

Crafting An OEM Warranty Program For A Remanufactured/Overhauled Capital Good

A white paper on the strategic and tactical issues to be addresses by a US-based capital good OEM
when crafting/revising a parts-based warranty program
in support of the sale of a remanufactured/overhauled product

Executive Summary

Historically, the sales volume of remanufactured/overhauled¹ capital goods by Original Equipment Manufacturers (OEMs), such as Caterpillar, Deere, Cisco, HP, Applied Materials, GE and United Technologies, has been immaterial (an accounting term referring to something that's "not important"), though virtually every OEM sells remanufactured/overhauled products. These sales have either encompassed the entire product or major subsystems of those products; for example an entire aircraft or a jet engine subsystem. As a result, the revenues and costs of remanufactured/overhauled products have often not been "deemed worthy" to be financially or operationally segmented from new-product sales and in turn have been "hidden" from the OEM's Leadership Team, as well as from its outside auditors and other stakeholders². Note also that because remanufactured/overhauled products have been often perceived as not being "sexy" by the OEM's sales organizations, little attention has been paid to these products.

The primary driver for an OEM selling a remanufactured/overhauled product is its need to market a not-new product that it obtained as a trade-in against a product sale; re-selling the traded-in product as a remanufactured/overhauled product versus selling an "as-is" product is often viewed by an OEM as a way of "protecting" the quality reputation of its brand.

If remanufactured/overhauled products have historically been deemed strategically immaterial, then the warranty aspects of these products have historically been perceived as being of even less importance. The focus of this paper is to discuss why remanufactured/overhauled product warranties are becoming more important to OEMs and what are the options that an OEM can select in crafting, or revising a warranty program to provide value to its customers. The paper will be segmented into the following:

The Capital Goods Remanufactured/Overhauled Product Market

1. Rentals/Operating Leases
2. Global Industrialization
3. Product Design-as-a-Platform
4. Profitability
5. New-Product Delivery Delays
6. Process Redundancy
7. Trailing-Edge Technologies
8. Environment

Options To Address In Crafting A Program

1. When Does The Warranty Effectivity Begin?
2. What Is Its Contractual Duration?
3. What "Part-Source-Type" Is To Be Supplied When Fulfilling Parts Demand?

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4. What “Part-Financial-Type” Is To Be Supplied?
5. What “Part-Ownership-Type” Is To Be Supplied?
6. What “Part-Site-Type” Is To Be Supplied?
7. What “Part-Life-Type” Is To Be Supplied?
8. What “Part-Substitution-Type” Is To Be Supplied?
9. What “Part -Configuration-Type” Is To Be Supplied?
10. What “Part-Transaction-Type” Is To Be Supplied?
11. What “Part-Condition-Type” Is To Be Supplied
12. How Long Does It Take To Get Replacement Parts?
13. How Reliable Are The Parts Supplied?
14. How Is Product Warranty Transferred, When The Product Ownership Is Transferred?
15. How Easy Is It For The Customer And The OEM To Work Together?

The Capital Goods Remanufactured/Overhauled Product Market

Starting in the late 1990’s, business transactions employing remanufactured/overhauled capital goods began showing-up on the “radar screen” of the OEM stakeholder community: Investors, the Leadership Team, Auditors, Regulators and others. The drivers for this change have been primarily the following:

1. Rentals/Operating Leases
2. Global Industrialization
3. Product Design-as-a-Platform
4. Profitability
5. New-Product Delivery Delays
6. Process Redundancy
7. Trailing-Edge Technologies
8. Environment

1. Rentals/Operating Leases

Over 20% of the annual production value of US capital goods, or about \$150B, is acquired by financial services organization, either OEM financial arms, such as GE Financial Services, Caterpillar Financial and Deere Financial Services, or independent financial services organizations, such as CIT and ILFC or banks such as Wells Fargo and Citibank. Note that a rental, which is a short-term service, or an operating lease, which is a long-term service, provides the access of a product’s use to an end-user, without the end-user owning the product. Put another way, the product owner reflects the product’s value on its balance sheet as a fixed asset and the end-user recognizes the service expense during the period of use. (Be aware that a recent FASB Interpretation Notification [FIN] requires an end-user to reflect on its balance sheet’s liabilities of the future obligations of operating leases). Rental/Operating Lease organizations are aggressive drivers of the sale and purchase of remanufactured/overhauled products; if these organizations do not embrace remanufactured/overhauled products in their

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business model, they are in effect managing their assets as a capital lease, and that has proven to be a “loser” for those who have tried it. Several construction industry rental suppliers made this ill advised strategic move and almost all spun into Chapter 11 by 2005.

2. Global Industrialization

Another driver of the sale of capital goods is a rapidly growing phenomenon of less developed nations obtaining “older” technology “on the cheap.” A remanufactured/overhauled product’s value to end-users has proven to be materially higher than that of an “as is” product sale; driven by higher reliability and higher capabilities. These demands have been fulfilled through such venues as Internet-based auctions or the showroom of non-US-based distributors.

3. Product Design-as-a-Platform

Many capital goods are now being designed as “platforms;” this is a concept in which certain subsystems are designed to experience “configuration-change,” while other subsystems are designed to be “configuration-stable,” during their lifetime. This design change strategy has been driven by the fact that few OEMs are “heavy duty” manufacturers anymore; they are designers, marketers, final assemblers, distributors and productivity sustainers of capital goods. Also, much more of a product’s value has become software driven, not hardware driven. For some sectors, there is no longer an economic necessity to buy new hardware because that could cause incompatibility issues for the use of the software; this is specifically the case in the transportation area, as well as in the factory automation area and the office automation area.

