Order Picking for the 21st Century

Voice vs. Scanning Technology

A White Paper

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Executive Summary

Companies continually strive to extract costs from their supply chains. Warehouse professionals in particular are constantly challenged to reduce labor costs, improve productivity and increase order accuracy while streamlining overall operational costs. As one of the warehouse's most labor-intensive functions, order picking is a key area that companies focus on for automating processes with new technologies. Although traditional order picking solutions—paper labels, RF scanning and pick-to-light—have been successful in making the process more efficient and accurate, increased competition and the demand for even greater levels of service continue to raise expectations for even greater efficiencies and improvements.

Enter voice technology—specifically speech recognition and speech synthesis combined on a wearable wireless computer connected real-time to the warehouse management system (WMS). When analyzing the order picking process, most errors occur due to mispicks, creating a significant cost through returns. Cumbersome handheld equipment or paper labels associated with traditional picking methods require more time to fill orders. Employee turnover, language barriers and seasonal increases in part-time employees reduce an organization's ability to maintain high productivity, all resulting in a less-than-efficient picking operation. Through direct communication with the WMS, labor management system (LMS) or host system, voice technology solutions facilitate simple, natural communication between order pickers and the system to speed the process and accuracy of order fulfillment.

Companies are finding that voice-directed warehouse solutions can improve operations and drive costs from the supply chain. Some of the findings addressed in this white paper are:

- Voice-directed warehouse order selection has been found to be more accurate and more productive than both handheld scanning and paper/label based methods.
- One company achieved a reduction of 50% in returns after implementing voice, which resulted in nearly $1.3 million in savings in the first year.
- The same company noted that additional physical moves required by scanning led to inaccuracies in picking orders. After converting to voice, shortages dropped by 11% and mispicks decreased by over 25%.
- Labor and training benefit directly from voice technology solutions.
- By applying voice solutions to perform a range of assignments across their warehouse, companies can further extend the economic and business benefits.

Voice-directed warehouse solutions enable companies to achieve efficiencies that translate into measurable operational gains over traditional picking solutions. Users report increases in productivity and accuracy, as well as a direct payback to the bottom line—all significant benefits that cannot be ignored—proving the value of the voice implementation. Whether the goal is reduced labor costs or greater operational efficiency, or both, voice technology has the ability to rapidly deliver a positive operational contribution to warehousing and distribution operations.

Order Picking: The Core of Warehousing

Order picking is the function that warehouse professionals consider to be one of the most critical in their distribution operations. As the point where receiving, putaway, storage, packing, shipping, order processing and customer requirements converge, order picking requires the most resources, and is the most customer-sensitive of the warehousing functions.

Order picking can account for nearly 40 to 60% of the direct labor budget in a warehouse. As a result, a facility's labor force and its ability to positively react to changes in the order-picking environment makes it a key economic indicator of costs and productivity—at its core, even the most automated warehouse is dependent on its operators to make it work efficiently and accurately. For most companies, high warehouse employee turnover is a reality. Additional costs are constantly being incurred for hiring and training new employees and often, accuracy and productivity suffer.

To keep accuracy and productivity high while keeping the costs of labor down, companies have turned to technology such as scanning, pick-to-light and voice technology to reduce costs from the order picking process. In preparing this white paper, Tompkins Associates further evaluated the effectiveness of two widely used technology solutions for picking: handheld scanning devices and voice-directed distribution.

The Evolution of Order Picking: Scanning

The more an area is identified as key to a company's success, the more technology emerges in that area. Order picking is no exception. A range of screen-based devices that employ a laser scanning beam have been deployed in warehouses. In a scanning scenario, a host system generates a "pick list" of items to be pulled from the warehouse shelves. That list is displayed on the screen of a handheld or truck-mounted terminal with location information and directions for picking.

To pick a product from the shelf or slot location, an operator is directed to a designated location by viewing the prompt on the handheld device. Next, the operator points the handheld device at the correct target, product bar code, attached case ID bar code, or a location bar code as confirmation that the selector is picking the correct product from the correct location. The operator then picks the listed item(s), and confirms the number of items being picked by entering the quantity into the keypad of the handheld device. Once this is completed, the operator places the items onto a pallet or into a carton.

Bar code scanning often produces data accuracy rates of up to 99%. This technology is far superior to manual data entry and recording, which, on the warehouse floor, can cause problems further down the supply chain, negatively affecting inventory accuracy and overall customer satisfaction.

