INVENTORY MANAGEMENT & OPTIMIZATION:

- *Increased Productivity*
- *Accelerated Cash Flow Savings*
- *Improved Service Levels*

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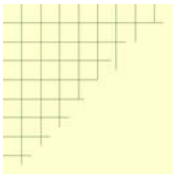

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Balancing the Availability of MRO Material with the Lowest Practical Inventory Cost

INCREASED PRODUCTIVITY AND CASH FLOW SAVINGS

I. Introduction

While most manufacturers invest significant time, energy and resources into an Enterprise Asset Management strategy, Maintenance, Repair and Operating inventories (MRO), have for the most part, remained a misunderstood and mismanaged portion of a company's asset base. In fact, there exists enormous potential for establishing a competitive advantage by optimizing purchasing and management of MRO inventories.

Companies that have begun to understand the unique characteristics of MRO inventories are using science-based optimization methodologies to their advantage. The direct and measurable result has been plant capacity increases along with significant cost savings through improved plant fill rates (percentage of orders that can be met by available stock at the time the order was placed) and utilization of new-found discretionary cash.

Effective management of MRO inventory is challenging and complex. Traditionally, the management of MRO inventory has revolved around manual and subjective ordering based on flawed historical information. The inferior plant fill rates experienced by the majority of manufacturing companies are evidence of this vulnerability. Twenty-two percent of the time [(1)] maintenance personnel are unable to respond to equipment breakdown due to stock outs in MRO inventory.

To combat stock outs (fill rates), companies have traditionally increased spending on MRO materials. For the most part, however, companies have lacked the analytical tools and expertise required to measure and manage MRO inventory behavior. They do not know with certainty the optimal Order Point (OP) and Order Quantity (OQ) for every SKU, especially in real time. With incomplete information, companies purchase too much inventory, and purchase items that will never be used in the future. In essence, a large part of every company's operating budget is redundant.

A new inventory management tool, based on proven algorithms is now available to optimize MRO inventories, and comply with new, more stringent corporate governance requirements. CFO's and purchasing staff can now take confidence in a truly independent yet "in-house" driven best practice solution.

II. Maintenance, Repair, and Operating Inventories (MRO)

MRO inventory definitions can be varied depending on your point of view or type of business. For the purposes of this paper, MRO takes on the more conventional definition of Maintenance, Repair, and Operations characterized as a class of parts and materials purchased by a business to adequately stock inventory levels in support of its internal operational requirements. The accounting world views MRO as "indirect material", whereas "direct material" actually forms a part of the finished product. At the core, MRO is about effectively managing spare parts inventory availability for critical production, facilities, and fleet equipment that businesses depend upon daily. The challenge is keeping just enough material on the shelf to maintain high levels of

equipment availability, uptime, and service management while not breaking the bank. The straightforward solution to maintaining equipment uptime is to simply maintain more parts in inventory. That way, whatever the service level requirement may be, you have the inventory on hand - whether you need it or not. But keeping stockrooms filled with excessive amounts of spare parts comes with a real cost to the business. Money tends to rapidly get tied up inside the stockroom with unnecessary purchases, shelves filled with infrequently used parts, and there's that dead inventory that never gets used but the carrying costs live on. MRO inventory can have a powerful impact on what the bottom line of a business (see customer case study in this paper) might look like. But properly managed, it can also create significant value through efficiency and competitiveness for the entire organization.

Inventory management decisions can be overwhelming when determining how much and which inventory should be replenished, how much safety stock should be kept, which parts should be purchased in batch, how inventory should be classified, and what considerations need to be made for older equipment because replacement parts are scarce or possibly discontinued. Chances are that as an MRO inventory manager, your management team is constantly looking to you to improve financial and operational performance year over year through:

- Reduced inventory
- Lowered inventory costs
- Improved availability of parts
- Reduced annual spend
- Shortened time to repairs

The challenge for inventory managers is achieving the right balance of spare parts inventory

There are many factors involved in making sound decisions about MRO inventory that are based on individual company business goals and objectives. The advent of inventory analytic tools is helping businesses remove the high stakes from the decision process and significantly reduce the financial exposure and risk to the business.

