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CRITICAL THINKING

MANAGING OBSOLESCENCE

of Rapidly Changing Network Technology

Critical Thinking, a new feature in *Army AL&T* Magazine, offers perspectives from those outside DOD and the defense industry on issues faced by the Army Acquisition, Logistics, and Technology community. Our intent is to provide fresh opinion and expertise on difficult challenges.

Our first Critical Thinking Q&A is with Dr. Peter Sandborn, a Professor in the Electronic Products and Systems Center at the University of Maryland's Center for Advanced Life Cycle Engineering. Sandborn's group develops obsolescence forecasting algorithms and performs strategic design refresh planning and lifetime buy quantity optimization. Sandborn is the developer of the Mitigation of Obsolescence Cost Analysis refresh planning tool, used by private and government organizations worldwide. He also performs research in several other life-cycle cost modeling areas, including maintenance planning, return on investment analysis, total cost of ownership of electronic parts, transition from tin-lead to lead-free electronics, and prognostics and health management for electronic systems.

Sandborn has taught industry short courses on electronic systems cost modeling and obsolescence management. He is a regular presenter at conferences on Diminishing Manufacturing Sources and Material Shortages (DMSMS) and was a visiting fellow of the Royal Academy of Engineering in 2010. Sandborn has been the principal investigator on programs for the Army, Navy, and Air Force; the Defense Logistics Agency (DLA); Lockheed Martin Corp.; Northrop Grumman Corp.; Textron Inc.; Motorola Inc.; Ericsson; and the Naval Surface Warfare Center.

The author of more than 150 technical publications and several books, Sandborn has a B.S. in engineering physics from the University of Colorado, and an M.S. in electrical science and Ph.D. in electrical engineering from the University of Michigan.

Following are his thoughts on managing obsolescence.

Q. Does the same planned obsolescence that you have observed in the world of consumer electronics also apply to military network communications?

A. Yes and no. Planned obsolescence in the consumer electronics world is one of the primary causes of obsolescence of military systems. However, planned obsolescence of military systems can be an effective strategy for managing obsolescence.

In this case, planned obsolescence means that you plan, fund, and actually carry out periodic refreshes of the system hardware and software that, among other benefits, mitigate obsolescence by keeping you

better synchronized with the supply chain for critical parts.

While this is fine in principle, in practice it proves easier said than done. Changes in priorities, funding profiles, etc., regularly destroy plans for refreshes and often create unplanned life extensions of systems, so it is important to build quantitative support in the form of life-cycle cost and inventory management models that are agile enough to be updated as situations change.

Q. With all of the different products to be acquired for its tactical network, what does the Army need to do to mitigate obsolescence? What kind of coordination and prioritizing are required for a multilayered, multifaceted acquisition such as this?

A. Three key things have to happen to perform state-of-the-practice obsolescence management:

- Stay on top of things. Institute a process that allows real-time visibility of the "procurement health" of your systems. A simple metric that measures the fraction of your system(s) that you understand and are effectively managing from a supply chain point of view is a good tool to keep things on track. Problems occur when organizations lose an understanding of their parts; then, when they suddenly need more of the parts, panic takes over. We advise constructing a simple ratio of parts that are well understood, non-problems, or problems with solutions, to all parts that could be problems.
- Plan the life cycle. Think strategically. A few judiciously placed design refreshes can make the day-to-day reactive management of obsolescence problems much easier and more effective. But, to sell the refreshes means you

A COMPLEX EQUATION

GEN Robert W. Cone, Commanding General, Training and Doctrine Command, learns how Advanced Individual Training Soldiers use software to perform engine troubleshooting during a visit June 2 to the U.S. Army Combined Arms Support Command. (U.S. Army photo by Heather Van, U.S. Army Garrison Fort Lee, Visual Information.)

have to be able to build business cases, which is not trivial to do. Business cases should be built far enough in advance that they can influence your budgeting process; this means that the life-cycle planning has to be carried out years in advance. There is little value in building a business case that says you ought to redesign the system six months from now if the budget is fixed three years in advance and doesn't include funding for the redesign.

- Consolidate supply and demand. Chances are, if you need the part, someone else does as well. There may even be a third party who is going to throw the part away because they have too many or no longer need it. Solutions like DLA's Shared Data Warehouse are intended to facilitate visibility into common needs and inventory across all the services.

NETWORKING

Boeing Network Systems Engineer Jason Fair checks the software on an AH-64 Apache attack helicopter. (U.S. Army photo by Drew Hamilton.)

Q. How long does the process of planning for obsolescence take? Does it complicate the acquisition process or simplify it? Is this planning process worth risking a delay in implementation of the tactical network?

A. The most time-consuming portion of the strategic planning process is data gathering. Usually the appropriate data exists, but rarely is it all owned by the same person. This data includes: bills of materials that include manufacturer part numbers, part types, obsolescence status (obsolete or not), part prices, qualified alternative parts, existing lifetime buys if any, observed or predicted failure rates, etc.

