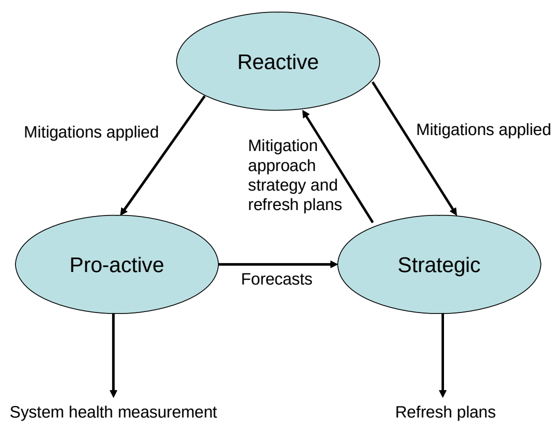
# "Strategic" Management of DMSMS in Systems

By Peter Sandborn

The escalating impact of DMSMS (Diminishing Manufacturing Sources and Material Shortages) on systems has resulted in the development of a growing number of methodologies, databases and tools that address the obsolescence status of components, forecast future obsolescence risk and provide DMSMS mitigation and management support. However, the majority of the existing offerings focus on reactive, and to a lesser degree, pro-active management of DMSMS issues associated with electronic parts.

Effective long-term management of DMSMS in systems requires addressing the problem on three different management levels: reactive, pro-active and strategic, Figure 1. In order to maximize the cost avoidance associated with managing systems; all three of the management areas should be considered concurrently.

FIGURE 1. DMSMS Management Strategy and Definitions




- Reactive – When components become obsolete, determining an appropriate resolution to the problem, executing the resolution process, and documenting/ tracking the actions taken.
- Pro-active – Determination of the status of the entire system with respect to DMSMS risk and assessment of the expected component needs against DMSMS risk, inventory and spares status. Pro-active requires an ability to forecast obsolescence risk for components. Pro-active management also requires that there be a process for articulating, reviewing and updating the system DMSMS status.
- Strategic – Use system status, forecasted DMSMS risk, and expected needs, inventory and spares to determine the mix of reactive mitigation approaches and design refresh (minor and major) that minimizes the lifecycle cost (i.e., maximizing cost avoidance) while continuing to meet all system requirements.

## Strategic Management of DMSMS

Strategic management of DMSMS means using DMSMS data, logistics management inputs, technology forecasting, and business trending to enable strategic planning, lifecycle optimization, and long-term business case development for the support of systems.

Too often, programs become caught up in addressing obsolescence events as they occur, for example, making decisions on a case-by-case basis whether to lifetime buy the obsolete part or initiate a design refresh activity to replace the obsolete part with a newer part. This can lead to being caught in a "death by a thousand cuts" system management trap spending valuable resources making a continuous stream of independent decisions about how to manage parts. Hindsight in these case often reveals that greater cost avoidance would have been realized by combining the management of many individual obsolescence events together into a single funded design refresh at a predefined date and bridge buying sufficient parts to reach that refresh date when obsolescence occurs rather than trying to mitigate each individual problem to the end of the field life of the system.

This example is not meant to imply that the best DMSMS management approach for all systems is bridge buy and refresh, but rather to point out that strategic management of DMSMS requires a broader view – it is not about making independent management decisions about each part in a list and then measuring yourself by accumulating individual DMSMS case resolution metrics and cost resolution factors. Strategic management requires:

- A view that extends beyond individual electronic parts to boards, boxes, LRUs, etc. Many things are not repaired, spared, upgraded or replaced at the part level. Part-level obsolescence management is of little value to programs that never reach deeper into the system then individual circuit cards or boxes.
- A view to all system components – obsolescence does not just affect hardware. Hardware and software obsolescence management must be coupled.[1]
- A view to the enterprise. Ideally, strategic solutions require coordination across multiple systems that share common parts and subsystems.
- Applicable policies, technology upgrade roadmaps and other factors that may constrain what DMSMS solutions that can be applied, when they can be applied and how they can be applied.
- Decision making under uncertainty. Everything that goes into determining a strategic solution is uncertain, e.g., obsolescence risk/dates are uncertain, resolution costs are uncertain, the end of support is uncertain. Finding optimum solutions that do not account for these, and other uncertainties, may be misleading.

