Quick Response Solutions
FedEx Critical Inventory Logistics® Revitalized

John B. Jasper
Marketing Specialist Advisor FedEx
Critical Inventory Logistics
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By John B. Jasper

When businesses experience a failure event, a dual economic impact results - loss of profit and absorption of costs. Usual fixed and variable costs of production are still incurred during the time of repair, but are wasted without a product or service produced. Sometimes called the “instantaneous cost of failure,” these impacts can be massive and therefore create a need for proactive business strategy to mitigate the impact of failure.

Even well designed business equipment will fail at some point. The challenge is knowing when and where the failure will occur so that a replacement part will be available to achieve a rapid repair and reduce the cost impact. FedEx Critical Inventory Logistics is a quick response inventory program that provides a strategic and tactical solution for businesses at-risk of instantaneous costs of failure.

Program Background

During the mid-1970’s, a team of Federal Express executives began innovating a consolidated parts restocking concept. Initially called PartsBank, the premise of the enterprise was to ship replacement parts directly to repair technicians from a centralized warehousing facility. The new model was designed to expedite repair times, reduce downtime and control failure costs. PartsBank was reasonably successful and served a number of service parts businesses, particularly medical service organizations.

In the early 1990’s, PartsBank was renamed Express Distribution Centers (EDC) and moved to a flow-through distribution operation that utilized the FedEx global network for delivery. The change was a shift in focus from the service industry to express distribution and provided customers with a powerful solution until Federal Express switched to distance-based pricing and acquired Roadway Package Systems (RPS) in 1998. At the time, Federal Express management was focused on integrating and expanding the newly acquired ground delivery business and EDC subsequently received little attention.

Today, this original parts supply concept is operating as FedEx Critical Inventory Logistics, a revised program that has a number of improvements to assist with supply chain logistics. Throughout North America, 25 companies have continued on the PartsBank program. A number of new customers are testing the full line of services from FedEx Critical Inventory Logistics. Initial review is positive and FedEx Critical Inventory Logistics is ready for promotion as a major integrated supply chain supplier to product service organizations.
The Service Parts Market

Service parts supply has evolved as a major stand-alone business. US Bancorp says that spare parts are a $700 billion annual expenditure that constitutes about 8 percent of the U.S. gross domestic product. AMR states that businesses are holding idle inventory, such as replacement parts, worth over $1 trillion. Surveys taken at AFSM International, IQPC and WBR Interlog conferences, along with individual company research, show the profit margin on service parts is usually above 50 percent.

Technology has become a prominent business resource, so supporting high-tech products has evolved commensurately as a business function. Computer and electronic parts, as an industry segment, are globally estimated to be a $150 billion annual business. With the advent of such a lucrative auxiliary industry, profits from product service frequently exceed a manufacturer's profits on the original product.

Considering the high profit margin for suppliers and rapid growth of the support industry, options for cost savings and revenue enhancements in service parts and logistics are receiving considerable attention. Customers frequently ask FedEx to provide an alternative to UPS' Supply Chain Services, DHL, Choice Logistics and smaller players. Utilizing the FedEx physical infrastructure and IT backbone to offer integrated solutions for a broader range of a customer needs makes sense. For the high-tech, computer, electronic and medical service businesses, FedEx capabilities provide excellent logistics support at reasonable costs.

More Parts and Fewer People

When PartsBank was first created, technicians did most repairs on site. Remote diagnostics was barely in its infancy. Most components were mechanical, hydraulic or electrical. Field engineers carried oscilloscopes and soldering irons. When a failure was diagnosed in the standard analog equipment, a technician would unsolder the failed capacitor or other component, and solder in a replacement part to restore operation. This system relied on the availability of the technician and the appropriate repair parts. Conditions have changed to require far less labor and far more replacement of specific electronic components. Service is now a business of logistics and finance. The new model involves far
fewer repairs on site and more remote and centralized diagnosis and repair. Since many parts and even whole units of equipment are now smaller and lighter, equipment may be shipped to a central repair facility that houses the expensive and intricate test equipment needed to assure that repairs are done correctly and quickly. Where larger equipment is involved, remote diagnostics with human help desks and technical assistance centers can troubleshoot the specific component to identify the specific defective part. Both strategies reduce labor and equipment costs, standardize diagnosis and repair, and result in greater efficiency for businesses.