However, scanning is not the ultimate solution. Bar code read rates can be affected by environmental conditions, lighting, dirt/smudges and print quality. For scanning to be effective, all labels must have bar codes that comply with standard size and format specifications, and the label must be in a good, readable condition. To read codes, a direct line of sight within a specified read range is also required for successful reads. Often, as an operation grows, the number of users connecting through a single access point can cause response delays to users and degrade productivity. As with any RF equipment, dead zones can be found within an operation either through poor access point design or blockage.

Voice Technology at Work in the Warehouse

Since its emergence in the 1940s, voice technology has impacted a variety of industries. Today, automobile manufacturers employ voice technology in vehicle navigation and safety systems to guide motorists to their destinations. More companies are using voice systems to automate customer service, order placements, banking transactions and information dissemination. As this technology continues to grow, consumers are becoming increasingly aware and accepting of voice technology in their daily lives.

At the same time, voice technology has made significant inroads into the more labor-intensive, industrial functions such as manufacturing and distribution, where the ability to be voice-directed is literally freeing up workers to be safer in the workplace, more accurate in their functions and more focused on the job at hand. For the distribution industry, voice technology provides an alternative to the labor-intensive multi-tasking that is typical of order picking. Voice's immediate contribution to more accurate, efficient, and effective order picking led many of the major grocery distributors to be some of the first adopters of this technology. Consistent pressures within this industry to improve productivity over the competition and to "do more with less" led to the search for technology that could go beyond traditional methods of order picking to improve the bottom line.

Voice systems allow operators to communicate directly with the WMS, LMS or proprietary host system to pick orders quickly and efficiently without using any handheld devices or paper to record picks. Because operators need only wear a lightweight headset with a microphone and a small, battery powered voice computer on a waist belt, the technology leaves both hands and eyes free for warehouse operators to actually pick product and move easily from location to location.

In preparing the case study below, Tompkins had the opportunity to evaluate the Talkman™ integrated hardware and software system from Pittsburgh-based Vocollect. The Vocollect system uses individually recorded voice templates to tear down the language barriers typical in this diverse working environment of a

warehouse. Ensuring accurate recognition, each person's voice templates are recorded once and then stored as a file. The operator then loads his or her voice template to the wearable terminal for each shift. The voice template establishes the operator's unique manner in which they will talk to the system. The recognition system is completely "language independent"and can be combined with the spoken commands from speech synthesis engines in a number of languages per the preference of the user. Vocollect's voice system has text-to-speech engines that allow the system to communicate with the operator in up to at least 11 different languages. The Talkman system even allows operators to hear one language and communicate back in another. Once the operators have acclimated themselves to being directed by the voice system, they are even able to increase the speed at which they are able to work.

Voice systems are easily integrated into a company's WMS, LMS or host system, and today, many of these software providers have created their own product-specific interfaces for voice technology. Implementation and configuration of the system requires no more time than an RF system, and often it takes less overall time to implement.

Once in place, voice technology order picking solutions offer many advantages over traditional methods:

- **Active, real-time labor direction.** The voice advantage is seen in its capability to actively direct the workforce. Paper-based or bar coding methods employ self-directed picking, allowing the operator to set his or her own pace. Voice raises productivity levels by establishing the pace for the operator. As part of daily operations, the workload assigned to an operator is downloaded into voice technology terminals from the WMS, LMS or other host system via the facility's RF wireless network. WMS systems provide the capability to prioritize the order picking process by grouping orders into waves for efficient picking. Wave management allows warehouse supervisors to dynamically manage large groups of orders to be picked efficiently. Voice technology systems work in concert with the WMS and LMS, capturing this waving information in a mode that can be acted on by the order picker. The sending of this wave information can either be dynamically downloaded to the operator in real-time as dictated by the supervisor or it can take place in a batch mode.
- **Precision accuracy and faster picking.** To ensure accuracy, the system employs a convention of "check digits." After logging on to their individual voice computers via a spoken password, the system directs operators to the first pick location. Using the Vocollect system, operators verify that they are at the correct location by reading aloud a unique numeric identifier called a "check digit" posted at each pick slot. Upon hearing the correct check digit for the assigned pick slot, the system will then direct the operator to make the number of picks for that location. When a worker speaks check digits that do not correctly correspond with what the back-office system indicates should be stored at that shelf location, the system tells the operator that they are in the wrong location. The pick quantity is not provided to the operator until the system hears the correct check digit. Optionally, as part of the installation configuration, the operator may be required to repeat the quantity picked, verifying this quantity. The system then directs them to the next location. The resulting smoother workflow is clearly a voice advantage. Operators stay focused as they are continually directed by the system's voice command, allowing them to pick with greater accuracy and productivity.
- **Real-time inventory feedback.** The voice technology system permits the operator to request detailed information about each product or location, including product description and UPC in the event that operators need to verify items at a location. Stock-outs and shorts are also easily handled by voice. In the event that an operator reaches a location that is empty or that lacks the appropriate number of items for the pick, the operator is able to alert the system, which will issue a prompt for that location to be replenished. The operator then has the option of adding the pick to the end of their assignment, or routing it back to the system to be assigned to another operator for picking. Voice technology offers clear inventory management advantages.