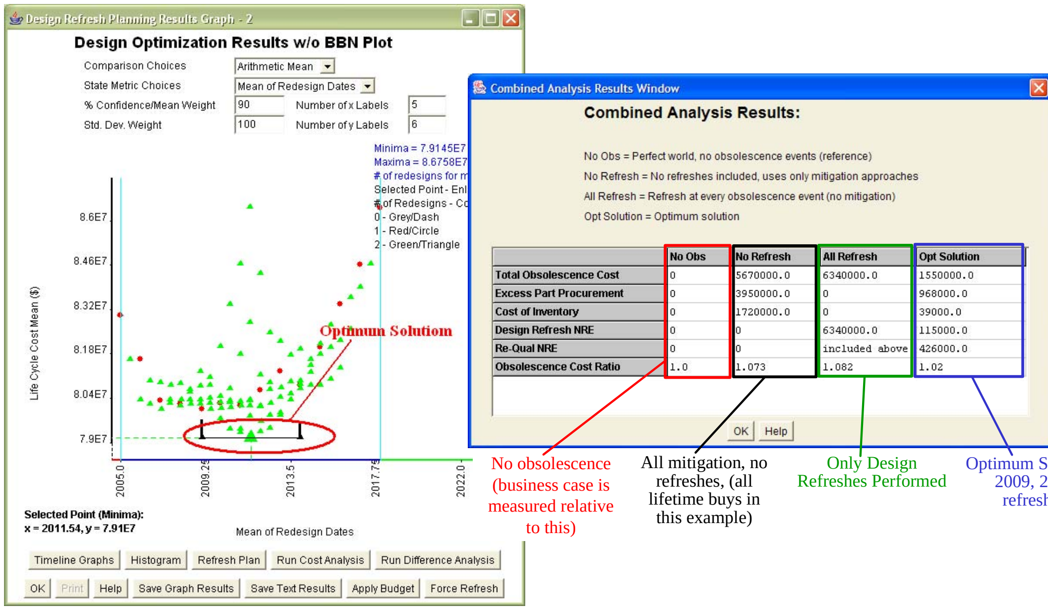
## Building Business Cases to Support Strategic Management

Unfortunately, even when experienced DMSMS managers think strategically and propose solutions that have longer term impacts (e.g., planned design refreshes) they often cannot create the necessary business case support to convince the customer to take a strategic view.

A tool has been developed to aid organizations in creating a plan for managing obsolescence and constructing associated business cases to support that plan. The Mitigation of Obsolescence Cost Analysis (MOCA) tool has been designed to output a plan consisting of design refreshes mixed with reactive mitigation approaches where the total sustainment cost of the plan has been minimized.[2] MOCA takes as its input the bill of materials (BOM) for a given system, along with the procurement cost and projected obsolescence dates or procurement lifetimes of the individual components.[*] MOCA can model multiple levels of hierarchy, so that an entire system or system-of-systems containing common components may be loaded into the tool for concurrent analysis. MOCA also requires a production/deployment schedule as an input. This schedule may

[*] "Components" in this context could be chips, circuit boards, LRUs of other kinds, or even software applications.

FIGURE 2.  Sample MOCA Solution




be supplemented with inventory status and a forecast of required spares. Using this information, MOCA creates a timeline of all possible design refresh dates that it couples with a timeline of all of the projected obsolescence dates for the components. MOCA generates candidate refresh plans consisting of zero refresh dates (all reactive mitigation), exactly one refresh date in the lifetime of the system, exactly two refresh dates, etc. The lifecycle cost of all the plans is computed and the candidate plans are ranked according to the resulting lifecycle cost of the system.

Figure 2 shows an example output from the CALCE MOCA tool. In the graph on the left side of Figure 2, each dot represents a unique refresh plan (the result in Figure 2 contains plans with exactly zero, one or two refreshes in them). Corresponding to each plan, MOCA generates a list of components that are obsolete or about to go obsolete so that they can be refreshed. Parts that become obsolete before the designated refresh date are managed using a user defined “short term” mitigation scenario (in the example shown here, the parts are bridge bought) until they can be replaced. The cost of the bridge buy, along with the storage and handling costs and the costs of the design refresh itself (including NRE and re-qualification costs) are all included in MOCA’s total life cycle cost calculation for each refresh plan. The vertical axis on the graph is life cycle cost and the horizontal axis is time. The data points corresponding to the plans are plotted at the mean of the group of refresh dates they represent (note, one plan is expanded in the graph to show the actual two refresh dates it comprises).

In order for the refresh planning predictions to be useful, the impact of the plans must be articulated as a business case. In order to evaluate the utility of the optimum plan it is compared to a case where no parts go obsolete, a purely reactive mitigation approach case, and a strategy where every obsolescence event is resolved with a design refresh. These four scenarios (no obsolescence, no refresh, all refresh, and optimum) are compared by breaking down the total cost of obsolescence management into sub-costs to identify where the money is being spent.

The true cost of obsolescence management can be determined for a given strategy by taking the total cost of the plan and subtracting from it the cost of managing the no obsolescence scenario,

$$O_c = T_A - T_{LCP}$$

where $O_C$ is the obsolescence management cost, $T_A$ is the actual total life cycle cost of the system with the selected obsolescence management approaches, and $T_{LCP}$ is the total life cycle cost in the no obsolescence scenario.

$T_A$ includes all costs associated with procuring parts and building the system, all costs associated with design refresh and re-qualification costs, all costs associated with mitigation, and all inventory costs for storing parts. The $T_{LCP}$ includes only those costs that are not associated with obsolescence, and simply includes the recurring costs of building the system (if applicable) and procuring the parts. Thus by subtracting the $T_{LCP}$ from the $T_A$ the obsolescence management cost can be obtained.