For example a railroad locomotive’s communication subsystems is designed for continuous configuration-change during the 35 years of a locomotive’s life, but the cab structure and the diesel engine are designed to be configuration-stable throughout their life. A configuration-stable subsystem’s design often enables a product to be remanufactured several times over its life; driven by the two events of product ownership transfer or the current end-user selecting to extend the economic life of the product.

Remanufacturing/overhaul-friendly subsystems can be driven by the durability of materials installed during new-product manufacturing. These subsystems are designed to withstand the stresses of multiple remanufacturing/overhaul processes intact, as well as the ability to be disassembled with a minimal breakage of “good” parts to get to “bad” parts.

4. Profitability

Recently many OEMs, as they have begun to take a closer look at their revenues generated by remanufactured/overhauled products, have discovered that these products can be wildly profitable; 75% of new-product sales have an Earning Before Interest and Taxes (EBIT) of less than 8%³ of their revenue, while remanufactured/overhauled product sales often generate an EBIT % of revenue of

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two to three fold greater⁴. Note that a remanufactured/overhauled product price is usually 70% of a new-product price. An example of the difference in profitability between the two is the following: a \$100 new-product sale obtains an \$8 EBIT, while a like-kind remanufactured/overhauled product sale of \$70 obtains an \$11 to \$17 EBIT. The reason for the material difference in EBIT is that the end-user, at least in the commercial world, is not as concerned about a product being “the latest and greatest” but is more interested in the fact that the process in which the capital good is employed is performing as efficiently and effectively as needed in creating outputs-of-value. For example, an end-user of a high-speed copier requires an output-of-value of 100 pages per minute, though the latest-and-greatest copier has an output of 140 pages per minute. If they can buy a remanufactured/overhauled unit that can produce the output needed for 70% of the price of a new-product purchase, why would they not embrace such an offer?

5. New-Product Delivery Delays

With many industries not anticipating the rapid growth in their sectors over the last few years, extensively long lead times for obtaining new-products has been experienced by end-users, resulting in an upsurge in demand for “readily available” remanufactured/overhauled products. This has been a way to reduce the time to access a product that is employed in a critical process; the global mining and construction industries have recently experienced such a situation where lead times for new-products have stretched out to one to two years, while a remanufactured/overhauled product may have a lead time of 2 months.

6. Process Redundancy

Many product end-users have been required by their customers to achieve certain performance levels, which require very high availability from the capital goods they employ. This has required redundant products, though often strictly used as stand-by resource for a process. Remanufactured/overhauled products have filled the bill for such redundancies. Electric utilities were famous for having banks of remanufactured/overhauled jet engines to provide for intermittent electricity generation during peak requirement.

7. Trailing-Edge Technologies

In certain economic sectors what is someone’s “cast-offs” is someone’s “gold.” For example a GE MRI product that is utilized in a large urban center hospital may be required to be robust enough to process 30 scans per day and have a very high imaging resolution. A small rural hospital, processes only 2 scans per day with only moderate resolution, because patients requiring high resolution imaging are sent to large urban hospitals. GE introduces a new MRI that can do 40 images per day with even higher resolutions than their current model. The large urban hospital trades-in its old for the new and the rural hospital acquires a 3-year old unit for 25% of its new price. This is a case in which the rural’s hospital strategy is to always buy trailing-edge technologies. This is often observed as being a strategy of privately held organizations who let the “big boys” take the depreciation hit and then benefit from this fact in the process employed by the

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product by having lower costs.

8. Environment

Many OEMs are beginning to include in their long-term strategies the need to become more “environmentally friendly.” This effort has had many false starts, but beginning in 2006 this initiative has become “main stream.” Companies such as GE, Caterpillar and Cummins created ways to “help the planet;” remanufacturing/overhaul has become one of their stated strategies in achieving this objective. Though organic growth has been a focus of these remanufacturing/overhaul initiatives, there has also been a flurry, over the last two years, of acquisitions by OEMs of organizations that remanufacture/overhaul the products that they have manufactured or products that some of their competitors have remanufactured/overhauled. For example, Caterpillar has grown its remanufacturing/overhaul business into a \$2B/year global enterprise through the acquisition of over a half-dozen remanufacturing/overhaul businesses located not only in North America, but also in the EU and Asia.

Studies by the Rochester Institute of Technology’s Remanufacturing Center has estimated that 85% of the value-added of the multi-levels of the manufacturing process is retained during the remanufacturing/overhaul process, versus 5% that is retained during the recycling process (bringing back to virgin materials). There are efforts underfoot to begin to allocate carbon credit offsets to products being remanufactured/overhauled through the two US-based exchanges selling carbon credits.

It is apparent from the above trends that remanufactured/overhauled products will be playing a more important role with OEMs and their stakeholders. As a result of this state of affair, the financial and operational impact of the warranty that is crafted by an OEM in the support of the sale of remanufactured/overhauled products will become greater. Today, an estimated 1-5%⁴, or about \$8B to \$40B of OEM revenues is generated by the sale of remanufactured/overhauled products, but that is forecasted to change materially over the next one to two decades.

One of the interesting aspects about configuring warranties for remanufactured/overhauled products is that these products’ EBIT % of revenue is materially higher than that of new-products and thus more creative approaches, but with greater potential risks, can be embraced to utilize warranty as a sales differentiator. For example a warranty period can be longer because higher profit margins enable the OEMs to absorb greater costs, and still maintain higher margins than new-products. Of course, if accruals were not segmented for remanufactured/overhauled products on the balance sheet, as well as their profitability on the income statement, this “fact” would remain “hidden” and thus cause many “poor” decisions to be made regarding the crafting of remanufactured/overhauled product warranty programs.