The first time a program attempts to do strategic refresh planning, it could take months to pull together the necessary data, but after that it should be much quicker. In some cases, the necessary data resides with a subcontractor from whom the "data package" was not acquired. When this happens, it can be a showstopper for strategic planning.

The cost avoidance associated with strategic planning to manage obsolescence can be significant; the planning can avoid or minimize the future unavailability of systems. Is it worth the risk of implementation delay? Hard to say. This is an application-specific issue that needs to be addressed when making a business case to perform strategic management.

Q. What is typically the weak link in obsolescence planning for an entire network? Where do you think the Army might be most vulnerable as it builds and acquires a tactical network?

A. There are several obsolescence management vulnerabilities in the ways that organizations build systems today. One common issue is understanding that obsolescence is not just a hardware issue; it's also about software. In fact, lots of folks would gladly change hardware to fix a software bug if they could.

That is to say, software is a worse problem. Most hardware obsolescence events fall into the category of "weak" obsolescence events that allow continued system manufacturing and the operation of fielded systems with the obsolete part as long as you have an ample supply of the part available.

Many software obsolescence events are "strong" events, in which continued manufacturing of new systems and operation of fielded systems may not be allowed when the software becomes obsolete.

For example, the end of support for a commercial software package—one possible definition of software obsolescence—means the end of security patches, which may dictate that the software cannot be used within systems. Software

obsolescence may cause the effective obsolescence of hardware, and vice versa.

Another weak link that organizations have is their fundamental inability to make a business case for anything other than reactive management of obsolescence. A business case minimally requires that a cost avoidance be estimated, or better yet that an actual return on investment be estimated.

These require the ability to perform viable life-cycle cost modeling for the system, which is difficult.

Be careful: The commonly used cost avoidance accumulation method (via comparison to the "next most expensive resolution" used by many DMSMS management organizations to justify their existence) produces a metric that indicates how hard an organization works, but it is generally not a valid life-cycle cost, and it won't sell strategic treatments of the problem.

Q. How does the need for interoperability with other services fit into this already complex equation?

A. One possible byproduct of this requirement is that there may be a larger set of common parts and assemblies between services. This increases the overall demand for parts to maintain the systems and means that the services could potentially consolidate supply and demand of the common system elements.

Q. What expertise can industry offer to keep the Army network from rapidly becoming obsolete?

A. Right now, the majority of commercial support for obsolescence (DMSMS) management is at the electronics "piece-part" level for standard parts, i.e., individual electronic parts such as integrated circuits that are not customized or modified. At this level, there are many commercial database tools that can provide obsolescence status, Restriction of Hazardous Substances (RoHS) compliance, and obsolescence risk forecasts. No such commercial database for obsolescence status or forecasting exists today at the commercial-off-the-shelf assembly level or for COTS software.

At the electronic piece-part level, commercial aftermarket suppliers and emulation solutions also exist. Emulation solutions mean production of legacy parts that are qualified by form, fit, and function to match the obsolete part, but are fabricated using newer technologies; needless to say, this is usually not an inexpensive solution.

