



## *2009 State of the VME Technology Industry*



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# State of the VME Technology Industry August 2009

by: Ray Alderman, Executive Director, VITA

*This report provides the reader with updates on the state of the VME Technology industry in particular and of the board industry in general, from the perspective of Ray Alderman, the executive director of VITA. VITA is the trade association dedicated to fostering American National Standards Institute (ANSI) accredited, open system architectures in critical embedded system applications. The entire series of reports can be found at [www.vita.com/mktoverview.html](http://www.vita.com/mktoverview.html).*

## VITA launches Open Architecture Review

New Internet pub targets embedded computing community

VITA is pleased to announce the immediate launch of a new Internet publication named *Open Architecture Review* ([www.OAReview.com](http://www.OAReview.com)). Designed to address the broad information needs of providers and users of nonproprietary computer systems and components, OAReview aims to make the most of readers' time investment by keeping editorial content short, relevant and to the point.

OAReview is manned by a staff of veteran journalists with extensive experience covering embedded computing and other hi tech fields. Editor David Lieberman has plied his trade at *Electronic Products*, *High Technology*, *Computer Design* and *OEM Magazine*, as well as driving the bus & board coverage at *EE Times* for over a decade. Associate editors Loring Wirbel and Terry Costlow are also *EE Times* alumni, with Wirbel logging many hours as director of communications coverage and market intelligence for CMP/TechInsights; and Costlow strutting his stuff at *Electronics* and *Electronic Design*, as well as managing a TechInsights website, *Industrial Control DesignLine*. Heading up the team as publisher and editorial director is Ray Alderman, who has served as executive director of VITA, OAReview's sponsor, for the past eleven years.

"You could say that OAReview has been in the works for twenty years or more," says Lieberman, "with Ray and me having regular discussions about what we like in various industry pubs and about what type of publication would really satisfy reader needs. The old print models appear to be failing, and nobody seems satisfied with the newer Internet models, so we think it's time to try something different."

"We believe that what the embedded board and systems industry wants is a USA Today web publication that keeps users and suppliers informed of developments on a real-time basis," says Alderman. "Additionally, we see the need for trend reports and other feature-level editorial, as well as the need for a dynamic library of reference material, backgrounders, market research results and so forth. OAReview is our answer to those wants and needs."

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## Business Conditions

Some segments of our industry endured very harsh conditions in the first half of 2009. At the macro-level, U.S. GDP declined 6.4% in Q-1 and 1% in Q-2. Japan's GDP was down over 12% in Q-1, and the EU (European Union) saw declines of 2-3%, propped-up by government spending approaching 50% of their total GDP. Worldwide economic conditions have depressed board and system sales in telecom markets the most, industrial second, and medical third. The MIL/COTS segment is showing some growth for the first half.

From conversations with vendors, I have extracted some basic numbers. Here are the highs and lows of those conversations for each market segment.

- *My unscientific survey of companies in our industry suggests that telecom board and system companies opened-up another vein as sales dropped 50-70% in the first half, and they are bleeding heavily. Even though a few million 3G phones have been sold, consumers have been reducing their telecom expenses for more than a year. This trend will continue as the economy tries to find a bottom and unemployment continues to climb. A decline in consumer spending on faddish telecom services and devices has put a damper on network upgrades and enhancements. I do not see any joy in the telecom segment for years to come. The fall of Nortel Networks has begun with the auctioning off of its assets as the first stage of self dismantling.<sup>1</sup>*
- *Board vendors selling into the industrial segment have seen a drop in sales of about 25-30%. With the demand for manufactured products down 22-24%, there is no motivation to automate plants or install new automated equipment. This is most pronounced in the semiconductor equipment handling business, a large board-user segment. Companies like Applied Materials, Watkins-Johnson, SpeedFam, and Grass Valley Group have seen the demand for their equipment drop dramatically.<sup>2</sup>*
- *Almost all states, cities, and counties are experiencing budget deficits. Sales of board-level products for traffic control, freeway information signs, and automated tollbooths have come to a halt in the U.S. (the transportation segment). Europe seems to have some continuing business in this segment, but it is also depressed. The bankruptcies of both GM and Chrysler have eliminated any business for test stands and automation projects in the automotive industry worldwide.*
- *In the medical segment, hospitals are delaying new equipment purchases until they see the details of the healthcare system revamp now underway in the U.S. Congress. This market segment will remain depressed until Congress and the new administration release their master plan to reduce healthcare costs and their plans for universal health insurance.*
- *Municipalities (states, cities, and counties) pay out a lot of tax collections for healthcare for their residents. In the first four months of 2009, most states saw severe declines in income tax collections. The top four states, with declines in income tax collections (according to state tax returns for fiscal 2008), were Arizona (down 55%), South Carolina (down 38.6%), Michigan (down 34.4%), and California (down 33.8%). Other than Michigan, these states have a large percentage of retirees on Medicare. Florida and Nevada, both states with a high percentage of retirees, are not on this list because these states have no income tax on their residents (their tax receipts come from very high property taxes, business taxes, and sales taxes). This reduction in tax collections is affecting medical equipment spending in every state.*
- *Highly diversified board companies (those with products targeted at telecom, industrial, medical, commercial, and MIL/COTS) seem to be in the same boat as the telecom only focused companies, with sales down 25-50% in the first half. A well-planned diversification strategy will not isolate you when demand in three or four market segments drops dramatically at the same time, as is the present case. Therefore, diversification is not an effective strategy in*