The remainder of this white paper will discuss all the options that should be addressed in crafting/revising warranty programs supporting remanufactured/overhauled products.

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Options To Address In Crafting A Program

When an OEM crafts a warranty program in support of the sale of a remanufactured/overhauled product, it needs to not only answer the question of how it will deliver value to the customer, but also how it will contain costs. This statement does not appear at first sight to be very difficult to execute, but as they say, “the devil is in the details.”

There are many issues that will be discussed; some of these issues are also applicable to new-products, but many are particular to that of the sale of a remanufactured/overhauled product. Note that we will be only discussing the parts-based aspect of a warranty program. For some programs, parts support is all that is offered, but for other programs, OEM-employed maintainers are also provided as part of the program. Also note that due to channel of distribution issues, sometimes it will be only the OEM who directly executes the programs, but sometimes it will be a combination of the OEM and its authorized distributors. Another wrinkle to consider is that it is often not the end-user who files a warranty claim, but the rental/operating lease service company.

The following will be discussed about a parts-based warranty program:

1. When Does The Warranty Effectivity Begin?
2. What Is Its Contractual Duration?
3. What “Part-Source-Type” Is To Be Supplied When Fulfilling Parts Demand?
4. What “Part-Financial-Type” Is To Be Supplied?
5. What “Part-Ownership-Type” Is To Be Supplied?
6. What “Part-Site-Type” Is To Be Supplied?
7. What “Part-Life-Type” Is To Be Supplied?
8. What “Part-Substitution-Type” Is To Be Supplied?
9. What “Part -Configuration-Type” Is To Be Supplied?
10. What “Part-Transaction-Type” Is To Be Supplied?
11. What “Part-Condition-Type” Is To Be Supplied
12. How Long Does It Take To Get Replacement Parts?
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14. How Is Product Warranty Transferred, When The Product Ownership Is Transferred?
15. How Easy Is It For The Customer And The OEM To Work Together?

1. When Does The Program Effectivity Begin?

This is not as simple as it appears. A warranty can come in effect in one of the following three ways:

- After the product is accepted by the end-user
- When the product is shipped to the end-user
- When the product is shipped to a distributor

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The above approaches significantly impact the accrual liability accounts for warranty; when does the product's liability end is the primary question to be addressed in managing balance sheet accrual accounts, as well as the forecasted expenditures to be incurred during the life of the program.

2. What Is Its Contractual Duration?

The issue to be addressed is what is the duration that the customer expects to be able to mitigate its risks of unplanned costs after acquiring a remanufactured/overhauled product. Obviously some of the drivers for the customer's expectation of the duration of the warranty are the duration offered by non-OEM competitors, as well as the current warranty duration offered for a new-product.

Also the OEM's understanding of how a product is to be used and how long the customer intends to keep the remanufactured/overhauled product is of utmost importance. In some industries remanufactured/overhauled products are used as an inexpensive way to obtain excess capacity; the product is not intended to be used and has been purchased as an "insurance policy." For this insurance-use case, a warranty may be offered that is of long-term, because there is a low risk to the OEM of unplanned high expenses.

An example of an insurance-use remanufactured/overhauled product warranty program duration could be one of 5 years or 1000 hours, whichever comes first; in this case the calendar time will most likely come first. Note that this makes the forecasting of warranty accruals expenses a bit more challenging, but they can be forecasted reasonably well. Accrual forecasting is like a stock portfolio, if you forecast more right than wrong, you're ahead of the game.

Most remanufactured/overhauled products have warranty durations similar to that of new-products; for many remanufactured/overhauled products, their reliability is greater than that of a new-product, especially for products that experience most of their failures during the early lifecycle of their use.

3. What "Part-Source-Type" Is To Be Supplied When Fulfilling Parts Demand?

A part-source-type is the segmentation of what part numbers will be covered under the warranty. All or some of the following four segments below can be fulfilled by the OEM:

- OEM unique: an OEM designed part where the OEM is the only source for the part
- M-COTS (Modified-Commercial Off The Shelf): a standard catalog part acquired from a supplier in which the supplier or OEM has modified the part for the OEM's specific product(s)
- L-COTS (Limited-Commercial Off The Shelf): a standard catalog part acquired from a supplier in which the supplier or OEM has not modified the

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part, but the OEM creates the majority of the demand for the part

- COTS: a standard catalog part acquired from a supplier in which the supplier or OEM has not modified the part, and the OEM creates the minority of the demand for the part

There are many ways to approach the above. Obviously a customer would prefer one contact point for administrating a warranty claim. If the remanufactured/overhauled product is still being manufactured as a new-product, then the approach could be a single contact point for all part-source-types, but if the product is Out-Of-Production (OOP), the world gets much more complex. OOP products, especially those older long-lived products, almost mandate that the OEM be the single touch point for warranty parts. To even compound the problem further, products on their second or third remanufacturing/overhaul cycle, located in Less Developed Countries (LDCs), can obligate OEMs to be one point of contact as well.

Note that in some industries it is common practice that the maintainers of a product will deal directly with the subsystem suppliers of an OEM for warranty. For example Boeing will have the aircraft buyer negotiate directly with the subsystem suppliers their own warranty terms; the customer goes directly to GE engines, Rockwell avionics, Goodrich landing gears and so on.