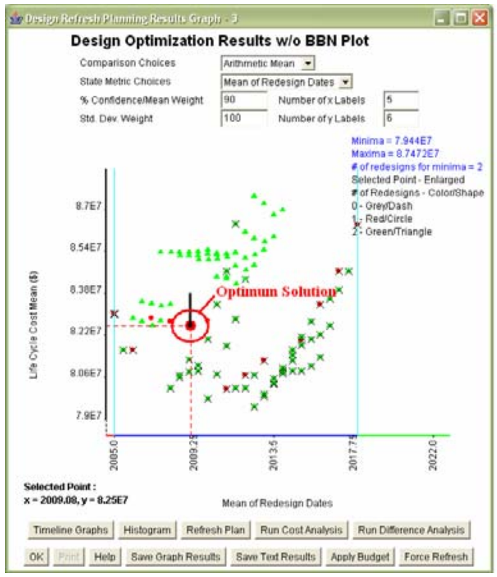
MOCA breaks down the obsolescence management cost into the sub-costs associated with the excess part procurement (the difference between part procurement costs if there was no obsolescence and part procurement costs associated with the mitigation of obsolete parts) as well as the inventory cost (cost of storing the parts over the long term). The obsolescence management cost also includes any costs associated with the redesign and re-qualification and any other costs associated with a design refresh. All the obsolescence management costs include cost of money (they are Net Present Value quantities indexed to the analysis starting year) and include the effects of the budgeting period duration. An example output from MOCA's business case analysis is shown on the right side of Figure 2 for a case where all mitigation was either lifetime or bridge buys.

## Constraint-Driven Planning

Constructing and costing combinations of mitigation approaches and candidate refresh plans is a significant step in the direction of strategic planning, but rarely is the management of a system this simple. Often a plethora of constraints find their way into DMSMS management problems. The constraints may be budgetary (e.g., a ceiling on the expenditure that can be made on the system in a particular year), logistical (e.g., the platform is not available to be refreshed during a particular period of time or there is a finite throughput associated with upgrading systems), or policy (e.g., a roadmap dictates that the system must be upgraded in a certain way during a certain period of time). In order to introduce constraints into the refresh planning process, the following obsolescence event types are used:

- "Weak" Obsolescence Event - No change to installed or new systems required. As long as the obsolete item is available, new systems can be built and installed using it and previously installed systems can be repaired with it if necessary.

FIGURE 3.  Sample MOCA Solution With Constraints Applied




- "Strong A" Obsolescence Event - Installed systems can continue to operate with the obsolete item until the obsolete item needs replacement due to a failure of the item. New systems cannot be built and installed with the obsolete item (whether the obsolete item is available or not).
- "Strong B" Obsolescence Event - Installed systems are not allowed to continue to operate with the obsolete item and must be backfitted within a defined time period. New systems cannot be built and installed with the obsolete item (whether the obsolete item is available or not).

For example, Strong B events can be associated with the end of support of critical software components such as operating systems used in communications applications that connect through public networks – end of support means the end of security patches and represents a security risk if not replaced.

Figure 3 shows the MOCA simulation outputs after specific roadmap constraints have been applied (the solution before constraints is shown on the left side of Figure 2).  The refresh plans that do not satisfy the roadmapping constraints are crossed-out in the graph in Figure 3.  All the viable refresh plans (plans that satisfy the constraints) have been shifted upwards in the graph because of the additional cost constraint that was applied to all design refresh plans with a design refresh between 2007 and 2010.  The optimum refresh plan, changes from a solution with two refresh dates (2009, 2014) to a solution with a single refresh date (2009) because of the constraint.

## Closing Thoughts

Reactive management of DMSMS problems will always be necessary.  However, strategic DMSMS management is possible and can lead to substantial cost avoidance for many systems.  Use of strategic approaches such as refresh planning must be carefully tempered, in particular when the required quantities of obsolete parts are relatively small, a more careful analysis is required because, as so aptly stated by John Becker (former DMSMS Program Director for the Defense Standardization Program) the "struggle to find duplicates, alternates or substitutes cost-effectively [creates] the illusion that some higher cost engineering solution or an end-product upgrade is financially attractive or the only option available" when it is not.

[1]P. Sandborn, "Software Obsolescence - Complicating the Part and Technology Obsolescence Management Problem," *IEEE Transactions on Components and Packaging Technologies*, Vol. 30, No. 4, pp. 886-888, December 2007.
[2]P. Singh and P. Sandborn, "Obsolescence Driven Design Refresh Planning for Sustainment-Dominated Systems," *The Engineering Economist*, Vol. 51, No. 2, pp. 115-139, April-June 2006.

**About the Author**

Peter Sandborn is a Professor in the CALCE Electronic Products and Systems Center at the University of Maryland. Dr. Sandborn's group develops obsolescence forecasting algorithms, performs strategic design refresh planning, and lifetime buy quantity optimization. Dr. Sandborn is a member of the U.S. Navy TRENT Shareholder Council and is the author of the U.S. DoD's DMSMS working group's DMSMS tool/data taxonomy. Dr. Sandborn is an Associate Editor of the IEEE Transactions on Electronics Packaging Manufacturing and a member of the editorial board of the International Journal of Performability Engineering. He is the author of over 100 technical publications and several books on electronic packaging and electronic systems cost analysis.