keyboard or screen interaction is needed. The worker also wears a wired or wireless headset. Optionally, these may also be used with a finger-mounted (“ring”) scanner. A voice solution also includes voice software, usually running on the wearable computer, which codes and decodes voice signals into digital data, as well as backend software to support this function.
- **Voice-Enabled Handheld or Vehicle-Mount Computers:** As an alternative, logistics operations may choose to use voice-ready handheld or vehicle-mount computers. This option offers the flexibility to use different user interfaces for different applications or according to individual user preferences. Voice blends well with scanning, imaging, display, keypad entry and RFID. In voice-only mode, handheld devices can be worn on the body in a belt-mounted case. These can also be used with ring scanners and a wired or wireless headset.

## WHEN IS VOICE BEST?

According to *Order Picking for the 21st Century: Voice vs. Scanning Technology*, by Tompkins Associates, “Voice technology-based solutions provide a faster, more efficient picking alternative that replaces paper-based pick lists and handheld scanning terminals. Its unique features allow tangible benefits in areas such as order accuracy, returns, productivity, training and labor, safety/ergonomics and ROI.”

Historically, voice was prescribed in situations with very high velocity and heavy each-picks, such as found in food service, grocery warehouses and cold storage. In cold settings, employees wearing thick gloves often find it cumbersome and time-consuming to use scanners, keyboards or paper-based picking and benefit from the hands-free aspect of voice.

Today’s diversity of voice technology options and its markedly lower cost of implementation has expanded use of voice into a more diverse array of warehouse types and picking environments. According to Aberdeen Group’s *Debunking Some Myths About Speech-Based Warehousing*,

August, 2007, “companies that investigated speech technology within the last few years and wrote it off as too expensive may find that the situation has changed in recent years.”

In applications where there is a context to the data, such as item condition, voice can also be applied. Voice systems are frequently used in manufacturing quality programs to record defects and benefit any application where the item must be handled and evaluated to record its condition, disposition or destination. Voice works well in environments with repetitive tasks, short identification requirements and a large user population.

Other vertical markets beginning to adopt voice include specialty retail (including apparel) and general merchandising, restaurant chains and convenience stores, auto parts, healthcare and pharmaceutical. In the ARC Advisory Group/Modern Materials Handling survey, 56% of all respondents were exploring voice in the warehouse, and 13% were strongly exploring the adoption of voice technology. The top three industries using voice in the survey were retail, food and beverage distribution, and wholesale distribution, each representing nearly 22% of the respondents.

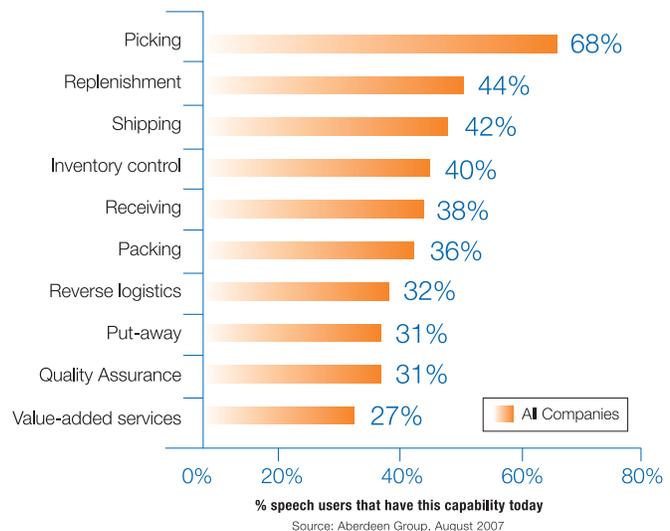
Picking has been the dominant use of voice. But after implementing voice picking in the warehouse and experiencing the results, many operators have extended voice to other functions. According to Aberdeen’s Debunking report, here are the ways voice (a.k.a., speech) is used today (See Figure 1 below).

Investment in voice can often be recouped by picking improvements alone. Additional applications simply enhance the value.

Voice or voice alone is not the best choice for every setting or application, however. In high-speed picking operation with a low number of SKUs, for example, pick to light may be a better method. In applications where collection of additional data not easily captured with voice (e.g., serial numbers, batch/lot numbers or catch weights), a conventional mobile computer with keyboard and display, or voice plus bar code scanning may be a superior solution.