III. MRO Inventory and the Supply Chain

One definition of supply chain management is: "Supply chain management spans all movement and storage of raw materials, work-in-process inventory, and finished goods from point-of-origin to point-of-consumption.[1]" Although this paper focuses on describing techniques and methods to specifically manage MRO inventory, the two are inexorably connected. Companies invested in the supply chain can't afford to forget or ignore the aspect of streamlining spare parts inventory management – holding costs, obsolescence, and parts availability. The result of having

comprehensive tools to provide accurate information about spare parts inventory will help businesses to objectively assess MRO inventory status, costs, and stocking policies, thus reducing their cost of managing the supply chain.

Large supply chains can usually be characterized as complicated mazes of different application functionality and process interdependencies ultimately connected together to achieve productive and profitable results for the business. In order for an inventory management and optimization tool to effectively work in this environment, it must possess a high powered capability to non-disruptively and seamlessly extract data from this system, perform detailed analysis, and deliver timely results to optimally stabilize and adjust for demand and procurement needs. Similarly, if employees bypass the supply chain systems and try to manage things manually, then even the most expensive systems will provide an incomplete picture of what is happening in a company's supply chain.

Managing supply chain performance ought to take into account a balanced inventory management approach that can largely maintain essential inventory levels without creating an overburdened system of excess/dead inventory and related costs. However, businesses must first be prepared to proactively undertake certain activities before fully introducing inventory management and optimization solutions into supply chain labyrinths that are expected to yield cost savings and efficiencies to the business. At a minimum, the following should be considered:

- Perform data scrubbing to combine and reconcile enterprise-wide data
- Decide on a streamlined and consistent inventory reporting mechanism
- Repair and optimize existing MRO inventory ordering processes
- Institute manageable service levels related to product availability
- Establish practical inventory management policies (replenishment, disposal, etc) designed to stabilize costs

Successful implementations of inventory management and optimization solutions within multifaceted supply chain implementations will necessitate the need for data integrity, scalability and straightforward integration for solving small or large supply chain problems. Only then will enterprises be able to expect the highest levels of business, financial, and operational excellence and performance from their inventory management systems.

1. Wikipedia Encyclopedia

IV. MRO Inventory Optimization?

MRO inventory optimization enables companies to achieve a desired fill rate (usually 90-95% +) when servicing requests for parts from maintenance personnel. It is achieved using the aforementioned algorithms to calculate optimal Order Points and Order Quantities for every SKU item in inventory on a monthly basis.

The goal of inventory optimization is to eliminate common problems:

- incorrect reorder points
- out of stock inventory (fill rates)
- excess inventory
- obsolete inventory
- inefficient min/max measurements
- low turnover rates
- ongoing purchase of dead or declining-use inventory

And to enable:

- critical spare enhancement
- spare sharing

- SCM initiative improvement such as scrubbing and leveraging

MRO optimization improves cash flow by reducing over-purchases of rarely used MRO inventory spare parts, and maximizes productivity by reducing plant downtime. This adds to a company's bottom line and improves internal controls.

V. How MRO Inventory Optimization is Achieved

First a brief understanding of the unique behavior of MRO inventory is presented here as a background to illustrate why optimization is such an elusive endeavor using traditional forecasting means:

Traditional MRO Inventory Behavior

In most MRO inventories, only 5-15% of items are frequently used. Traditional business systems can indeed forecast their usage with sufficient accuracy. However, it is the remaining 85% of items that cause the problems. These items are infrequently used, and sit in a company's inventory only to be used a few times per year, or perhaps never used at all. It is these infrequently used items that cannot be accurately forecasted using traditional means.