4. What “Part-Financial-Type” Is To Be Supplied?

Most OEMs assume that all the parts that it owns are only classified on the balance sheet as current asset inventory; this is not correct. GAAP requires that parts be classified into the following three groups:

- Current asset inventory: these are typically parts that are sold, with no anticipated returns. They are also forecasted to be employed within a one year period
- Fixed asset: these are parts, or their like-kind part removed, that are returned for renewal. They are in most cases used for an exchange/rental/warranty program. This grouping is depreciated; their Cost Of Sales (COS) is not the value of the asset. COS includes the cost of depreciation
- Long-lived inventory asset: these are parts that have no predictable demand, but due to the long lead time to acquire, the OEM purchases a group of these parts in order to mitigate the ability to execute their assured performance-of-deliverables. An example of a part that falls within the group is a iron casting where demand can be only created through a “freak” accident, but the OEM’s customer has an expectation of delivery within 24 hours. These parts are depreciated, whose depreciation costs are driven by the size of the installed base requiring these parts

5. What “Part-Ownership-Type” Is To Be Supplied?

In order for an OEM to achieve the performance-of-deliverables it assures, as well as

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mitigate its unfavorable financial risks, specifically to do with cash flow and the balance sheet, an OEM can be very creative in how it populates the supply chain with parts. One of these ways is to strategically shift part or all of the ownership of parts to others. There are four types of organizations that can own parts to meet demands of customers, regardless of their location, that are used for a specific program:

- OEM: they may own the parts, but may have a buy-back clause with their suppliers
- Customer: they may own the parts, but may have a buy-back clause with OEM
- OEM-supplier: they may own the parts, but may have a buy-back with their suppliers. This can go back several rungs down on the supply chain
- Others: these can be financial services that own the parts, entities that pool together several customers, suppliers who jointly own the parts in support of a program or others

Note that some parts can be sold as a service to the OEM, without the parts ever going through the balance sheet. An example would be in the aerospace industry where there is Power-By-The-Hour.

6. What “Part-Site-Type” Is To Be Supplied?

In this case, there is the de-coupling of part ownership from the site that the part will be shipped/issued to the customer. Traditionally the organization facility where the part is situated is also the organization that owns the part. Below are the four site options for managing a program:

- OEM: at one of the OEM’s facilities
- Customer: in their facility or in the case of mobile products on the product
- OEM-supplier: at their facility
- Others: Examples are authorized distributors, brokers, repair facilities, public warehouses and others

7. What “Part-Life-Type” Is To Be Supplied?

Part-life-type is divided into two grouping, the longevity that a part should remain installed, as well as the expected longevity of a part’s life once it is removed from a product due to its impairment. Most warranty programs exclude some of the parts falling into specific part-life-type categories. A good example is the structural parts that can become impaired as a result of “abuse” by the end-user. These exclusions can cause some problems with customers, especially if the OEM’s lawyers “get a hold” of the terms and condition of the program and attempt to mitigate all risks for the OEMs when its customers “do something stupid.”

During a consulting assignment, the author was assisting an OEM client who was remanufacturing/overhauling a product for the Army. The client inserted a term and condition that excluded some structural components from the warranty because only abusive use by the end-user could result in the installed part becoming impaired. The author reminded the OEM that the end-users were 19 to 20 year testosterone-filled young men who were operating this equipment and “stuff happens” when you’re in a

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combat zone. The OEM agreed that maybe it wasn't the best policy to "over" mitigate its risks and in turn just included the projected costs into their business model; absorbing the extra cost as part of their price. The following is the segmentation of part-life-types:

- Installed-life
 - Limited: these are parts that are required to be replaced. They can be driven by regulations (i.e. FAA), by use (i.e. hours of use), or the requirements of adhering to a contract (leasing company mandating their end-users of their product replacing parts based upon the OEM's recommended PM schedule). Note that these parts, if stored in a not-new condition, must reflect the remaining time available for the part to be used or installed. The period that a part must be replaced, due to limits in driven by two factors
 - Lifetime: a part may have a total life of 1000 hours of use or 10 years of installed-time, regardless how many times it has gone through a remanufacturing/overhaul process
 - Renewal: a part may have to be removed every 500 hours of use, or every 4 years to be remanufactured/overhauled
 - Unlimited: these are parts that have no known limits
- Storage-life
 - Limited: these are parts that are required to be installed within a calendar time after being manufactured/renewed; assumption is that the reliability of part will become degraded if installed after a certain date
 - Unlimited: these are parts that are not required to be installed within a calendar time after being manufactured
- Removal-life
 - Dispose: part, once removed, can never be installed again. These are typically parts that are uneconomic to fix or they are required under regulatory compliance to be disposed
 - Continue: part, once removed, can be used again and doesn't need any renewal process applied. These parts are usually a result of "cannibalization" of a product, or of a "No Defect Found" condition. This can be a part whose role is to enhance the aesthetics of the product, but doesn't add to its capabilities, such as a highlighting vinyl strip applied for reflective safety purposes, or it can be a piece of hardware, such as a bolt.
 - Renew: part, once removed, must go through a renewal process to be able to be re-installed. Most assemblies are in this category

Note that the part-life-type can change, and this is especially true for Out-Of-Production remanufactured/overhauled products. A removal-life-dispose category may evolve to a removal-life-renew category because there are no longer any new condition parts in the supply chain. Also a repair schema that has been developed that

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makes it economical to reuse could drive this change.