**The Current Program**

These industry advancements have dramatically increased the ability to identify the specific part needed for the technician’s site visit, a strategy often termed *know before you go*. Field technicians historically carried parts to meet about 85 percent of their anticipated needs. Although this method was efficient at the time, technology and logistics advances are making remarkable improvements for advance parts shipping.

FedEx Critical Inventory Logistics can greatly improve parts support for customers and achieve demand satisfaction close to 100 percent by operating controlled stocking facilities and delivering parts where they are needed, when they are needed. Through in-depth supply chain analysis, FedEx Critical Inventory Logistics partners with companies to develop multi-tiered support strategies that meet parts acquisition needs. These strategies include parts on hand, forward parts stocking and delivery, and centralized stocking and overnight shipment.

The heart and soul of the FedEx Critical Inventory Logistics system are warehousing locations throughout the nation. These are often end-of-runway locations that allow rapid shipment of parts. FedEx Critical Inventory Logistics has dedicated facilities open in 50 major markets across the U.S. By June of 2007, FedEx Critical Inventory Logistics will expand to 120 staffed locations covering 80 major markets, with added locations possible to meet special customer needs. Most of these locations are FedEx Kinko’s Office and Print Centers® that are open 24 hours a day. These facilities can provide two-hour parts delivery to cover 87 percent of the target markets, and four-hour delivery to 97 percent. With regular FedEx® delivery services, 100 percent can be reached by overnight. Many FedEx Kinko’s Office and Print Centers provide space for service parts and critical inventory, and can receive and ship parts to speed delivery. Add on the capabilities of FedEx Express, FedEx Ground, FedEx Home Delivery®, FedEx Freight, FedEx Custom Critical, FedEx Trade Networks and FedEx Global Supply Chain Services®, and companies can customize their services with the appropriate value needed.
How It Works
FedEx Critical Inventory Logistics will work with a company’s current parts supply chain system to customize the right business solution for their needs. On a typical FedEx Critical Inventory Logistics program, FedEx will replenish technician stock parts on a use one, get one basis, mostly overnight from the Memphis Global Distribution Center. Replacement parts can be consolidated for weekly restocking or some other period determined by the customer. With optimized planning and implementation, technicians carry fewer expensive parts and more parts are delivered to the point of need, for reduced total cost of business.

FedEx Critical Inventory Logistics relies on the new Global Distribution Center (GDC), an impressive facility, located near the Memphis FedEx airport hub. The 490,000 square foot building is a modern “class A” facility with controlled climate throughout. The facility is ISO 9002 compliant, secure, and operational year around. Orders can be received at GDC as late as 11:30 p.m. and arrive at their destination early the next morning by FedEx Express.

Which parts a tech should carry versus which parts should be in forward stock or the GDC is initially calculated by reviewing the parts used recently and adding any parts for new products or changes expected in the near future. After a few months of operation with FedEx Critical Inventory Logistics the parts being used (and also parts requested, but not stocked) will be accurately known so inventories can be optimized.

The Level of Support is the multiple of Demand Accommodation x Demand Satisfaction. Demand Accommodation is the list of recognized field replaceable units (FRUs). These are also termed items, part numbers, or stock keeping units (SKUs). Demand Satisfaction is the probability of having the identified part. If, for example, a tech’s authorized stock list (ASL) identifies parts to meet 85 percent of expected needs and 90 percent of those parts are on hand when needed, then a total of 76.5 percent of needs will be met locally. That is calculated 0.85 X 0.90 = 0.765 or 76.5 percent.
Figure 1 illustrates how an average Part Acquisition Time of two hours can be achieved with three levels of support. The scenario assumes a typical service situation in which the technician’s vehicle stocks are planned at 85 percent. The logic also assumes that all unfilled orders flow through the next immediate higher level of stocking.