In the same vein, inefficient warehouse layouts or processes will not be improved simply with the addition of voice. To attain the best possible results, an important first step is to assess the current environment – outside expertise can be invaluable for this -- and implement recommendations prior to beginning a voice implementation.

**Figure 1: Speech-Technology Isn’t Just Used for Picking**



## BENEFITS OF VOICE-ENABLED MOBILE COMPUTERS

In a 2007 survey by ARC Advisory Group and Modern Materials Handling magazine, nearly 60% of respondents saw productivity gains greater than 8% in their picking operations when they adopted voice, while another 26% saw productivity gains of between 4% and 8%.

### Voice's many benefits include:

- **Boosts Productivity:** When responding to voice instructions, the worker is not stopping to locate a bar code, navigate and read a screen, or enter or scan in data. Systems can be programmed to re-prompt after an unanswered prompt, eliminating delays in the work process. Users of voice technology are 50% more likely to have reduced labor costs.<sup>1</sup>
- **Delivers Accuracy Rates of 99.9+%:** Because they are hands- and eyes-free, voice solutions virtually eliminate errors and the high cost of correcting them. A warehouse that picks 500,000 cases per week with a 99.8% accuracy rate (2 per thousand) incurs 50,000 errors a year. Reducing that by 80%, to 99.96% accuracy, or 0.4 per thousand, will reduce errors by 40,000 per year. If each error costs a conservative \$15, that amounts to \$600,000 a year in savings.
- **Prevents Accidents:** Shifting eyes away from the activity at hand and toward a screen, hundreds of times throughout the day, introduces opportunities for injury as well as error.
- **Prevents Damages:** Eyes and hands-free motion also helps avoid damage that can occur when the chain of attention is broken. Workers that are watching what they're doing are less likely to mishandle goods.
- **Multi-Lingual:** Both voice-enabled and wearable computers can be configured to offer instructions in multiple languages, accommodating a diverse workforce.
- **Rapid Training:** With a voice system, additional training personnel are unnecessary: the voice system prompts the new worker, and the worker can ask the system what to do when uncertain.
- **Boosts Compliance:** Voice-enabled computers may be used to ensure safety compliance; the user verbally confirms items on checklist by reading check digits. Some users have lowered insurance premiums as a result.
- **Easy Integration:** Many warehouse management system and enterprise resource planning system vendors have worked with voice providers to directly integrate voice into host systems. VoiceXML, Java, browsers, voice-enabled terminal emulators and other open technologies make voice more flexible and easier to install than ever. Voice systems can now communicate with warehouse management and other host systems<sup>2</sup> virtually in real time.
- **Flexibility:** It can be easier to alter voice applications to new processes, additional SKUs or other warehouse changes.

- **Real-Time Stock Updating:** The ability to enact automatic priority updates for replenishments to short picked items means pickers can work efficiently and build proper pallets, and short-shipments are reduced.
- **Reduced Employee Turnover:** Workers appreciate easier training, a smoother workflow and safe environment.
- **Incremental Benefit:** According to a February, 2007, Aberdeen Group Research Alert, unlike other warehouse automation technologies, the cost of voice technology does not increase proportionally to the number of SKUs or size of the pick area; after upfront costs are covered, additions are incremental.
- **Multiple Modes:** With more open platform data collection options now available, warehouse operators are free to use a blend of solutions according to the specific needs of the user and the task. For example, an operation may use different picking strategies for different SKUs or picker groups. Mobile computers with multiple data collection inputs maximize value; 52% of current voice installations use multi-modal devices, versus 48% that use dedicated speech devices<sup>3</sup>. As seen in Figure 2, the combination of voice and another mode, such as scanning, allow certain processes to be performed more efficiently than either mode on its own.

**Figure 2: The Power of Multiple Modes: When voice is used together with scanning, warehouse operators can further enhance productivity while maximizing the value of their investment.**

<p><b>MOBILE COMPUTER (Scanning only)</b></p>	<ul style="list-style-type: none"> <li>- Sorting</li> <li>- Point of Sales</li> <li>- Inventory</li> <li>- Cycle Counting</li> <li>- Shipping and Receiving</li> <li>- Put Away</li> </ul>
<p><b>VOICE ONLY</b></p>	<ul style="list-style-type: none"> <li>- Put Away where data entry &amp; verification is not required</li> <li>- Freezer environments, where the scanners performance is limited</li> <li>- Environments where screen and keyboard performance are limited</li> </ul>
<p><b>MOBILE COMPUTER SCANNING + VOICE (Multi-Modal)</b></p>	<ul style="list-style-type: none"> <li>- Put Away where data entry and/or verification is required</li> <li>- Where on device needs to perform multiple tasks</li> </ul>

Return on investment in voice-enabled warehouse operations varies depending upon a range of factors, including current picking methods, current accuracy and productivity rates and the cost of discrepancies to the supply chain, the shipping volume, and what infrastructure and software changes are required to implement. However, many users see return on investment in six to 12 months.