8. What “Part-Substitution-Type” Is To Be Supplied?

This area can cause great conflict between the customer and the OEM. Its purpose is to identify what alternative parts the OEM can provide to a customer for a part that has failed and is covered under the warranty program. If the OEM does not stock a “like-kind” part and requires the customer to modify their product to accommodate another available part number, there can result a level of mistrust between the two parties; the customer can infer that “the OEM doesn’t have my part number in stock in order to force me to pay for a modification that I don’t need....what a worthless warranty!” There are four part-substitution-types:

- Same: the same form, fit and function of the part removed is shipped. For example PN ABC is removed, PN ABC is shipped to replace the PN. There is a small twist in this area and that is when an OEM uses its supplier’s part numbers. Sometimes OEMs change suppliers, and a result the part number is changed because the new supplier has a different part number for an item that has the same form, fit and function as the part number removed by the customer.
- Revision-unrestricted: the same form, fit or function, but performance has been changed, with no requirement for a modification to a product. Usually noted as a part with a revision level, such as PN ABC-2.
- Revision-restricted: the same form, fit or function, but performance has been changed, with no requirement for a modification to a product, but not all products can accept the part without modifications to the product.
- Modified: different form, fit or function and product must be modified to accept part.

Note that the OEM must be very aggressive in notifying the customer when the part number ordered is not the part number shipped. The customer’s receiving area will go “tilt” if there is a mismatch between order PN and shipped PN. In some high tech areas, this can become a very annoying problem.

9. What “Part-Configuration-Type” Is To Be Supplied?

A part-configuration-type is the level of the product’s Bill Of Material that a warranty part will be supplied. Remanufactured/overhauled products have many alternatives for this segment. For example, if a component is not immediately available for shipment, but the next higher-level of assembly is available, from “stuff in the corner that’s hanging around”, that higher-level assembly can be shipped to fulfill the lower-level demand. Note that the higher-level assembly could have a value that is less than the lower-level assembly, because of the way the higher-level assembly was valued during a disassembly process This author has spent much time in the arcane area of cost accounting that values the parts that are removed from the disassembly of a not-new product, but that discussion is for another white paper. There are four part-

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configuration-types that can be shipped to a customer to meet warranty obligations:

- Product: In certain industries, such as communications, the part configuration is actually the remanufactured/overhauled product. Sometimes it's of greater value for all concerned to do this. Especially if the OEM has a bunch of "surplus" units in stock. In other words, ship an entire router, rather than only the electric power pack that failed.
- Higher-level: one level higher than the part removed, such as the shipment of an assembly versus the subassembly that was removed.
- Same-level: the same level that was removed by the customer.
- Lower-level: one level lower than that removed. In this case the customer should be compensated for the additional labor and piece parts that may have been performed in the installation of the part.

The above is often driven by customer satisfaction considerations; if the customer needs the part right away, they will accept anything that will get their equipment up again. Also its execution is often dependent upon the technical knowledge of the individuals managing customer orders, as well as the signing authority that permits individuals to be empowered in dealing with customer issues. Some warranty management personnel have no discretion to make changes to the configuration of a part number ordered by a customer; this is often a "dead giveaway" that the OEM is treating the remanufactured/overhauled product warranty management as though all that it needs are clerks to execute the programs. It is the author's experience that by treating those engaged in the warranty program as clerks, an OEM's costs will be higher than if employees were materially empowered to change part-level configurations in order to satisfy their customers, inclusive of giving them credits for parts that are of a lower-level configuration.

10. What "Part-Transaction-Type" Is To Be Supplied?

This type is another driver that provides the customer with several options in which to satisfy their warranty demands; it has an impact upon OEM costs, speed of customer fulfillments and ease of customers working with the OEM. There are five segments for part-transaction-types:

- Sale:
 - Part number (PN) "A," serial number (SN) "123" is shipped to customer. Note that I have used Serial Numbers only for illustrative purposes; many of these parts will not be serialized
 - Removed PN "A" (SN) "132" is not required to be returned; usually a non-repairable part that is disposed as waste
- Sale-Return:
 - (PN) "A," (SN) "123" is shipped to customer

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- Removed (PN) “A,” (SN) “132” which is not normally required to be returned, but for this transaction, the OEM wants (PN) “A,” (SN) “132” to be returned and be physically reviewed. The reason for return could be for reliability analysis, a recall or others

- Supplier Forward Exchange:
 - (PN) “A,” (SN) “123” is shipped to customer by OEM
 - Removed (PN) “A,” (SN) “132” is required to be returned; usually a repairable part. The returned part is often called a “core”
 - Core is renewed by the OEM for a future transaction

- Customer Forward Exchange:
 - Removed (PN) “A,” (SN) “132” is shipped by customer to OEM
 - (PN) “A,” (SN) “123” is shipped to customer upon receipt of removed part
 - Core is renewed by the OEM for a future transaction

- Loaner-Fix-Return:
 - (PN) “A,” (SN) “123” is shipped to customer. Removed (PN) “A,” (SN) “132” is shipped to OEM for renewal (repair or remanufacturing/overhaul)
 - Upon renewal process completion, (PN) “A,” (SN) “132” is returned to customer
 - (PN) “A,” (SN) “123” that was shipped to customer is removed by customer and shipped back to OEM
 - Customer installs its renewed (PN) “A,” (SN) “132”. This almost exclusively occurs with complex repairable components/subsystems

- Loaner:
 - (PN) “A,” (SN) “123” is shipped to customer. Customer chooses to do renewal process themselves for the removed (PN) “A,” (SN) “132” (piece parts may be also shipped for the repair)
 - Upon the organic completion of the renewal process of (PN) “A,” (SN) “132,” (PN) “A,” (SN) “123” is removed and returned to the OEM by the customer
 - The customer then re-installs the (PN) “A,” (SN) “132