**Figure 1 – Technician 85 percent Plan to Achieve Part Acquire Time Under Two Hours**

<table>
<thead>
<tr>
<th>Stock Location</th>
<th>Plan Order Acquire Time Hours</th>
<th>Location Acquire Time Hours</th>
<th>Cumulative Acquire Time Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Tech carry/On site/ or Pickup at Forward Strategic Stocking Location</td>
<td>85</td>
<td>0.25</td>
<td>0.21</td>
</tr>
<tr>
<td>2. Forward Strategic Stocking Location delivers when part need is identified</td>
<td>4</td>
<td>2.33</td>
<td>0.09</td>
</tr>
<tr>
<td>3. Global Distribution Center ships overnight</td>
<td>11</td>
<td>15.00</td>
<td>1.65</td>
</tr>
<tr>
<td>Total Average Acquire Time</td>
<td>100</td>
<td>15.26</td>
<td>1.96</td>
</tr>
</tbody>
</table>
If parts were costly and not used frequently, technicians would carry a lower percent of total parts needs, with perhaps only 60 percent on hand in the service vehicle. Figure 2 illustrates one version of stratification that should achieve the same two-hour part acquisition time with only 60 percent FPFR at technicians.

**Figure 2 – 60 percent Tech Vehicle Stock to Provide Two-Hour Part Acquisition Time**

<table>
<thead>
<tr>
<th>Stock Location</th>
<th>Plan Fill %</th>
<th>Location Acquire Time Hours</th>
<th>Cumulative Acquire Time Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Tech carry/On site/ or Pickup at Forward Strategic Stocking Location</td>
<td>60</td>
<td>0.25</td>
<td>0.15</td>
</tr>
<tr>
<td>2. Forward Strategic Stocking Location delivers when part need is identified</td>
<td>33</td>
<td>2.33</td>
<td>0.77</td>
</tr>
<tr>
<td>3. Global Distribution Center ships overnight</td>
<td>7</td>
<td>15.00</td>
<td>1.05</td>
</tr>
<tr>
<td>Total Average Acquire Time</td>
<td>100</td>
<td></td>
<td>1.97</td>
</tr>
</tbody>
</table>

This scenario reduces the number of parts carried by technicians and therefore reduces the investment in inventory on the company balance sheet, as well as decreases actual carry cost expenses. Fewer parts also mean smaller vehicles. While this scenario has significant cost savings benefits, the tradeoff is against increased cost of advanced transportation and outsourced stocking.

Technician confidence is another important element of the tradeoff. If techs have confidence that ordered parts will absolutely, positively be delivered to plan, they will not cache parts in private stocks. If technicians do not trust the logistics system, they will establish personal stocks of parts and drive up investment costs. The logistics system must prove over time that it is dependable. Mistakes take a long time to recover in a technician’s mindset.

Figures 1 and 2 represent averages that should be detailed for specific situations and probabilities. Calculations assume that the technician knows the specific part number and can place the order within a few minutes of identification. The part would be delivered to the location where the tech is gainfully working on other activities. Forward stocking locations require about 20 minutes to process and order and average two hours to deliver, so this scenario uses 2.33 hours as average total time.

For centralized ordering, Global Distribution Center delivery time depends on when the order is placed. If an order is placed at 6 p.m. and FedEx First Overnight is used, delivery can be 14 hours. If the order is placed at 9 p.m. and FedEx First Overnight is used, time can be as short as 11 hours. Most orders are placed throughout the day as the part need is identified. These will be shipped standard overnight, so an average of 15 hours is used for calculations. Stock locations and percentages to meet service level agreement (SLA) restore time can be tailored to meet specific situations. Variables include required SLA restore times, part acquisition time, cost of the part, need for climate control, part essentiality, part size and fragility, and tax rates.
Other scenarios create additional end-user delivery options as well. Sometimes the customer can install or replace the part without technician support. This can speed up restoration of the equipment to operation, reduce the service company's expense and give the customer self-satisfaction of completing the repair.