## WHEN TO CHOOSE WEARABLE COMPUTERS?

Operations choose wearable solutions for a variety of reasons. Wearable computers require very little change to existing warehouse operations that currently use handheld computers, so those not in a position to allocate resources to deploying voice solutions may use it to boost productivity, whether as a long-term or interim solution while planning the addition of voice

Wearable computers also entail little retraining of staff and usually no software modification. The existing application designed for a handheld or forklift-mount unit can usually run on a wearable device with no modification. Workers simply need to adjust to putting the wearable components on, the feel of the computer on their wrist, and if elected, the use of a ring scanner. Today's wearable units typically weigh just a few ounces, so fatigue and comfort are typically not an issue. Power is usually supplied from a battery pack worn on the arm or at the small of the back.

Breakaway features on ring scanners and headsets mean units can be operated quite safely as the worker uses both hands to pick up and move cartons. If the ring scanner mechanism catches on anything, it safely slips off the finger without causing injury. Headset safety features work similarly.

## BENEFITS OF WEARABLE COMPUTERS

Wearable computers can make measurable additional impact on an operation beyond the benefits of handheld devices, including:

- **Building Better Pallets:** The screens on wearables provide workers with visibility into upcoming picks, allowing them to ensure the heaviest items are at the bottom of the pallet without needing to pick up and put down an RF terminal. The approach works best for experienced pickers.
- **Prevents Damages:** Terminals worn on the body don't get dropped, run over, or accidentally shipped with the order – all everyday occurrences in the warehouse world.
- **Boosts Productivity:** Wearables free hands for tasks; because workers are not picking up and re-holstering a computer, they can move more quickly from one transaction to the next.

- **Increase Accuracy:** At points in the process, handhelds can cause the operator to focus on the equipment rather than the task at hand. The hands-free nature of wearables enable the operator to stay focused on the assignment, resulting in fewer mis-picks due to taking his or her eye off the ball.
- **Lower Initial Investment than Voice:** Since there is little or no configuration or modification to existing software applications required.

**Figure 3: How benefits of handheld, voice and wearable computers stack up against paper-based warehouse processes:**

	Handheld Computer	Wearable Computer	Voice-Enabled Computer
Increases Productivity	●	●	●
Increases Accuracy	●	●	●
Reduces Costs	●	●	●
Multi-lingual	●	●	●
Multi-modal	●	●	●
Reduces Damages		●	●
Reduces Accidents		●	●
Hands-free		●	●
Eyes-free			●

## VOICE + WEARABLE COMPUTERS TOGETHER = PRODUCTIVITY BOOST

Those employing handheld wireless mobile computers to conduct and record data collection transactions may be leaving some productivity improvement opportunities on the table. When voice and wearables are paired, operations glean the benefits of both hands- and eyes-free.

Most picking errors in environments using handheld computers result when the picker returns the handheld computer to the holster. Commonly, the picker scans a location, shifts his or her eyes to re-holster the device, then picks the item from a neighboring location instead of the correct one. Even if the product scan catches the error, time is added to the transaction. If it doesn't, the result is a mis-pick. Productivity and accuracy in warehouse and industrial operations can also be compromised by employee turnover, language barriers and use of temporary staffing. It's hard to reach the 99.9 percentile with handheld solutions because very human tendencies such as losing one's place, scanning one carton but picking up another, and so on.

When the operator wears the computer, whether he or she interacts with it via a keyboard or

through voice, the picking process is not interrupted by the steps taken to pick up and then re-holster a mobile computer. The pick is inherently faster. A few seconds saved per pick, per worker, per shift, per day, per week, quickly add up to substantial time savings. The maximum benefit comes when the two are used together, with the hands-free aspect of wearable computers combining with the eyes-free abilities of voice to make the worker as productive as possible.

## **WHAT TO CONSIDER WHEN SELECTING A HANDS-FREE SOLUTION**

### **Warehouse Environment**

First come the basics: size, type of product, type of order (each-picks, cases, pallets, pick-by-store, pick-by-line, etc.), type of storage, current picking technology, temperature issues (i.e., freezers), RF suitability, processes, and so on. A related factor is the workforce: experienced, transient, multilingual?