11. What “Part-Condition-Type” Is To Be Supplied?

This is an area in which new-product warranties and remanufactured/overhauled warranties can be significantly different. Customers filing a warranty claim for a new-product warranty often expect that they will be supplied with a new condition part, but that is not the case for remanufactured/overhauled products. There can be very large differences in cost for the OEM based upon the condition of the part shipped to the customer. Note that the selection criteria of a part condition should be the following, from least costly to most costly to the OEM. This prioritization sequence requires application software that recognizes assets by part number and their interchangeable/substitutable item and condition. “Bastardization” of part numbers, such as creating different part numbers for different conditions often causes mayhem

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to implement this prioritization model. There are the following four options for part-condition-types, in priority sequence:

- Not-new-as-is: part removed from a product and is “deemed to work”; none, or minimal testing performed. This is usually for highly reliable parts.
- Not-new-repaired: part removed from a product and a “repair” process has been performed for it to be “deemed-to-work.”
- Not-new-remanufactured/overhauled: part removed from a product and a “remanufacturing/overhaul” process has been performed for it to be “deemed-to-work.”
- New: part has never been installed on a product.

Obviously there are many nuances in the above. Certain parts will only be shipped in a new condition, while others will only be shipped in a not-new-as-is condition. The drivers for these choices are the availability of not-new condition parts, as well as the availability of new condition parts. In some cases, where reliability issues have occurred, and the product is Out-Of-Production, a not-new part is the only choice available to be shipped.

12. How Long Does It Take To Get Replacement Parts?

This issue has huge implications upon the supply chain network that supports the warranty program of a remanufactured/overhauled product. The duration that an OEM responds to a warranty part’s requirements can be “you’ll get it when I can ship it to you,” to “we will ship 98% of mission critical items within 8 clock hours, 24/7, from the time we receive your order; and if we don’t achieve the aforementioned performance over the life of the warranty program, we will extend the contract by one year.”

This area causes a paradox for the OEM; the more time that an OEM takes to respond to a customer’s warranty parts demand, the more parts the customer will buy to assure that they will have the right part at the right time in order to maintain the uptime of their product. Conversely, the shorter the response time by the OEM, the less parts that are required to be bought by the maintainers.

There are many strategic issues to address in order to create delivery response times. Without a computerized business model of the entire warranty program, the ramifications of choices made in this section would be difficult to discern. The following are the areas impacted which will require sensitivity analysis via a business model:

- Do I have 24/7 coverage to respond to customer demands? How do I respond to “off-hour” demands? When a customer calls at 0400 on a Sunday morning,

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how do I get an organization energized to get a part to a customer?

- Do I “steal” parts from production, assuming that the remanufactured/overhauled product is still in-production, to meet commitments to the customer? What is this action’s impact upon new-product commitments?
- Do I segment shipment speed by uptime-criticality of the part? Note that these segments can be very subjective, but they should be identified in the terms and conditions of the warranty program. This author has experienced an ashtray being classified as a hi-critical item, because the owner of a corporate jet smoked cigarettes and would not depart on a flight in his \$25M jet without the ability of smoking. The following are the primary drivers of each of the product criticality groupings:
 - Hi-critical: no output can be achieved from the process in which the product is employed
 - Mid-critical: output can be achieved from the process in which the product is employed, but current or future maintainer productivity will be adversely impacted
 - Lo-critical: output can be achieved from the process in which the product is employed and shipment can be deferred for a period of time
- Response time measurement must be parsed in one of the following ways:
 - Receipt-clock-time: from the time requirement captured by the OEM to the time that the part is received by the customer. For example if an order is captured at 1800 Eastern on a Thursday, and performance is 24 clock-hours, then the part must be received by the customer by 1800 Eastern on Friday
 - Ship-clock-time: from the time requirement captured by the OEM to the time that the part is shipped to the customer. For example if the order is captured at 1800 Eastern on a Thursday, and performance is 24 clock-hours, then the part must be shipped to the customer by 1800 Eastern on Friday
 - Receipt-work-time: from the time requirement captured by the OEM to the time that the part is received by the customer, within the context of stated OEM work hours. For example, an order is captured at 1800 Eastern on a Thursday, and the performance assured is customer receipt within 2 business days after the OEM workday order receipt. OEM works Monday through Friday between 0800 and 1600 Eastern. Order capture is thus recognized as Friday, because it was processed after the end of the business day of Thursday. In order for performance to be achieved, the part must be received by the customer by Tuesday at the end of the customer’s business day

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- Ship-work-time: from the time requirement captured by the OEM to the time that the part is shipped to the customer, within the context of stated OEM work hours. For example, an order is captured at 1800 Eastern on a Thursday, and assured performance is the shipment to the customer within 2 business days after order receipt by OEM. OEM works Monday through Friday between 0800 and 1600 Eastern. Order capture is thus recognized as Friday, because it was captured after the end of the business day of Thursday. In order for performance to be achieved the part must be shipped to the customer by Tuesday at the end of the OEM's business day

The above may seem pithy at times, but it is absolutely critical in crafting a demand response approach that leaves no doubt as to the OEM's obligation to the customer. Again, different customers, based upon how a remanufactured/overhauled product is utilized, will have different response requirements. Obviously a \$1.5B paper pulp mill that is running 24/7 will need a very short response time to ensure the uptime of their process when they require a hi-critical item

- Who pays for transport costs for parts shipments? A customer-centric perspective would have the OEM pay for transport, both forward and reverse; the logic is that if a part has failed, why should the customer pay for the cost of shipping it. Sometimes freight costs can be multiple times the cost of the part, for example a \$10 fitting could cost \$50 to ship counter-to-counter airfreight. There are four types of ways to deal with the transport cost of forward and reverse supply chain transport:
 - OEM/forward-reverse: the OEM pays for the round trip. Note that there are also packaging issues, especially the returned packages; it is the author's belief that parts that require a reverse supply chain movement should be initially shipped forward with a reusable container
 - OEM/forward, Customer/reverse: OEM pays for forward costs and customer pays for its return
 - Customer/forward-reverse: Customer pays for the round trip
 - Customer/forward, OEM/reverse: Customer pays for forward and the OEM pays for its return
- Should customer-site, OEM-owned parts be deployed to reduce delivery time? Does the OEM manage these assets, or does the customer? Who is accountable for the asset's control, and its management? Remember that this scenario results in a "bloated" balance sheet, if not well managed. Issues such as the OEM having the right to redistribute parts from one end-user to another has to be considered and negotiated.

