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OVERCOMING REPAIR DEPOT CHALLENGES

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ABSTRACT
Many OEMs develop repair depot strategy reactively. Properly planned, repair depot services can be a source of customer satisfaction and even an additional revenue stream. This paper looks at key issues that should be considered in developing a robust outsourced repair depot strategy.

INTRODUCTION
Original equipment manufacturers (OEMs) in high volume consumer products applications tend to have a wide range of repair depot strategy options. They often also have the advantage of product life cycles more aligned with component life cycles which minimizes the requirement to support obsolete product. Comparatively, OEMs in industries with lower volume, longer life cycle products face a range of challenges in supporting end market service requirements including component obsolescence, increased regulatory issues and special handling requirements. In many of these cases, repair depot strategy isn't addressed in the product development or manufacturing strategy as a standalone issue. It is instead assumed that the manufacturer handling production will also support any repair depot needs. The end result can be an inefficient, reactive strategy.

However, even lower volume, long life cycle products can have efficient repair depot support strategies. Whether the work is performed in-house or outsourced to a contract manufacturer or third-party repair depot, important issues to consider in developing a robust repair depot strategy include:

- Best logistics strategy
- Product support feasibility/challenges
- Environmental or "green" considerations
- Supplier ability to support an evolving partnership.

BEST LOGISTICS STRATEGY
Several factors go in to determining the best logistics strategy including:

- End customer cycle time requirements
- Preferred physical location of the replacement unit inventory
- Support capabilities of chosen repair depot
- OEM preferences for information exchange and customer service related to field repairs.

Two typical repair service support models are the *Direct Business Model* and the *Indirect Business Model*.

In the *Direct Business Model*, the OEM issues return authorizations, but the physical product is typically shipped direct to the repair depot from the field. The supplier has a database which is polling the OEM's return database several times a day looking for the latest information on returns issued by the OEM but shipped directly to the supplier.

On the other side of the direct transaction, the OEM database is requesting or is being "pushed" information on the status of the returned goods. This is critical as it shows the status of product along the reverse logistics supply chain. Elements that are usually monitored include:

- RMAs issued, but not yet received
- Product in the "to be repaired" warehouse
- In-process repairs
- Product in the "available to ship" warehouse
- Shipment status.

This data exchange typically occurs several times per day. Also, the *Direct Model* often includes a fulfillment aspect in which customer orders are received daily. Based on this demand signal, items are picked, packed and shipped directly to the end user by order. Because the majority of the transactions are automatically made by the system, transactional costs drop. Since returns are being shipped directly from the field to the repair depot and then from the repair depot back to the field, two legs of transportation logistics are removed. This lowers costs and improves turnaround time.

In the case of an *Indirect Business Model*, RMAs are consolidated by the OEM and shipped to the repair depot. Information is exchanged in a less real-time manner. In the *Indirect Model*, transactional costs are typically higher and cycle times longer. In this model cycle times can be reduced by adding an "Advanced Exchange" agreement; however, the OEM still incurs the added cost of two additional legs of transportation logistics. Those two legs are the reverse logistics leg of "customer to OEM to repair depot" and forward logistics leg of "repair depot to OEM to customer."

In the *Direct Model*, the repair depot becomes the face of the OEM customer to the end market. This means that the repair depot's quality, service and support guarantees need

to align with the OEM's commitments to its end customers. Internal stocking and fulfillment procedures need to support guaranteed turnaround times of as little as 24 hours, and provide both the OEM and the end customer with adequate visibility into repair status.

PRODUCT SUPPORT FEASIBILITY/CHALLENGES

Industry-specific and individual product requirements drive both business and technical considerations. On the business side, incoming material handling and traceability/information exchange requirements must be addressed.

Material handling can be a fairly simple incoming inspection process or far more complex. For example, a medical product that comes in from a hospital or clinical environment may require a decontamination step at initial receipt. With this type of product, a segregated area for incoming unit "triage" is required. Units which have been exposed to potentially bio-hazardous substances may require a chemical sterilization process. If residues remain which are not broken down by a chemical wash down or UV decontamination, provisions must be made to place these residues into a special bio-hazard container which is disposed of per regulatory requirements. Production operators involved in this stage of the process must be given specialized training in handling potential bio-hazards. Comparatively, products without potential contamination issues undergo a far simpler incoming screening and disposition process.

Traceability is another area that may have varying requirements that are driven either by industry regulations or customer preference. Mission critical products typically require traceability at both the serial number level and the component level. At that level of traceability defective units are received and assigned a unique bar code that corresponds to that model and serial number. Each step of the repair cycle is then recorded and becomes a part of that unit's lifecycle history. When component level traceability is required, it is not enough to simply report that the component at location C12 was replaced, but there must be a record that lists the manufacturer name and date code of the replacement component.