Case Study: The Difference Voice Technology Can Make

Founded in 1926, Associated Wholesale Grocers (AWG) is one of the largest grocery wholesalers in the United States. AWG's 1,000,000 sq. ft. facility in Kansas City, KS is one of the company's largest and consists of five primary areas: dairy, dry, freezer, meat and perishables. The Kansas City facility implemented scanning technology in its entire operation with the exception of the freezer in the early 1990s.

The need for greater order accuracy and productivity as a result of growth through mergers and acquisitions continued to be a challenge for AWG. The company was also dissatisfied with the performance of the scanning technology used in their produce, dairy and meat areas, and although they needed to conduct a critical overall technology upgrade, they wanted to see greater performance improvements without having to upgrade their existing RF system.

AWG was aware of voice technology as early as 1994. With early adopters and industry leaders such as Wal-Mart and Kroger successfully using the technology, AWG clearly understood the benefits of voice—reduced overhead/labor costs, greater productivity and accuracy, and more—and hoped this would provide a single technology they could deploy throughout their entire network of facilities, including the refrigerated and freezer areas. Voice, unlike RF technology, operates more efficiently in freezer and cold environments. Voice does not require the need to remove gloves to enter information, to wipe frost off screens, or to remove RF guns frequently to thaw the liquid crystal displays. In addition, companies do not have to invest in more expensive RF units to use in the harsh environment.

A pilot test conducted in the Kansas City facility confirmed the potential for significant accuracy improvements over the existing scanning operation and resulted in the decision to convert their entire picking operation to voice. AWG implemented the Talkman solution from Vocollect in January 2003. The entire operation was up and running on voice within just two months. The process of bringing each of the facility's five areas up on voice was sequentially deployed, moving from dairy, to meat, to produce, to freezer and finally to dry goods, which accounted for the largest of the areas with 60 to 80 operators.

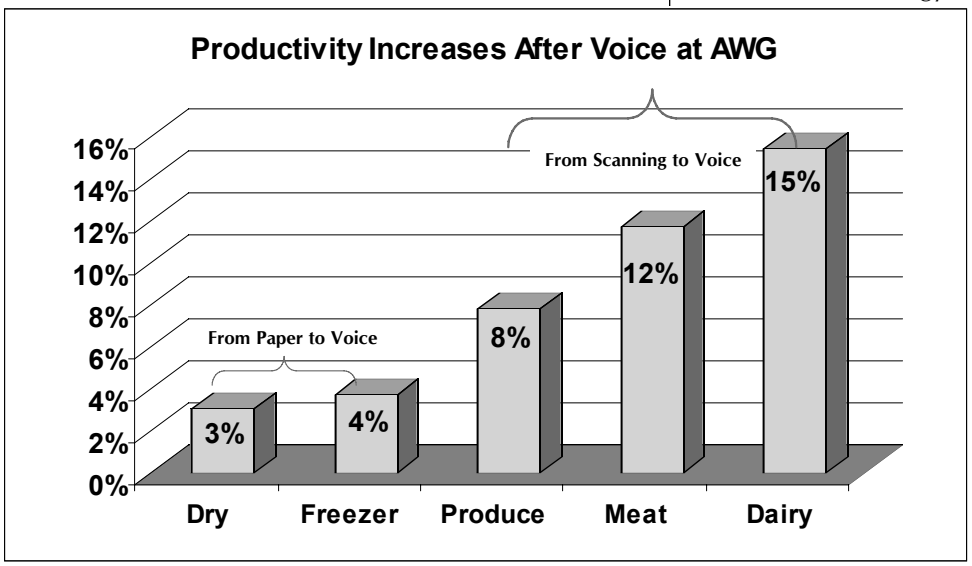

Figure 1. Picking Productivity Improvements after Voice Technology Implementation at AWG Kansas City.