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- Should the OEM offer a “premium” fee for higher levels of parts availability under a warranty program (This is often covered as a SLA under an extended warranty)? This area has to be very carefully treaded upon because a sales person may promise a premium warranty program for the delivery of parts for “free” in order to close a sale and obtain their commission. Note that some warranty costs are not really warranty costs, but “freebies” provided by sales person to “ease the close of a sale.” In virtually all companies, sales persons do not “pay a price” in being overly generous with the terms and conditions of a warranty program. This author has seen as much as 10-15% of warranty costs being driven by a sales person’s “generosity,” or put another way, if remanufactured/overhauled products warranty costs are 2% of sales revenue and a remanufactured/overhauled product’s EBIT is 15%, EBIT \$\$ will be reduced by about 1.5%. This appears to be small change, but major Lean manufacturing initiatives often obtain even less paltry results.

- Should customers be encouraged to buy parts to support their product’s failures under warranty? This is how it can work in order to have a “win-win” when taking this approach:
 - Identify the parts that will most probably fail during the duration of the warranty; this can be a bit touchy effort because the OEM is acknowledging that their product may be not very reliable

 - Provide a discounted price for the purchase of the parts by the customer

 - The customer is to use the parts as its “warranty pool” where any part taken out of this pool to be installed on its product results in a removed part being sent to the OEM and a like-kind part being sent by to OEM to the customer to make his pool “whole.” Note a twist in this area is to have several customers, who are all under warranty, jointly own a pool which they can all access; obviously these customers would be in close proximity to each other and would not view this pooling arrangement as being unacceptable due to competitive reasons

 - At the end of the warranty duration, the customer has the choice of selling the warranty pool back to the OEM or purchasing the pool at a predetermined price

- Should the OEM commit to a performance criteria for delivering warranty parts by “walking the talk” in providing “penalties” if they do not perform as promised? To be able to execute assured performances, an OEM organization must be established that is focused on balancing costs and customer satisfaction. Many OEM organizations assign relatively low-level individuals to manage warranty programs because they have historically lacked resources. As a result of the anticipated increase materiality of remanufactured product sales, OEMs must seriously rethink how they are organized to manage a remanufactured product warranty program.

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Again to reiterate from a previous discourse, remanufactured/overhauled products usually generate profit margins materially higher than new-products and a remanufactured/overhauled product warranty program can “afford” to engage higher-level individuals to optimize the outputs of a warranty program. This author has upgraded his warranty personnel, but it took over one year for the Human Resources group to craft a unique job classification for the warranty program manager of remanufactured/overhauled products (Note: the US Department of Labor does not have job classification for a “remanufactured/overhauled products warranty program manager” and thus most HR personnel are “confused” when confronted with a job description that “doesn’t exist”).

- Does the OEM harmonize processes for managing parts for a warranty program with that of the non-warranty program for parts; non-warranty is revenue driven, while warranty is cost-avoidance driven. Again the OEM has a paradox in trying to manage the self-interests of the customer and the Leadership Team’s drive to increase profitability through cost reduction.

13. How Reliable Are The Parts Supplied?

Does the OEM assure that parts replaced under warranty will be reliable after the end of the warranty period? This issue is germane to a remanufactured/overhauled product; especially if it is Out-Of-Production and new reliability issues are popping-up that often require a modification. One approach to take is to provide no-cost modification kits if the reliability issues perseveres. Sometimes, based upon market conditions, the OEM may find it more economically to just exchange the entire product for free in order to mitigate their future risks.

14. How Is Product Warranty Coverage Transferred, When The Product Ownership Is Transferred?

This is a very interesting issue, which often rears its ugly head when products have long-lives, or when there is a “gray market” for the remanufactured/overhauled product. This change in ownership can be triggered by a company acquiring the organization that originally purchased the product; not an uncommon event in the US. In this case the product does not typically change site, and as a result, the OEM may grandfather the new owner as to the warranty program. If the product was physically transferred to a new site as a result of ownership transferred, unless negotiated at the time of the purchase from the OEM, most OEMs will terminate the warranty.

”Gray market” remanufactured/overhauled products conditions are often created by the “clever” exploitation of a particular global situation. Currently with the “weak” dollar, US based OEMs may be selling remanufactured/overhauled products to their authorized distributors who are then selling them to a non-US-based company, even though they are not “authorized” to sell outside the US. The OEM is often ignorant of these transactions until the first warranty claim is filed by the end-user and the OEM’s warranty administrator goes “tilt,” and identifies the claim as not valid. This

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can cause grief between the distributor and the OEM; lots of anti-trust issues in the scenario.