Computer database management of part locations also improves acquisition time and accuracy. When a part is not available in local inventory, the customer's computer system may be configured to route that requirement to FedEx Critical Inventory Logistics, where workers can then search other inventories stocked in FedEx facilities and determine the best source for parts delivery to meet the acquisition times necessary to achieve SLAs. If next-day service is possible, centralized stock and overnight delivery as early as 8 a.m. is a viable option. If restoration requirements are such that less delivery time is available, then local delivery from a forward stocking location is an option; or even next flight out (NFO) or charter aircraft can be used from the Global Distribution Center or alternate location where the part can be acquired. Some equipment may have such extreme business value that any option will cost less than the downtime or other fixed or variable costs resulting from failure. For example, magnetic resonance imaging (MRI) equipment can bring revenue of $10,000 per hour, but only if fully operational.

Benefits

The ability to identify the specific part needed, so it can be available for the technician's site visit, is a major advantage. The most efficient service situation is next-day response and restoration. For companies like Dell Computer Corporation, IKON and Siemens Business Services, who offer significant next-business-day service level agreements with their own customers, a comprehensive FedEx Critical Inventory Logistics program enables their help desk and logistics center to diagnose most parts needs over the phone and then send those parts overnight to the servicing technician. From a logistics perspective, this system provides the lowest cost service option, allowing most parts to be centralized and shipped when and where needed. Centralized warehousing and shipping requires much less investment in inventory since fewer quantities can meet broader needs, versus every technician carrying a stock of those same parts. Individual shipments may cost more if using express shipping, but the net result is major reductions in carrying costs of inventories.

Consider another example to illustrate this point. If 900 technicians each carried a $500 part used on the average four times a year, the total inventory cash investment is a minimum of $450,000. This minimum is low since additional parts must be stocked at the distribution center to replenish usage while the used parts are being returned and repaired. Carrying costs for this scenario would be about 30 percent a year for annual expenses of $135,000. If the businesses has 3,600 part uses per year, that averages 10 uses per day. If technicians achieve a two-week return and repair cycle with little fallout, FedEx Critical Inventory Logistics can support supply chain needs with 140 parts plus safety stock, for a probable total of fewer than 200 parts. That requires investment of only $100,000 in inventory and saves $350,000 plus annual carrying costs. The breakeven point of stock- order- pick- pack- deliver costs would be at roughly $37.50 additional per shipment, which is much higher than expected. All-in-all, savings will be gained by less inventory utilized more fully.
Experience shows that 15 percent to 35 percent of part needs cannot be identified in advance and are determined once a technician is on site and has examined the equipment. This is the main reason field technicians carry many parts in their vehicles to support part needs both that are known before they go and that are not known until the technician is at the equipment site. FedEx Critical Inventory Logistics faces a service challenge and delivery objective to provide a First Visit Fix Rate above 90 percent. That requires either carrying or rapidly obtaining necessary parts, especially if the service level agreement (SLA) is for same-day restoration. Every call that cannot be fixed at the first visit requires at least one more visit, adding several hundred dollars expense to total cost of business.

Although centralized warehousing and shipping is ideal, situations that require technicians to stock low cost, high use parts will still exist. Overnight shipment of fuses or printer rollers that are frequently used, easy to carry and low cost, does not make sense. Parts classified as expendable will usually be in this class. They can best be shipped in quantities to satisfy several months’ needs to reduce order-pick-pack-ship costs. Reverse logistics is not a consideration for expendable parts since they are rarely returned.