Today, there are approximately 170 peak users on the voice system at any given time across three shifts over a 24-hour period. Since implementation, AWG has seen significant improvements in productivity in all areas of the distribution center (see Figure 1). It should be noted that the greatest improvements in productivity came over existing scanning operations in produce, meat and dairy areas ranging from a low of 8% improvement in produce to a high of 15% improvement in dairy.

In the dry and freezer areas which had been using paper pick lists, AWG also saw significant improvements in productivity up to 4%. Direct costs were also reduced by approximately $250,000 annually through the savings on bar code labels. Additionally, AWG also saw a significant reduction in training time for order picking staff—less than half what was expected. Today, AWG is implementing voice technology in its Springfield, Missouri site, with upcoming plans to implement in its Oklahoma City facility.

Voice vs. Scanning: The Advantage of Voice

While bar code scanning has carved out a niche in warehouse operations, it is not the optimal solution for every operation. The costs of labor continue to challenge many facilities where employee turnover and new employee training keep costs high. At the same time, advancements in WMS, LMS and other technologies continue to boost service levels and provide greater opportunities to make improvements. As companies deal with high turnover, greater workloads as a result of acquisitions and consolidations, increasing competition and greater customer demands, these factors continue to drive the need for greater accuracy and productivity.

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.

Order Accuracy: For most companies, order accuracy is the single largest benefit gained from voice technology systems. In order picking, errors occur frequently because of mis-picks, over-picks and under-picks and can contribute to significant costs through returns.

After successfully implementing voice in its Kansas City facility, AWG saw its overall order accuracy rise from 99.52 to 99.64%. To better understand this reduction, for a warehouse that ships a volume of approximately 62 million cases/year, this results in an additional 74,000 cases picked correctly that will not have to be repacked or brought back into the facility and replaced in inventory. Assuming a value of $20/case, this amounts to nearly $1.5 million in savings.

Greater order accuracy achieved through voice technology leads to a significant reduction in returns

that were picked in error and not captured by the auditing process. For companies like AWG who have high volumes and thousands of SKUs, returns represent a significant cost. At AWG Kansas City, the 50% returns reduction after implementing voice resulted in nearly $1.3 million in savings in the first year.

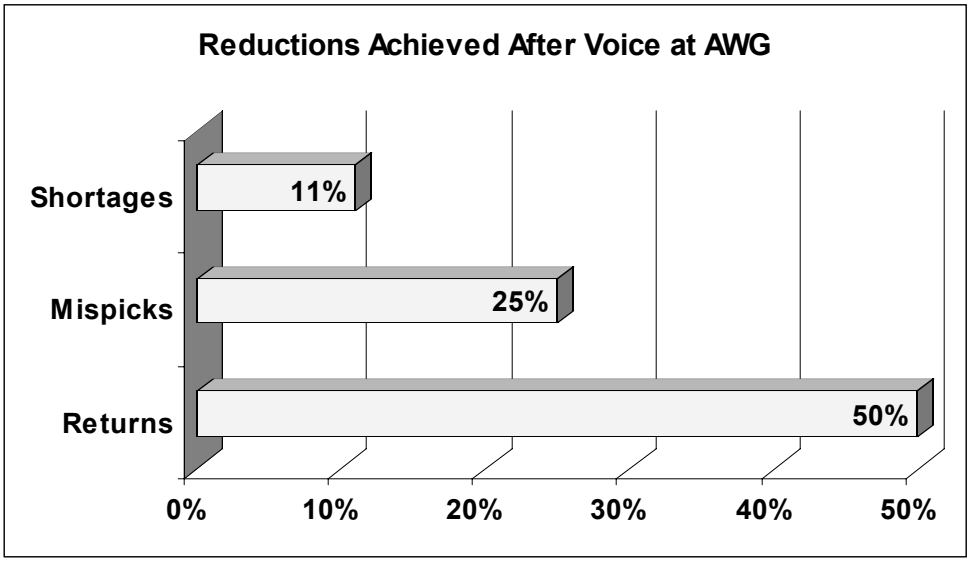

Figure 2. Reductions After Voice Technology Implementation at AWG Kansas City.