Of course, warehouses are living entities. Customers change, product characteristics and assortments evolve, policies get altered. Processes that once made sense grow outmoded by shifts in the business and evolving technology. Automating existing processes simply speeds up and illuminates the gaps between current processes and business needs. Even environments currently using automated data collection can often benefit from a periodic refreshing in layout, workflow and other processes. Simply transforming the prompts from text-based to voice-enabled may not be enough.

To maximize the benefit of voice and wearable solutions, the best practice is to optimize warehouse processes first. Outside consulting expertise can be invaluable in making an unbiased assessment and recommending changes. Interim steps may be necessary to evolve toward processes that will make best use of voice capabilities and deliver the anticipated benefits.

That assessment should include metrics to measure performance gaps between where the business is, and where it should be: worker productivity, the number of mis-shipments, over- or under-shipments per thousand orders, loss/damage numbers, and so on.

### **IT Environment**

What platform underlies warehouse-supporting applications? Are existing applications capable of accommodating any changes required in warehouse processes to make optimal use of the power of voice or wearable solutions? What modifications are necessary?

The good news is, open, more flexible voice applications can accommodate even older and

proprietary applications, integrating via APIs or voice-enable TE's and layering on additional functionality to improve warehouse processes. And today's warehouse management, enterprise resource planning and other host applications are migrating toward treating all types of data collection in an agnostic way, accepting voice as easily as bar code, RFID, 2-D symbol, keyboard or other input. Speech is usually converted into data and vice versa right in the wearable computer, so no additional steps must be taken between the input device and the host application.

## PRODUCT FEATURES

Open systems means users are free to choose from a wide variety of voice-enabled and wearable mobile computers, selecting those that best fit their applications. Factors to consider include:

- **Ergonomics:** Voice-enabled or not, wearable data collection devices should be:
  - Comfortable to wear and use, even over a long shift, no matter the size of the user
  - Lightweight, small size and people-friendly
  - Include comfortable design features such as elastic and Velcro straps
  - A wrist-mounted unit should not exceed one pound in weight
  - It's important that the user not be required to bend the wrist to use the ring scanner. A continuous-on scanning option helps avoid repetitive motion injury.
- **Safety:** Ring scanners and headsets must feature breakaway design, so they will slip off the user when a component gets caught on an object, without causing injury. Well designed wearable computers can safely be used around conveyors.
- **Programmability:** Programmable mobile computers allow operators to customize the interface to specific needs. Even voice-only solutions often include a few buttons, which help users perform certain functions such as "repeat instruction."
- **Battery:** Supporting voice or a display can additionally tax batteries, so battery management capabilities are essential, including rapid re-charging. Location of the battery is also a consideration: options include at the small of the back, on the bicep or within a wrist-mounted computer; consider the weight relative to the location. In freezers, batteries can be worn in a pouch held close to the body to keep the unit warm.
- **Durability:** Resilient, lightweight materials are essential to survive the rigors of the warehouse environment, including temperature extremes. Look for plastic- or glass-filled materials, drop test results of at least six feet and a high IP rating. For voice solutions, the headset connector can be a particular area of vulnerability, so it's essential to ensure a long-wearing design. Look for temperature-specific wearable computer features where appropriate.
- **Multi-Modal Capability:** Some applications require a combination of interfaces, such as voice for pick instructions and scanning to record long bar codes. Multi-modal devices also allow use of the same devices for different applications within

the warehouse.

- **Multi-Language:** An essential capability is a platform that accommodates multiple languages and dialects, whether instructions are provided via text or voice.
- **Wearability:** The user should be able to put on and take off all components in under five seconds without assistance. The product should be wearable on the right or left hand, as applicable.
- **Push-to-Talk Capability:** This function is used for voice communication with supervisors even in the absence of a voice application.
- **Display:** Some operators choose to use wrist-mounted or waist-mounted computers with displays to enable multiple inputs, or allow the operator to both see and hear instructions, or enable exceptional transactions. In a wearable, maximizing display size yet minimizing form factor is critical. A touchscreen display also adds great utility to a wearable computer.
- **Open Platform:** Choosing open platform, software-agnostic hardware and wireless infrastructure ensures the mobile computer will work with any standards-based application. For voice-enabled hardware, be certain the device has been certified by your voice vendor of choice, to ensure it has been tuned to work consistently no matter what the application. Software that uses service-oriented architecture eases application development and alteration.
- **Service and Support:** All industrial equipment is subject to wear and tear. Choose a vendor with a solid track record of superior service and support to ensure rapid service and return.

