Obsolescence:

The U.S. military is facing one of its most dangerous enemies to date. It is a foe the Pentagon thought was being defeated by new procurement policies begun in the 1980s and transformed into near-religious zeal in the 1990s. The enemy is obsolescence, and a major part of the cure was commercial off-the-shelf (COTS) components replacing costly milspec parts. But after a decade of heavy COTS infusion into nearly all military programs, it now appears the cure may be worse than the disease.

"The military used to fund the leading edge of technology research and bought the largest number of profitable components. Supporting military requirements was good business," says Gorky Chin, vice president for advanced technology at Vista Controls in Valencia, Calif. "Today the business models of the component manufacturers have been restructured to take advantage of the new mass market opportunities. Military components are now viewed as diffusive of energy, profitability, and market positioning."

As a result, the military has virtually no influence over the direction or speed of technology advancement. It relies entirely on consumer-driven needs to coincide with military requirements in microprocessors, capacitors, batteries, displays, and, in many cases, even materials, software, and complete systems (such as handheld computers).

The advantage, as anticipated, has been a dramatic decline in the cost of both R&D and initial acquisition. Industry has paid for the R&D, and commercial economies of scale and heavy competition have kept costs down.

The disadvantage, which is beginning to severely impact both program capabilities and, ironically, costs, is the massive and growing disconnect between commercial and government life cycles.

"COTS is causing more obsolescence problems than it is solving," warns Ron Shimazu, chief of the microelectronics division at the Defense Microelectronics Activity (DMEA).

Diminishing sources and materials

DMEA's mission is to leverage advanced technologies to extend life for weapon systems by improving their reliability and maintainability while addressing the problem known as DMSMS (diminishing manufacturing sources and material shortages).

DMSMS is defined as the loss—or impending loss—of manufacturers or suppliers of items, or the shortage of raw materials at any phase in the acquisition cycle, from de-

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The new enemy

sign and development through postproduction. While most DMSMS cases historically have involved electronics (primarily microcircuits), the problem can affect all weapon systems and material categories, at the part, module, subsystem, or system level.

The magnitude of the current DMSMS problem has resulted from a combination of industry factors and DOD actions. In determining what products to continue making or even supporting, manufacturers must take into account rapidly changing technologies, increased foreign competition, federal environmental and safety regulations, and shortages of needed materials. At the same time, DOD's long design-to-acquisition lead times, increasing number of service life extension programs, and decreasing percentage of total commercial demand have left military systems highly susceptible to DMSMS difficulties.

But that is only the beginning of the problem, according to the DMEA. "Even after DMSMS situations are identified, resolution efforts are often hampered by other factors: short notification response time frames, which leave insufficient time for review options in end-of-production cases; lack of coordination among affected parties (both government and industry), which affects development of cost-effective resolutions; and lack of dedicated DMSMS funding, which means that dollars from other program areas must be found to resolve obsolescence issues."

To help combat that, "we intend to put a lot of the DMS management in the risk management section of new contracts," says Shimzau, and to "design for obsolescence during the development phase to minimize future obsolescence risks."

Impact of COTS

The impact of COTS on component obsolescence has been multifold. The most immediate—heightened by government downsizing—was the shift of maintenance and support responsibility from government to industry. But with government such a small part of the customer base for many companies, especially in the microcircuitry industry, support for legacy systems also has fallen victim to commercial life cycles.

The government's growing use of commercial off-the-shelf systems has led to a worsening of the very problem it was meant to correct

"OEMs [original equipment manufacturers] are focused on new products. The rapid introduction of new technology, the greater

In the world of computers, "old" comes very quickly

reliance on commercialization, has left legacy systems behind," says Lt. Gen. Charles Pitman (USMC, retired), senior vice president-international business at EFW in Fort Worth, Texas. "Parts obsolescence causes serious delays and increases costs significantly. Few are interested in investing in old technology."

In the world of computers, "old" comes very quickly.

"IC [integrated circuit] life cycles used to be five to eight years; now they're 18 months," says Lee Mathiesen, operations manager for Lansdale Semiconductors (in Tempe, Ariz.), "but weapons systems life cycles have gone from 25 years to 40 years."

As one industry observer noted, in the five years it takes most major military programs to get through the initial design phase, the microprocessor industry has gone through three or four cycles, each one doubling processor speed, in keeping with Moore's Law.

But the military program generally faces another five years of prototype development before a contract is issued for low-rate initial production. Often, moreover, the program does not get into full production for another three to five years after that. If it survives, production is likely to continue for anywhere from 10 to 30 years, and the resulting system—especially in the case of an aircraft—may be in service for anywhere from 30 to nearly 100 years. (Current plans call for the B-52 bomber to continue in service through 2040, when it will be 94 years old, triple its original planned lifetime.)

"One of our challenges is to sustain aging weapons systems in a technologically unstable commercial environment," says Roger Kallock, deputy undersecretary of defense (logistics). He adds that DMS solutions not only should combat obsolescence but also should provide a direct contribution to U.S. warfighting capability as "readiness enablers."

The technology supporting those programs, however, is racing forward at breakneck speed. In addition to faster processor speeds, program managers also must deal with everything from changing sizes and environmental concerns to new power requirements. For example, industry experts say systems using 5-V, 3-V, and 2.5-V technology have peaked, 1.8-V is here now, 1-V has been demonstrated, and sub-1-V is coming. All this is creating new and serious DMS problems.