During the RF scan process at AWG in Kansas City, the additional physical moves required by scanning led to inaccuracies in picking orders. As described in Figure 2, with voice, shortages dropped by 11% and mispicks decreased by over 25%. Instead of having to reach to scan a label when picking with voice technology, a spoken check digit easily confirms the correct location. This demonstrates a key benefit of voice, as operators are able to visually focus on the assigned task rather than on a technological device. Eliminating excess physical movement that can sometimes be a distraction, voice enhances an operator's ability to concentrate on a given assignment. For example: bar code locators require operators to scan the item and then key in the quantity picked into the device. This diverts their attention away from the inventory location slot, as they are required to look down at the scanning device to key in the information. This diversion can allow them to easily lose track of where they are in the process. If they key in the wrong information, inventory inaccuracies result. With voice, operators are continually being prompted, keeping their concentration and attention levels high and focused directly on the pick itself.

Like most scanning technology, voice systems are able to communicate with the host system in real-time. Because each pick is tracked, the system has immediate visibility of its inventory, and operators are able to communicate back to the system from the floor. Therefore, operators are able to alert the system of stock outs or shorts, allowing the slots to be filled and the order picked before the end of the operator's assignment. With a voice technology solution, empty locations do not result in an unfilled order for the customer.

At Associated Grocers of New England in New Hampshire, returns have decreased from three per 1000 to one per 1000 after the implementation of voice technology. At Price Chopper, a large, East Coast-based grocery chain, inventory returns adjustments after voice have decreased from $500,000 in a 30-day period to just $1,500 over the same period. At another leading grocery retailer, Hannaford Brothers, voice picking allowed inventory accuracy improvements from 50 to 80%, with errors reduced from 3 to 5 errors per thousand to ½ to 2 errors per thousand via voice.

Productivity: Voice's hands-free inherent features contribute to the ability to make significant, measurable improvements in productivity almost immediately after implementation. The lack of cumbersome equipment to operate or labels to carry translates to less time required to fill orders. The hands-free and eyes-focused capability enables operators to make picks at the instant they receive the command because both hands are available to pick heavier or multiple items, resulting in less time required for picks.

Voice is of particular benefit for facilities with heavier items of varying weights, sometimes called catch weights. For example, in the meat section at AWG, packages vary by weight. In a scanning or label environment, operators must first verify the weight by scanning or logging the weight of each pick on a paper list. This list is then handed to a clerk to be keyed in at a later time, thus incurring additional labor and increasing the chance for errors. With voice, operators are only required to read the weights back to the system and continue picking without losing momentum.

As provided in Figure 1, following the voice implementation, AWG Kansas City saw an overall productivity increase that ranged from 3% in the dry goods area to 15% in dairy. Similarly, Hannaford Brothers realized productivity increases of 5% to 6% in their initial roll-out of voice in their dairy section. Other areas realized productivity gains that ranged from 3% to 15% at Hannaford.

Training/Labor: Voice technology has a great impact on an operation's labor force. A successful facility focuses on customer requirements—and is directly

dependent on its operators to make order picking, receiving and all downstream functions work correctly.

In high-turnover industries, companies using voice have reported greater employee satisfaction since implementing voice technology. Employees enjoy the new, modern technology, and they like the flexibility and control the system gives them over their assignments and the speed at which they work. The personalization feature of voice technology makes it ideal for distribution environments that typically employ a significant population of non-native English speakers. This feature makes it easier for employees to be trained and achieve peak performance quickly compared to the training required for scanning applications. Reduced training time through voice is common when compared to traditional training times for scanning and manual operations.

In addition, voice makes the employees and not the equipment accountable for performance. Warehouse supervisors are better equipped to address performance issues because they have daily, measurable feedback about employees' performance. Because the employees are actively involved in their assignments by adjusting the system speed to work faster, many report employees feeling a greater sense of ownership for their work.

ROI: Companies who have implemented voice technology have been able to demonstrate a payback that is well above industry standard for other picking technologies. After implementation of the Vocollect product suite, typical ROI achieved is in the range of six to nine months. At AWG Kansas City, the company expected to see an ROI of eighteen months, but actually achieved it in less than nine months.

Safety and Ergonomics: In addition to the obvious hands-free features of voice that contribute to productivity, the fact that operators have to constantly communicate with the system leaves them more focused on the assignments at hand, rather than on conversations, traffic or other distractions in the aisles. At companies like AWG Kansas City who have 175 operators picking throughout the facility, peak shipment times have 60 to 80 operators picking in a single area using pallet jacks and other motorized vehicles moving quickly through the aisles. Voice leaves operators more unencumbered and alert to their environment as they travel from pick to pick.