On the technical side, obsolescence management is always a key focus in longer lifecycle products. In an optimum situation, design for sustainability occurs at the beginning of the project and repair depot strategy is addressed during product development. However, in the real world, the repair depot contractor must often address unanticipated obsolescence issues in ways that maintain quality at a competitive cost. Standard practices in this area include:

- Identify alternate suppliers and obtain substitution approval if comparable components are available from multiple sources
- Purchase end-of-life inventory if a component is going obsolete and substitutions are not an option
- Maintain an inventory of repaired spares
- Search qualified independent distribution channels to find excess inventories of the obsolete part
- Support a redesign effort if alternate sources or acceptable substitutes are not available.

Repair depot strategy must accommodate the RoHS or leaded requirements of the product both now and in the future. There should be a segregation strategy that minimizes the potential for contamination if both RoHS and non-RoHS-compliant products are repaired. Certification requirements for RoHS-compliant products must be addressed.

RoHS-compliance also drives another set of challenges in the repair area: potentially greater failure rates. Tin whiskers are an issue with some RoHS-compliant product. This may increase field returns or change the complexity of repair when products are converted from older designs to RoHS-compliant designs.

Another area of potential challenge when repair depot strategy evolves over time can be unit cosmetics. For example, in older products a mold may no longer be available for the plastic housing. The electronics may be in perfect operating condition, but if the housing is cracked or damaged and can't be repaired, the unit must be replaced. It is important to assess whether or not a potential repair depot contractor has the ability to repair housing or faceplate cracks and fractures, and the ability to match paint, in the event new housings will not be available.

LCD repair capability is another area of specialized support that is often required. The size of LCDs change rapidly with commercial product trends. Longer lifecycle equipment may have odd-sized LCDs which are now obsolete. The OEM either needs to make a lifetime buy of the obsolete LCDs or be able to repair the existing units. The repair itself is relatively inexpensive, but because LCD repair involves replacement of the flexible circuit tab that goes between the glass and an FR4 PCB, a cleanroom, specialized equipment and highly skilled operators are required. The process involves removal, optical realignment and bonding with conductive adhesive.

LCDs aren't the only custom subassembly likely to have obsolescence issues and there are a number of ways a repair depot contractor can address this issue. For example, an original design manufacturer (ODM) obsoleted a subassembly and told the effected OEM that it would be necessary to make a 10K lifetime buy of the remaining inventory in order to continue to have a supply of spare parts. However, the customer had an existing inventory of subassemblies in need of repair. In this particular case, the repair facility was able to analyze the device, figure out the root cause of the failures and repair the existing inventory. The repair cost was 20% of the cost of a new unit. The ability to repair the bonepile saved the OEM approximately $1 million in actual inventory costs.

Test can also be an area of complexity. In some cases, the customer may provide a functional test unit. But in cases where a tester is not available, the contractor may need to analyze a theory of operation and create a functional test. This process is often more complicated than when developing a test for a new product. In some cases, several levels of revision may be missing from the existing product documentation or flash files may not be readily available. In those situations, the ability to work with the customer's engineering team to understand the issue is very important.

ENVIRONMENTAL OR "GREEN" CONSIDERATIONS

E-waste stream disposal management is another area of increasing focus. Old components can be a liability if not disposed of through a certified disposal partner. CRTs have a significant amount of lead and generally require specialized disposal. There is not a Federal standard that addresses e-waste handling requirements and different states are beginning to impose WEEE-like requirements, so what is acceptable in one location many not be acceptable in another. Working with a contractor who takes a proactive approach to good e-waste disposal practices is the best solution in avoiding unexpected fines, unplanned recycling costs or bad publicity.

SUPPORTING AN EVOLVING PARTNERSHIP

The biggest challenge in most lower volume, long-lifecycle outsourced repair depot partnerships is finding a contractor willing to support lower volumes with a great enough breadth of capabilities to support likely project requirements over time. This is particularly true if obsolescence issues require engineering support or specialized manufacturing capabilities.

Questions to ask when assessing the best choices in this area include:

- Is there synergy with my existing manufacturer in terms of test platform or raw material inventory that would make this contractor the best choice in terms of leveraging economies of scale for the project?
- Does the contractor have the component engineering, test engineering and specialized manufacturing capabilities needed to give a wide range of options for support of this product over its lifecycle?
- Does the contractor have the customer service function and information systems needed to support direct interface with my end customers?
- Does the contractor have the needed industry-specific quality systems to support my mission critical projects?
- Is the contractor willing to invest in additional support infrastructure should my requirements change?
- Which contractor is best positioned to help me convert repair from a customer support cost into a service contract revenue stream?

CONCLUSION

Developing a robust repair depot strategy involves assessing both immediate requirements and long-term needs. Repair depot strategy development during the product development process is best. However, even a repair depot requirement which evolves over time can be efficiently supported provided there is clear definition of requirements. Low volume repair projects may be best served by the current manufacturing build site when specialized test platforms or custom component inventories can be leveraged for both options. Partnering with your repair depot partner in addressing unexpected challenges can expand the range of available solutions.

REFERENCE

[1]S. Mauldin, "Optimizing Outsourced Medical Equipment Repair Depot Support", Circuits Assembly Magazine, March 2009.