This means that even new programs, including the Air Force's F-22 fighter and the B-2 stealth bomber, are facing the microelectronics obsolescence problems identified in Defense Acquisition Board reviews. For the F-22 alone, DMS efforts will total $1 billion through the aircraft's currently planned 15-year production cycle. Parts availability during that time is projected to average only two to five years per component.

Developing a DMS strategy

A key tenet of the F-22 program's DMS strategy is to resolve the problem within the confines of existing appropriations. This includes aligning redesign efforts into preplanned production block upgrades to minimize program impacts and costs. Thus program managers have been forced to forecast costs for both known and unknown DMS problems across 12 blocks through 2012. But DMS will continue to be an issue throughout the aircraft's operational life, which will extend well into the 21st century and through dozens of commercial microelectronics life cycles.

"DMS is highly situational, like a giant kaleidoscope," says Malcolm Bacca, chief operating officer for TacTech in Yorba Linda, Calif. "We can't afford to fight DMS program by program—we must have a collaborative process."

Noting that Texas Instruments, National Semiconductor, Harris, and Analog Devices control 60% of all electronic parts for the military, Bacca warns that if even two of those firms decide it is no longer good business practice to continue supporting military-specific requirements, the results for defense programs could be disastrous.

"A DOD-wide cultural change is needed for DMS management," he says. "It must include DMS information integration, a collaborative DMS information environment, a willingness to team common DMS problems, and DMS decisions based on cost of ownership."

A number of possible solutions to the growing problem are being examined. Examples include trying to make a lifetime buy while components are in production (however briefly); remanufacturing by third parties; finding excess inventory available from other programs or aftermarket dealers; and substituting with different (and presumably newer technology) parts. But none is without drawbacks.

For example, "in repair and sustain-

ment, there is no such thing as a lifetime buy," warns B.J. Scott, director of EFW's product support business unit.

"There is no 'one size fits all' scenario," adds Kerry Stevens, materials segment project team lead at the Naval Underwater Warfare Center. "The key is integrated customized engineering support solutions."

One avenue that is not considered a viable solution, with perhaps a few specific, limited exceptions, is a return to the old milspec approach. Aside from the stark realities of budget limitations, it would be difficult—in some cases perhaps impossible—to find a company willing or even able to take on a purely government contract. For example, the commercial demand for some types of capacitors already has reached maximum global production capacity for telephones, PCs, and automotive applications. This would make minimum buys of milspec products a bad business option.

Modernization through spares

In general terms, the favored approach is "modernization through spares," inserting new technology into the spare parts inventory to help modernize systems on a continuing basis throughout their life cycle. In addition to providing a systematic approach to technology insertion and extending useful life, this also is seen as a way to leverage traditional spares funds to help address the mounting DMS problem.

"Modernization and technology insertion equal obsolescence mitigation," says Bob Gibbs, team leader for the electronics engineering prototyping group at the Army's Redstone Arsenal in Huntsville, Ala. His team is combating DMS problems on the multiple launch rocket system. "We will work with the assets we have and use traditional obsolescence solutions until they are no longer feasible," Gibbs says.

Growing dependence on the commercial world for military components has given rise to another concern—keeping the U.S. battlefield technology edge over potential enemies.

"The acquisition security considerations you apply to your program have to take into account that leveraging commercial technology so heavily means this same technology also will be available to your opponents," warns Air Force Col. Gary Connor, the program manager for Joint STARS.

Connor, however, still believes the military made the right choice in changing how and where it procures needed materials—so long as all of the drawbacks are acknowledged and addressed up front.

"The old way of doing business—with a very narrow milspec requirement—put us in a very tight box regarding DMS. COTS is not a panacea, but it is better than that approach," he says. "What we're doing in Joint STARS is called future support, where we try to pull everything together and put it under the prime. DMS is as much a vendor-based issue as it is a technology issue."

Connor says the key elements of a successful DMS effort are:

- An open architecture with the flexibility to adapt.
- Business strategies regarding weapons system production and development that encourage industry to focus on life-cycle improvements.
- Effective supplier management for effective early warning.
- Budgeting for and anticipating DMS.

"The center of gravity for resolving DMS problems rests with the contractors, but that does not relieve government of its responsibility," he adds.

Need for cooperation

Capt. Michael Erno, deputy commander for logistics at the Naval Surface Warfare Center at Port Hueneme, Calif., says the problem of materials obsolescence is not restricted to any particular service, nor even to the military, but is affecting civilian and commercial systems as well.

"We need to come together to get a handle on total ownership costs," he says. "It will take industry and government working together and joined at the hip to solve these problems."

The prevalence of COTS components in military systems is a fact. It is also a practice that is likely to grow despite the mounting problems that surround it. Every branch of the military is working to combat DMS by bringing into common databases (such as the Government/Industry Data Exchange Program) as much information as possible on discontinued parts, excess or residual components, and other resources, then using life-cycle prediction algorithms to forecast life-cycle stages and years to obsolescence.

As Bacca told the Naval Sea Systems Command's second annual workshop on DMSMS late last October, "if you can't immediately correct your past, at least protect your future."