## VOICE-SPECIFIC FEATURES:

- **Powerful Processor:** A powerful chip speeds processing of voice signals.
- **Simplicity:** A dedicated voice-only wearable computer boasts an elegantly simple user interface, with just a few buttons.
- **Noise Reduction:** Inferior systems can confuse ambient warehouse noise, or cross talk, with the user's voice. The ability to filter speech and eliminate echo in industrial settings can be a key contributor to the success of the solution. Look for:
  - Highly refined noise reduction technology including an advanced codec (coder-decoder program)
  - Precise tuning controls to improve performance in specific applications and environments
  - Design features that eliminate electronic noise and echo to improve the fidelity of voice reception and play-back. Noise-canceling headsets, which typically feature two microphones, one for voice and one for ambient noise, are a must.

- **Speaker-Dependent vs. Speaker-Independent Recognition Engine:** A speaker dependent system is designed to only recognize the speech of users it is trained to understand. These systems are usually more accurate but not as flexible as speaker adaptive or speaker independent systems. This speaker-dependent type of speech recognition requires a brief 10- to 25-minute training session, depending on the number of different responses required, to allow the system to learn each user's voice. Technology has evolved to the point that performance is often unaffected even if the user has a cold or other alteration to speech; cadence of speech is the critical factor. A speaker-independent system is developed to operate for any speaker of a particular type (e.g. American English). These systems are more flexible; however, accuracy can be lower than speaker-dependent systems. That being said, speaker-independent engines are getting better every day and may offer a better approach for applications that capture of natural speech and typically require no training.

The size of vocabulary of a speech recognition system affects the complexity, processing requirements and the accuracy of the system. Some applications only require a few words (e.g. numbers only) others require very large dictionaries (e.g. dictation machines) Logistic applications typically require only a small (tens of words) to medium (hundreds of words) vocabulary.

- **Wireless vs. Wired Headset:** Wireless headsets compress voice signals in the headset; data is sent to the wearable mobile computer for decompression and processing. Wired headsets, on the other hand, pass the voice signal, to the computer as an analog signal typically with better voice fidelity and lower cost. Nevertheless, Bluetooth-enabled headsets are emerging due to their promise of enhanced ergonomics, particularly for vehicle-mounted applications.
- **Hygienic:** While some companies issue one wearable unit per user, many others share units. Any soft components and parts that touch the skin, such as straps and ear pads, should be issued one to a user, while the actual computer can be shared and snapped into place. Hard components should be easy to clean.

## **CONCLUSION: HANDS-FREE SOLUTIONS BRING VALUE BY BOOSTING ACCURACY AND PRODUCTIVITY**

There is a fundamental difference in the way workers approach warehouse tasks when their hands are free to do the work. Voice and wearable solutions mean the flow of work is never disrupted to shift the line of sight and pick up a mobile terminal to record data, leading to faster, more efficient and accurate execution of tasks. Voice and wearable mobile computing solutions resolve the trade-off warehouses and other industrial settings have traditionally made between the benefits of data collection and the cost these activities incur in productivity and accuracy.

According to the Tompkins white paper, “Companies who have invested in voice systems are successfully utilizing the technology to achieve accuracy rates of up to 99.9% and above, productivity increases of over 25% and are pleased with the reduced turnover and training time required for their labor force. Perhaps most important is the fact that voice solutions demonstrate direct payback to the bottom line—typically in less than one year.”

Technical maturity in the voice and wearable categories mean today’s solutions are highly affordable, easy to use, use industry-standard protocols and deploy in weeks rather than months, to quickly deliver significant return on investment for their users. Savvy warehouse operators improve and future-proof their operations by choosing wearable and voice-enabled mobile computers.

### (Endnotes)

1. In a February, 2007 Aberdeen Group Research Brief, the company found “compared to companies in general, users of voice technology are 50% more likely to have reduced labor costs in the last two years.”
2. “The ultimate trend will be for WMS systems to have a single integration approach regardless of underlying data collection or related technology,” according to Supply Chain Digest, October 21, 2008.
3. According to Aberdeen Group’s Debunking Some Myths About Speech-Based Warehousing, August, 2007