Until now most companies have been applying traditional forecasting methods when purchasing MRO inventory items. As a result, with virtually every purchase transaction, costly errors are made. No adjustments are made to min/max levels on items that are increasing in demand; while the need to reorder items that are declining in demand are renewed. The outcome: low fill rates and unnecessary high inventory investments.

The Inventory Optimization Process

The optimization process seeks to make the right inventory items available to customers in the appropriate quantities such that customers can obtain needed material in a timely manner. A secondary but important goal of the optimization process is minimizing the costs of providing MRO materials to these customers. Of course, the customers for these MRO materials in this context are operations and maintenance people in the plant or facility being served by the inventory investment. A wide range of items are needed to keep plants and facilities operating at the appropriate levels of efficiency and safety. Inventory optimization involves first setting target stocking levels at the plant and then developing a set of procedures for each item so that timely and cost effective material replenishment takes place.

Setting target stocking levels and developing replenishment procedures are implemented as the result of several key decisions:

- Whether or not an item will be physically stocked at the plant
- Consideration of customer service requirements
- The target average investment in inventory for each item
- Direct and indirect consideration of replenishment handling costs

All of the above decisions require the setting of target levels of performance and depend, in part, on the analysis of past demand for the items to be stocked at the location in question.

Safe and Efficient Operations:

Primary consideration is given to customer service. These service requirements and the criticality of a repair part to the continued efficient and safe operation of the plant or facility will determine what is stocked at the location. The *allowable inventory investment is secondary* in that it may be allowed to grow within limits in response to customer requirements, availability in the market, lead time for replenishment and the need to reduce replenishment handling costs.

Optimal Fill Rates:

Customer service level goals are most often stated as the desire to fill a target percentage of all stock line items requested by customers, quantity complete, off the shelf at the time the customer request is made. The *target service level* also known as target fill complete rate must be set by

management and is usually in the range of 90% to 99%. The approach used makes extensive use of two distinct sets of algorithms that estimate the least biased value of the next quantity demanded. The first set of algorithms is used for items demanded frequently enough that an underlying statistical distribution can be identified. The second set of algorithms is used for items that are not demanded frequently enough to identify an underlying statistical distribution. Determination of which set of algorithms should be used for a particular item is entirely automatic.

The Right MRO Investment:
The limits placed on the inventory investment are usually stated in terms of management's desire to achieve a *target rate of turnover in the inventory investment*. Often, an item's lead time will determine that a minimum amount of the item must be stocked in order to satisfy demand at a plant or facility during the interval between orders.

VI. Who Can Benefit from MRO Inventory Optimization?

Ideal candidates for employing inventory optimization methodology are companies with the following characteristics:

- Limited by forecasting tools and techniques
- Experiencing high stock out rates
- Carrying MRO inventory values of $2M and above

On average the quantitative impact of these conditions are as follows: [1]

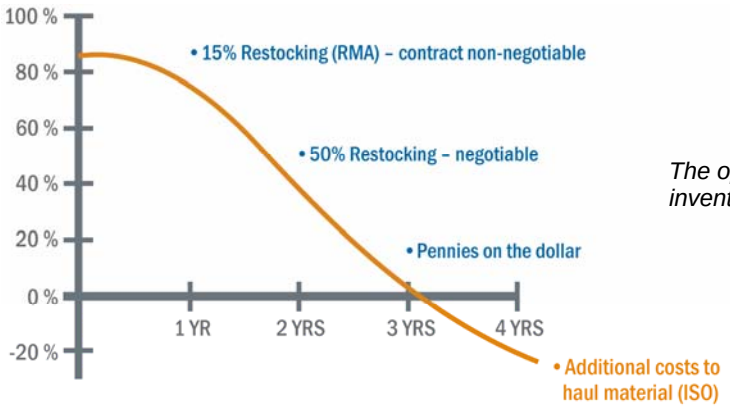
- 22% of the time, the maintenance person leaves the storeroom without the proper quantities or material
- 9.7% of material purchased today is in excess of 1 year's supply
- 5% of material purchased today will never be used
- Less than 3% of "excess material" will be returned to original supplier