Flexibility for a variety of environments: Regardless of the type of product being picked in the warehouse, voice technology makes the picking process easy. Scanning is difficult in many refrigerated and frozen environments where temperatures require operators to wear heavy clothing and gloves—making the equipment and paperwork even more cumbersome and difficult to handle. The hands-free, wireless features of voice leave operators able to more easily pick heavy items. Because these operators will record their voice templates in the same environment in which they work, the system adjusts for the additional background noise common in freezer and refrigerated environments. The voice terminal's two-sided microphone allows the operator to speak into one side while the other side calibrates background noise, reducing its ability to interfere with transmission.

Goal	Voice	Scanning
Order Accuracy	Focus on Assignments	Focus on Equipment
Productivity	"Hands-free, Eyes-free™"	Handheld Equipment
Labor	Active Direction	Passive Direction

Figure 3. Voice vs. Scanning Technology.

Voice: The Picking Technology for Today

For any organization seeking improved order accuracy, increased productivity and reduced labor costs, voice technology has proven its value in the warehouse:

- **Voice technology solutions are proven to benefit organizations that seek improvements in accuracy and productivity.** The technology's hands and eyes-free interface and active labor direction allows operators to work more efficiently without cumbersome equipment to slow them down or distract their focus while picking. The check digit and catch weight features of voice systems like Vocollect's make it easy for operators to quickly verify product locations and weights without the additional handling of paper or scanning equipment. The increased productivity and accuracy results in reduced error rates, fewer returns and greater supply chain efficiency. Many companies who have implemented voice solutions see these benefits from just the initial test pilot.
- **Labor and training benefit directly from voice technology solutions.** Companies using voice technology report overwhelming success in training and the amount of time it takes to achieve peak productivity with their employees. Voice technology breaks down the language barriers for multi-lingual operations. For many users, turnover has reduced since voice implementation and productivity gains continue to rise as operators become more skilled in their positions.
- **Voice solutions are proven to be well suited for labor-intensive, high-volume, high-SKU operations.** Grocery, food and retail distributors have

achieved significant operational improvements using voice technology in their picking operations for full case and each picks. In addition to picking operations, many companies who have implemented voice solutions for order picking are also planning to add voice in their replenishment, receiving and inventory control areas.

- **Voice and RFID are complementary technologies.** Like voice, RFID's promise of a scan-free supply chain is too compelling to ignore. RFID readers come in two basic configurations: mobile and fixed. Mobile readers are usually employed as peripheral devices on handheld or vehicle-mounted terminals. Like the early days of bar coding when scanners typically could handle only one bar code symbology or type, many RFID readers are capable of only interrogating one tag frequency and protocol. As operations are required to integrate multiple technologies, voice technologies will enhance the hands-free nature of the RFID tag by reading the tags with a wearable reader incorporated into the voice terminal. The integrated voice-driven RFID reader in the wearable computer will allow operators to interrogate RFID tags by a voice command and have the tag talk to them regarding which actions are to be taken. This can be occurring while simultaneously passing relevant data from the RFID tag directly to the WMS system over the WLAN.

Summary

Establishing the best order picking practices for your warehouse or distribution center operation is a significant task. An appropriate solution for one operation may not be the most ideal solution for another. Evaluating any solution requires an in-depth analysis of an organization's current and future needs. For companies who need to improve order accuracy, increase productivity and reduce labor costs, voice technology solutions present a viable alternative for reaching these goals. 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.

While voice systems were initially considered by some to be a novelty, they have proven themselves to be a beneficial and rugged tool in the warehouse environment. Significant increases in productivity and accuracy, reductions in picking errors in addition to minimal training time makes this technology one that should definitely be considered when searching for methods to lower overall operational costs. Tompkins Associates believes that this type of technology will continue to be adopted by an increasing number of industry segments and feels comfortable in recommending that this technology be considered as part of an organization's overall supply chain improvement strategy.

About Tompkins Associates

Tompkins Associates provides companies with consulting expertise in warehousing, logistics, distribution, fulfillment, manufacturing, material handling, transportation, inventory management, and procurement. Customers seek our hardware and software integration expertise to create intelligent warehouses using material handling equipment, automation and controls, warehouse management systems and well-trained people. Simply no other company offers more capabilities in distribution center design, warehouse strategic planning, distribution network configuration, transportation system planning, and supply chain strategy.

Tompkins Associates is headquartered in Raleigh, N.C., and has offices throughout the United States and in the UK and Canada.

Visit **www.tompkinsinc.com** for more information.