15. How Easy Is It To Work Together?

There are many subjective factors that makes it easy or difficult for a customer to work with the OEM to administer a remanufactured/overhauled product warranty program:

- How much of the customer's personnel time is employed to administer a warranty claim? This is very important because if the customer is using high priced maintainers to process "non-value added paperwork," the costs incurred by a customer can be very expensive. Obviously an Internet claims processing solution would keep this tasks relatively Lean.
- How quickly can the OEM be reached during off-hours? This is a very interesting issue to address if the customer base is global. Different time zones, coupled with different days of operation, pose many challenges. The author believes that outsourcing off-hour phone contact to a "service bureau" is a big mistake; why would an OEM provide a non-technical individual to answer a call at 0200 on a Saturday morning, when the only reason for the customer's call is that they have an urgent issue?
- How convenient is it for the customer to process the return of parts? Returns transport can be pre-paid, with a returnable container provided and a transport company can "automatically" pick them up. Neither the OEM, nor the customer want impaired parts "to hang around;" there are major supply chain investment ramifications when delays occur in the reverse supply chain flow. Note that the author has had encountered many challenges in the return of parts, specifically from customer locations outside the English-speaking world. At sites where the individuals receiving parts may not speak English, the adherence to policies and procedures for warranty parts can often be not followed. As a result, the author has had much success by creating "comic books," inserted in the parts container, that "told the story" of the warranty program in pictures; it has been effective several times in redressing non-conformance to warranty program terms and conditions.
- How easy is it for the customer to view the status of their open warranty orders, from order receipt status to in-transit status? This requires a highly robust IT infrastructure to deliver timely and accurate information to the customer. Working with a 3PL and integrating the OEM's systems with that of the 3PL often provides the connectivity required by the customer.
- How much self-help tools are provided on the OEM's web site to makes it efficient for the customer to resolve their technical inquiries? An example of a tool would be having a web-based digital part catalog with the latest and greatest product configuration that is being assembled in the remanufacturing/overhauled

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process. Note that “older” remanufactured/overhauled products sometimes were not designed through digital means; only hardcopy exists for engineering drawings. Also planned future product modifications should be included on the web site. The OEM can also link their web site with those of their suppliers to provide even further in-depth technological information.

Conclusions

All the options addressed above provide only a small window of insight into crafting/revising a warranty program for a remanufactured/overhauled product. The Leadership Team of an OEM must make many decisions. If decisions are done haphazardly, those decisions made today will result in many “land-mines” being implanted onto a road, which the OEM will walk upon in the future. Unfortunately the “guilty” will have long since been gone, and others will step upon those land mines and they will have to pick-up the pieces.

This author has managed complex warranty programs for remanufactured/overhauled products for a capital good OEM, as well as has helped capital good OEMs develop warranty programs. The author has a deep appreciation of the “pain” incurred with such initiatives. Surprising enough, it has been Marketing personnel who have been the greatest advocates of a thoughtfully crafted remanufactured/overhauled product warranty program; they have viewed these programs as a way to protect the Intellectual Property (IP) of their brand by “standing behind our product throughout its lifetime.” It is the author’s belief that OEMs will become the lifetime stewards of assuring the productivity of the process that supplies their products, and as a result will truly embrace the effectiveness of their future warranty programs for remanufactured/overhauled products.

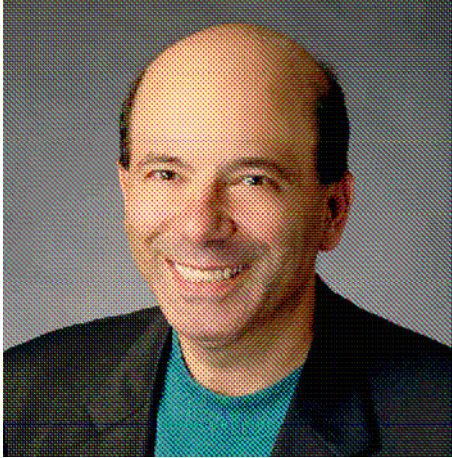
¹ A product, which has been inducted into a process, which has resulted in the extension of its economic life. The remanufacturing process is also referred to in certain industries as overhauling, refurbishing, reconditioning and other terms. Note that there are no legal constraints on what can be called remanufactured, except for the aerospace industry where the FAA regulates the process of overhaul and the DOE which regulates the process of overhaul for components used in nuclear power plants. Outside of these two-safety related initiatives, there are no other known regulations for products that are remanufactured.

² OPI has performed a detailed analysis of the financial reports of 180+ US-based public capital goods OEMs, which generate an estimated 95% of all capital good sales, and has identified less than 5% of these firms have any mention of remanufacturing in their 10Q, 10K or annual report during the last 10 years.

³ OPI has a database, which is updated weekly on all 180+ US-based public capital goods OEMs; this includes EBIT based upon most recent SEC filings

⁴ OPI has data from over a dozen client-consulting projects that entailed the sale of remanufactured product; the estimated EBIT presented is a result of these studies

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For 9 years Ron ran the Service-Parts Business Unit of Dassault/Falcon Jet. Ron has also been a Management Consultant with Booz, Allen & Hamilton. He began his career at Gould, Inc. where he held the manufacturing positions of: Director of Materials Management, P&IC Manager, Customer Service Supervisor and Operations Analyst. Ron is a pioneer in Supply Chain Management application software systems; he implemented his first MRP/ERP/DRP system in 1975. He has been an independent business owner for the last 17 years.

Ron has been engaged by many commercial capital good OEMs and has also been involved with DoD contractors and the Government.

Ron has written dozens of articles, published in such journals as The AFSMI Journal, The APICS Performance Advantage, Transportation and Distribution, The Journal of Management Accounting, Environmental Total Quality Management, Business Horizons (Indiana University's Kelly School of Business) and others. He has been quoted in the Wall Street Journal and other publications. Ron has spoken at over two-dozen international professional society conferences and has presented over 100 public seminars. He has traveled globally and speaks fluent French.

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