The questions that these conditions raise are the first step toward rectifying the issues:

- *Which MRO inventory items should be purchased in greater quantity, to enable a plant to operate more safely, more efficiently, and at higher production?*

- *Which inventory items are at risk of stock-out due to OP/OQs that aren't sufficient to meet fill rate requirements?*

- *What accumulated inventory items have the highest value of recovery? Of those, which items can be directly returned to the manufacturer? And which items can deliver returns via investment recovery specialists?*



The opportunity to extract cash from dead inventory decreases rapidly over time

Most

Companies are surprised to learn that the information required to formulate the answers already exists in the past transactional data of their MRO inventories. Extracting this information and analyzing it enables businesses to set OP and OQ or Min and Max to achieve a specified fill rate at the lowest cost.

VII. Expectations: Early Deployment, Timeline and Value Measurements

This single business tenet must hold true: **Without Increased Productivity, There Is No Credibility** – and even the best conceived SCM solutions are doomed. No matter the extent of cost savings, or the pursuit of best in breed programs, if productivity is in question, there will be no deployment at the asset level in the "trenches".

Inventory optimization should be the first supply chain initiative employed by any asset intensive corporation. In all cases, it can be achieved while ERP systems are being deployed, upgraded or changed. By optimizing first, the redundant inventory is flagged and omitted, duplicates are removed, lead times confirmed, and most importantly, fill rates are achieved. The required inventory budget is projected over three years.

SCM initiatives such as scrubbing, leveraging, pricing, VMI (vendor managed inventory), consignment and critical part sharing all benefit from employing optimization first. Fewer data points (SKU's) need reviewing, analyzing and servicing. Optimization methodology should also present constant benchmark and KPI feedback to measure not only its performance, but also the performance of the related best practice solutions.

Web-based tools enable better tracking and monitoring of Key Inventory Performance Indicators (KPI)

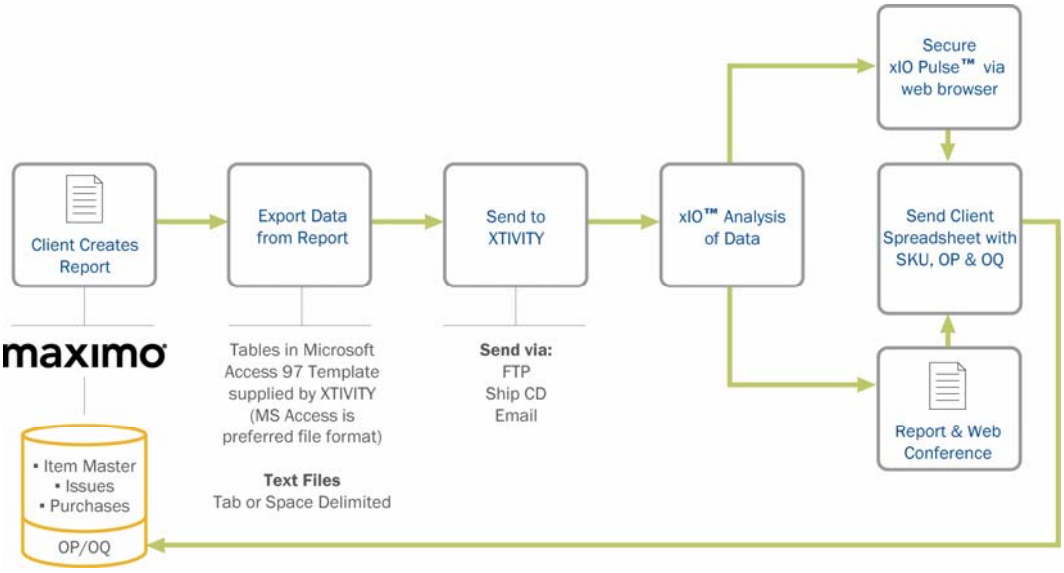
VIII. The Integrated Solution: MXES/xIO Inventory Optimization