Some companies brag about operational availability of 5-9s (99.999 percent). Note that this failure rate of 1 per thousand is 1,000 failures per million, which is still far from the 3.4 failures per million required by six sigma. Since a 365 day year of 24 hours a day has 8,760 total hours, at 99.999 percent uptime that requires 8,759.9 hours of performance. Any business meeting this criterion must operate on a foundation of highly reliable equipment that rarely fails in addition to redundant backup equipment. If equipment does fail, many consumers want their high-tech equipment, such as network servers, restored to good operation with in four hours or less. Given that the technician may not arrive at the site and diagnose the need for a specific part until one or two hours into the call, Part Acquisition Time is often reduced to one or two hours. FedEx Critical Inventory Logistics can help businesses meet these stringent service delivery goals.

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**Operational Availability of 5-9s (99.999 Percent)**

<table>
<thead>
<tr>
<th>CURRENT RATE OF FAILURE: 1,000 per million</th>
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<tbody>
<tr>
<td>(1 failure every 8,768 hours)</td>
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<table>
<thead>
<tr>
<th>SIX SIGMA RATE OF FAILURE: 3.4 per million</th>
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<tbody>
<tr>
<td>(1 failure every 2578.4 hours)</td>
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</table>
Even the time of day when most parts are ordered has influence on service fulfillment. Most technicians order parts at the end of their work day and request overnight shipment. That creates an evening rush in the distribution center to make sure all orders are shipped that same day. If technicians order parts via wireless data communications in real time when the part is used, part order-pick-pack-ship is seamless and more evenly distributed. For parts on the ASL, orders should automatically occur when a part is reported as used. The few non-ASL orders should arrive when the technician electronically closes that service call. When service organizations operated from brick and mortar facilities, many organizations consolidated orders to a geographic location and shipped once a week. Now that most technicians operate from their homes or independent locations, shipping parts directly to individual technicians as soon as orders are received makes more sense.

Service level agreement (SLA) may vary even within a customer creating a situation where identical equipment has a four-hour restore time in one location but next-day restore time in another. Changes can occur with seasons or special events such as fast restoration being required on a CPA’s computers at tax time but slow and low cost after April 15. Note also that parts in central and strategic stocks can be shared by several techs who service the same equipment, but at different times. The ability to direct shipments to varied locations and select the optimum arrival time and cost provide a major advantage. The combination of automated information, personal attention as necessary from the Command and Control Centers and the options the FedEx portfolio of services provides can give customers major advantages to both speed restoration and reduce costs.

FedEx Express, FedEx Ground, FedEx Home Delivery, FedEx Freight, FedEx Custom Critical, FedEx Kinko’s® Office and Print Services, FedEx Trade Networks and FedEx Global Supply Chain Services offer a selection of services to provide customers with comprehensive, easy-to-use, flexible stocking and shipping solutions. Complete custodial control is given for peace of mind. Customers can know at anytime where their parts are, how those parts can be rapidly delivered to a point of need, and can continuously track the process from any Internet device.
From a comprehensive perspective, a single supplier should handle all aspects of the part acquisition pipeline. On a FedEx Critical Inventory Logistics program, FedEx will be responsible for part delivery from start to finish, but will manage the processes of providers who specialize in non-core activities. Special skills and remote geography are two reasons to have partners for non-core tasks. FedEx Critical Inventory Logistics has the comprehensive capabilities of both FedEx and external collaborators ready to effectively assist the logistics business of commerce, government and industry. These extensive capabilities include:

- Forward parts stocks at many FedEx Kinko’s locations, with expansion as customers require.
- Global Distribution Center that can ship parts overnight as late as 11:30 p.m.
- Rapid knowledge of all locations holding a needed part, with delivery time and cost.
- Customer choice of stock location, delivery time and cost.
- Automated replenishment of issued parts.
- Communications using customer’s preferred means.
- Continuous tracking of orders through receipt.
- Custodial control of physical inventory at all times.
- Reports that provide guidance for superior performance.
- Reverse logistics processes to rapidly retrieve repairable and excess parts.
- Many return locations to reduce technician effort.
- Comprehensive, reliable shipping solutions.

FedEx Critical Inventory Logistics can provide the logistics support service organizations need to achieve loyal customers and increased profits.

For additional information, please contact John Jasper at 901.263.8559 or jbjasper@fedex.com.