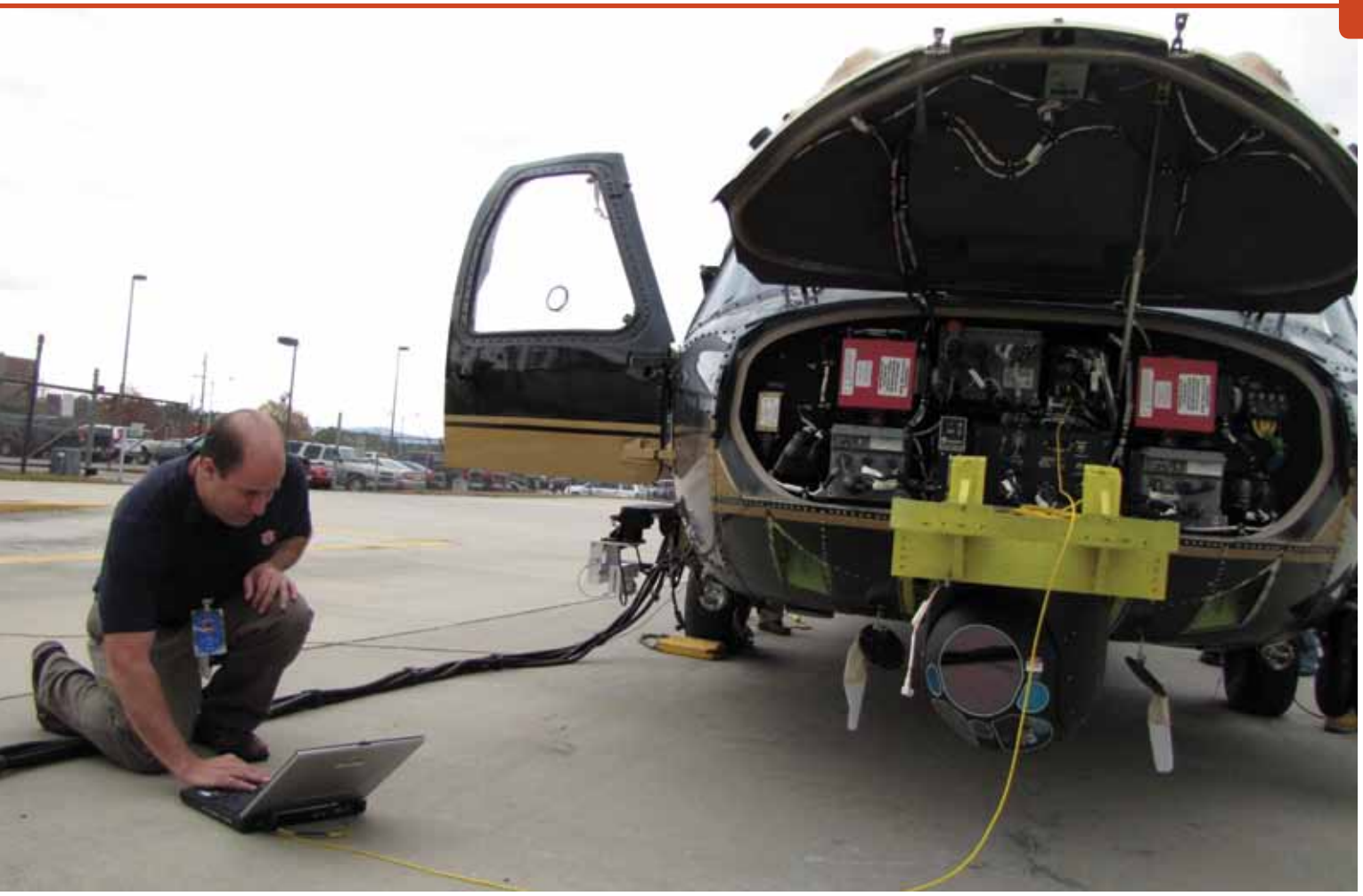
Some electronic board-level aftermarket manufacturing and emulation also exist. Strategic planning support exists in the form of tools that perform life-cycle cost analysis of different sustainment strategies and can thereby optimize mixtures of reactive mitigation and strategic management activities.

Q. Does industry have any inherent incentive to keep the Army network from rapidly becoming obsolete, or does the Army need to create these incentives?

A. The mainstream electronics industry has little incentive to make things easier for the Army. The supply chain for electronic parts is driven by personal computers, cell phones, and other high-volume applications. Unfortunately, several global issues have recently conspired to complicate this issue in the shorter term: emergence from a worldwide economic recession and the earthquake in Japan.

TESTING PROGRAM SOFTWARE

Ron Mercatili, electronics engineer, validates software for the Miniature Airborne GPS Receiver Test Station. (U.S. Army photo by Steve Grzezdzinski.)



PUTTING THE PIECES TOGETHER

Kelvin Pressnell checks out a software program that allows a forward-looking infrared night vision system to work with a spotlight, both features of the UH-60M Black Hawk helicopter. (U.S Army photo by Kari Hawkins, U.S. Army Garrison Redstone.)

Right now, many electronic part suppliers either have not fully ramped up from production cutbacks made during the recession, or they are hindered by the supply chain disruptions in Japan. As a result there are allocation problems even for parts that are not obsolete; so low-volume customers, which include military customers, get to go to the "back of the line" for their parts. Some non-obsolete electronic parts are currently quoting 18- to 24-month lead times.

Q. What should the Army realistically expect in terms of how soon a refresh will be needed for the network?

A. Some parts—maybe a lot of parts—are going to be obsolete before the network is "switched" on for the first time. Determining when to refresh, or the optimum frequency of refresh, and what to refresh is application-specific, but it can be done.

Q. Is there anything else you'd like to add?

A. Other issues that arise include the management of nonstandard parts—parts that are modified or customized. It isn't even clear how to define the obsolescence date for these.

Conversion of systems to lead-free solder is another issue. The fact that Army systems are exempt from RoHS and RoHS-like legislation around the world that restricts the use of tin-lead solder is moot. You have to depend on a supply chain built to support a customer base that is for the most part not exempt; therefore, transitioning legacy systems to lead-free will be an issue.

Any solution for estimating life-cycle costs and optimizing the obsolescence management within a system has to account for uncertainties. The forecasted obsolescence dates are uncertain, demand for spares is uncertain, and the end-of-support dates are uncertain, so planning solutions need to be robust in the sense that they find strategies that put you in a good place even when the inputs to the problem change. ?