So how does a large enterprise with hundreds of millions of dollars tied up in MRO inventory achieve the right balance between replenishment and costs? How can the enterprise take back control of spending, improve ROI, and guarantee MRO availability? Simply. They implement the leading strategic asset and service management solution, Maximo Enterprise Suite (MXES) with the Xtivity xIO Inventory Optimization Service (xIO). By building this integration, businesses combine modern, scalable, and extendible architectures that can immediately create opportunities for improvement in inventory management processes as well as deliver significant financial savings to the business in a very short period of time.

The process of integrating MXES and xIO is culturally non-disruptive and delivers dependable and defensible inventory level recommendations tied to financial results regardless of the inventory size. This success is easily measured with metrics and KPI's that are resident in each solution. The integrated solution addresses the problem of inventory management and optimization as follows:

1. MXES transactional data is extracted into a specified file format and exported to the xIO analysis system
2. xIO service processes and analyzes the MXES data to scientifically measure transactional changes in MRO inventory

3. xIO service immediately responds to increases or decreases in demand for MRO items; recalculates optimal Order Points (OP) & Order Quantities (OQ)
4. New optimized OP's and OQ's are delivered back and entered into the MXES system
5. Performance is tracked



Non-disruptive and seamless integration between MXES & xIO service delivers optimized inventory values

Research reveals that large enterprises can easily have over 155,000 SKU's but usually less than 1 to 1.5% of this inventory can really be shared. So, in global businesses where assets play a critical role in the operations, ensuring that MRO inventory is actually available when it is needed can't be overestimated. A reliable inventory optimization tool can help to determine what is available thereby increasing fill rates and reducing stock outs. This is one of the benefits realized from implemetning the combined MXES and xIO solution.

Because enterprises are multi-site and multi-org, the combined use and power of MXES and xIO reminds us that technology does matter when addressing inventory management and optimization. Information availability and delivery can't be taken too lightly. On the MXES side of the solution, customers receive a full web-and standards-based architecture that is anywhere/anytime accessible. With xIO, customers immediately save on capital and remove much of the IT involvement, as xIO is purely a hosted service. And in the middle, customer options to transfer transactional data can range from email, to ftp, to implementing consistent and automated on-line commerce capabilities.

The MXES/xIO integrated solution has been created to help businesses in complex, asset-intensive industries with high inventory investments that support a wide variability of assets. This emphasizes the need for a solution that can regularly and accurately optimize MRO inventory using current and comprehensive transactional data from the MXES system and powerful analytics for calculating and reporting critical MRO inventory values that support the operations and overall supply chain of the business.

MXES Materials Management tracks asset-related materials and their usage. All transactions involving materials are recorded, allowing for real-time knowledge of materials status so stockroom managers can easily identify and track transactions that move items into or out of inventory, or from one location to another - streamlining the part and materials management process.

When MXES is coupled with the xIO inventory optimization tool, the solution helps companies strike the right balance of MRO inventory within the supply chain to meet maintenance demand, attain service level agreement metrics, and adhere with regulatory compliance requirements.

The integrated solution is able to:

- Track and report on material usage, locations, and assignments
- Verifiable at line item level for Sarbanes Oxley
- Item by item inventory analysis of inventory value
- Properly set minimums & maximums
- Establish order points & order quantities
- Provide analysis of infrequently used and/or dead inventory
- Ensure that the right parts are available
- Reduce stock-outs, inventory shrinkage, & carrying costs
- Improve ROI in only a few months
- Deliver, on average, a minimum 10% cash flow return and increase customer-specified fill rates

Deployment is uncomplicated:

- Data format templates are supplied - Data is entered into the template forms from existing ERP/EAM systems (2 hours – usually job-stream)
- Supplied to Xtivity for analysis over secured web transmission
- Completed analysis (recommended OPs and OQs) are returned to client for automatic upload
- Completed within 3 days of month end
- Posted to the xIO Pulse for client review on a line item basis over a number of parameters.
- 10% increase in fill rates within two weeks.
- Average cash flow savings of 10% of MRO inventory value in the first year (heavily weighted in the first 3 months) and 2% - 5% every year thereafter.

