TECHNICAL NOTES

VASFT006

**What Happened? Why
Mobile Workstations
Make Sense Today**

We often are asked questions such as: "If mobile workstations such as smart carts are such a good idea and they are so simple, why haven't they dominated order fulfillment operations?" A good question. There is really only one answer. The concept of mobile workstations such as smart carts and mobile order fulfillment modules have always made sense, however their implementation lacked just one ingredient – a dependable, inexpensive standardized means of communication. Sounds too simple? Ideally Smart Carts and mobile order fulfillment systems provide an order selector (picker) with a mobile workstation that contains all the tools and data necessary for the efficient completion of orders. They can be moved to the product rather than requiring product to be moved to a stationary workstation. If the efficiency of operation of both workstations is identical, then mobile stations will make sense where mobile system equipment costs less than alternatives requiring product movement to workstations.

Our staff's experience with mobile order fulfillment workstations started in the mid 1970's with a system called WICS installed at Robbins Air Force Base in Georgia. What we believe was the first such system used mobile workstations on modified Crown stock picking vehicles and consisted of a computer, display screen, keyboard, printer, 80 column card reader (the old IBM punch cards), and a badge reader. At that time, there was no off-the-shelf communication or computing hardware available and literally the entire system, electronics as well as software (both operating and application), had to be constructed from scratch. Workers (order selectors) were taken to the product. This system included fully automated computer controlled routing of the vehicles to the product without worker intervention. Once at the location, the worker was instructed as to the action they were to take. This system operated up until the early 1990s.

Of course, the design and construction of the communication and computing hardware was expensive and thus limited the application of the mobile order fulfillment technology to a small customer base.

Technology advancements in computing hardware began to blossom during the late 70's and early 80's. Less expensive, commercially available computing platforms that could be used for mobile order fulfillment operations emerged (single board computers, Apple, Multibuss, etc. and later IBM PC's). The availability of off–the-shelf computing hardware provided one of the ingredients that were necessary to make mobile order fulfillment systems both cost effective and widely applicable.

Following the availability of suitable computing platforms, operating system software began to emerge that could be applied to projects. The operating system software further reduced the implementation costs of mobile fulfillment systems.

However, even with the lower costs of both computing hardware and operating software the cost of development was still too high for mobile order fulfillment systems to make sense when compared to fixed workstations. The major factors that limited their appeal were the rapid changes in technology and the lack of standardization of both hardware and operating systems. These factors created a very short life for the developed system sometimes to as little as 24 months. Enter the 1990's and the years of standardization. In the late 80's and the early 90's both inexpensive computing hardware and operating system standards emerged. These standards made it possible for development work for mobile order fulfillment operations to have a much longer usable live.

Finally mobile order fulfillment stations began to make sense if it were not for one missing

ingredient – a communication system. As mentioned early in this paper, the earliest solutions required that communication hardware be designed and constructed from scratch. As the years progressed, off-the-shelf communication solutions emerged, however until the mid to late 1990's these solutions were all proprietary, each vendor insuring that their solution was NOT compatible or operable with any other vendor. Not only were the communication systems proprietary, the vendors embedded it into their own proprietary mobile computing hardware thus negating much of the progress that had been made in hardware and software standardization.

Although order fulfillment solutions could be built upon any and all these technologies, the cost of the unique development effort increased and the application became less universal. Of course, there were means for development to allow configuration for the use of competing technologies, but these raised costs. It was equivalent to designing an automobile engine to run on gasoline, diesel, propane, and hydrogen.

Enter 802.11 – In the mid 1990s a specification was created that standardized wireless communications. This standard provided the last ingredient necessary to create low cost efficient mobile workstations. In the few ensuing years, equipment conforming to that standard emerged and in the last two years, this standard has gained nearly universal acceptance. This standard allows engineers to construct systems with low cost commercially available hardware and utilize standard interfaces that would not require modification as equipment vendors modified their own offerings. VAS recognized this benefit and started using 802.11 before the specification was ratified.

Mobile order fulfillment applications can now be constructed with features that are no longer subject to nearly immediate obsolescence. The

application of such features too many installations reduces the cost of the development of the features and thus reducing the cost of each individual installation.

Mobile order fulfillment systems make sense when their productivity benefits, compared to their associated cost, provides the best return on investment. Reliable, low cost, standardized wireless communication now makes this possible!