Together, MXES and xIO improve inventory management, replenishment, and optimization through increased fill rates, lower inventory investments, and eliminate the purchase of items today that will become dead in the future. The solution's success can be confidently measured in its' ability to streamline the supply chain and allow the business to realize maximum cost improvements.

Footnotes:
(1)Averages based upon new xIO clients in 2005

IX. A Customer Study

Accelerating & Optimizing Business Performance

Client:
Wescast, a Southwestern Ontario company, is the premier provider of automotive exhaust manifolds and other components for the automotive industry. Yearly revenues exceed $450M. The company has seven manufacturing and machining plants worldwide and implements MRO Software's MXES to manage their strategic asset management requirements.

Challenges:
Wescast has been recognized by its' peers & clients for its excellent and effective approach toward implementing "best practice" asset management business processes that includes the use of MXES. A preliminary study indicated that manual adjustments were still required to adjust MXES OP/OQ's. The initial analysis revealed that improvements in fill rates could still be achieved. A decision was made to concentrate the focus on reducing costs and increasing fill rates by employing the xIO technology to optimize maintenance inventory across the business.

Outcome:
The integrated solution of MXES and xIO was implemented for use at five Wescast manufacturing facilities with plans to include the solution at two more facilities in the near future.

- Result 1: Wescast inventory managers can better perform item-by-item analysis of inventory allocation
- Result 2: Wescast realized improved fill rates by more than 10%
- Result 3: Wescast cash flow is anticipated to improve by 16.5% over 3 years
- Result 4: Wescast will gradually eliminate the need to purchase items that are declining in demand
- Result 5: Wescast can now focus on critical purchasing activities specific to high impact tasks

X. Summary

Through the integrated solution of MXES and xIO, inventory managers can now make sound decisions by being able to assess the financial impact of inventory levels on the business. This assessment knowledge can be used to improve areas like work/job planning and service levels. A good inventory management and optimization solution should adjust for changes in business operations and recalculate the impact on fill rates and cash flow savings. A solution that brings powerful inventory management and analytics together will create an effective system to significantly improve business process effectiveness and profitability.

About MRO Software, Inc.

MRO Software is the leading provider of asset and service management solutions. The Company's integrated suite of applications optimizes performance, improves productivity and service levels and enables asset-related sourcing and procurement across the entire spectrum of strategic assets.

The Company's asset management solutions allow customers to manage the complete lifecycle of strategic assets including: planning, procurement, deployment, tracking, maintenance and retirement. Using MRO Software's solutions, customers improve production reliability, labor efficiency, material optimization, software license compliance, lease management, warranty and service management and provisioning across the asset base.

MRO Software (Nasdaq: MROI) is a global company based in Bedford, Mass., with approximately 900 employees and more than 300,000 end-users. The Company markets its products through a direct sales organization in combination with a network of international distributors. MRO Software has sales offices throughout North America, Europe, Asia/Pacific and Latin America. Additional information on MRO Software can be found at http://www.mro.com.

About Xtivity Inc

Services from XTIVITY Inc. deliver hard cost savings in 90 days, while improving executive confidence in Operations decision-making. XTIVITY's executive team includes experienced leaders in MRO, software development and best practice implementation. The XTIVITY Inventory Optimizer (xIO™) is the only service in the market proven to optimize MRO inventories - while offering unparalleled efficiencies and controls in corporate governance at the Operations level. xIO™ delivers proven results in refining, mining, food, transportation and automotive industries. More information is found at www.xtivity.com.