*“Highly diversified board companies seem to be in the same boat as the telecom focused companies.”*

1 Pav Jordan, "Nortel, a fallen Canadian icon, starts asset sales," Reuters, 7/24/09, URL: [news.yahoo.com/s/nm/20090724/bs\\_nm/us\\_nortel\\_auction](http://news.yahoo.com/s/nm/20090724/bs_nm/us_nortel_auction)

2 Suzanne Deffree, Managing Editor, News, "Outlook for semiconductor equipment industry improving, spending growth expected, Gartner says," EDN, 6/15/09, URL: [www.edn.com/article/CA6665241.html?nid=3351&rid=9447059](http://www.edn.com/article/CA6665241.html?nid=3351&rid=9447059)

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these unusual times. This situation may cause some diversified companies to abandon certain market segments (specifically telecom) to concentrate on other more promising and more profitable future market opportunities (like industrial and MIL/ COTS).

- Suppliers in the MIL/COTS segment have seen increases in sales in the first half, up from 3% to over 20% for some vendors. Most of this has been coming from new refresh programs for existing platforms and a few new platforms that are going to deployment. One example is the Aegis upgrade awarded to Mercury Computer in June.<sup>3</sup> Other MIL/COTS board vendors suggest that we will see the MIL market show sound growth for all of 2009, and many vendors are very positive about the future. The new defense budget is in Congress now and is discussed in the MIL/COTS market segment update in this report.

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From a macro perspective, the semiconductor industry showed sales declines of 12-24% in the first half of the year, from some reports, to a decline of up to 64% year over year in other reports.<sup>4</sup> SEMICO Research Corporation claims a drop of 12-13% while the SIA (Semiconductor Industry Association) claims a 21-24% drop.<sup>5</sup> My market research friends in the connector industry tell me that worldwide connector sales are down over 36% in the first half. The connector industry has more exposure to the decline in telecom and automotive demand than the semiconductor industry. Over 60% of all semiconductors shipped go into consumer devices today (cellphones, TVs, PCs, MP3 players, etc.) while most of the connectors go into automotive, industrial, and telecom applications. Additionally, over 79% of all semiconductors made ship to just 100 top companies.<sup>6</sup> Again, the extreme diversification of the connector industry (across application segments) has proven to be a failing strategy in these times, while the focus of the semiconductor industry (on consumer products) has limited their sales declines (down 23% versus the connector decline of 38%).

While these figures are disconcerting, the board industry has shown an ability to adjust and recover in difficult times. I am amazed at the resilience of the embedded board and system industry and its players. I believe that the key to survival and growth in these market conditions is the fact that we are in a high variable-cost business, with very low fixed costs. Most can adjust their variable costs to the deepest downturns, as many vendors have done, without taking destructively severe actions. If variable costs run above 50% (i.e., Gross Profit Margin (GPM) is about 50%), then one has a lot of elasticity to reduce costs and can access enough cash flow to pay fixed and reduced variable costs. However, if variable costs are near 80%, meaning GPM is about 20%, then one will have trouble surviving by cost reductions alone. The 20% positive cash contribution can't cover even a low level of fixed and variable costs at a depressed sales level. Surviving this downturn is all about GPM on products, not sales revenue. The higher the GPM, the more elasticity a company will have to adjust to adverse conditions. MIL/COTS vendors will do fine in these conditions with 50-70% GPM, even if sales decline. Telecom and industrial vendors selling commodity PC-based products at 6-12% GPM will have a very tough time staying afloat.

*“I am amazed at the resilience of the embedded board and system industry and its players.”*

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3 “Mercury Computer Systems Delivers on Aegis Weapon System Upgrade for Lockheed Martin,” Mercury Computer Systems, 6/18/09, URL: [www.mc.com/mediacenter/pressrelease.aspx?id=13064](http://www.mc.com/mediacenter/pressrelease.aspx?id=13064)

4 Suzanne Deffree, Managing Editor, News, “SEMI reports growth in bookings as book-to-bill ratio improves,” EDN, 7/22/09, URL: [www.edn.com/article/CA6672608.html?nid=3351&rid=9447059](http://www.edn.com/article/CA6672608.html?nid=3351&rid=9447059)

5 Suzanne Deffree, Managing Editor, News, “SIA estimates rebound will begin in 2010,” EDN, 6/5/09, URL: [www.edn.com/article/CA6663072.html?nid=3351&rid=9447059](http://www.edn.com/article/CA6663072.html?nid=3351&rid=9447059)

6 Suzanne Deffree, Managing Editor, News, “Percentage of semis consumed by top OEMs increased in 2008, expected to decrease in 2009,” EDN, 6/29/09, URL: [www.edn.com/article/CA6668026.html?nid=3351&rid=9447059](http://www.edn.com/article/CA6668026.html?nid=3351&rid=9447059)

## Critical Embedded Systems Markets

Let's dive into the key markets for VME Technology and see what is developing.

### MIL/COTS

In the first half of 2009, the MIL/COTS segment seems to be the shining star of our industry. Some vendors reported sales increases of 20% or more. Secretary of Defense Gates gave his outline of the 2010 defense budget back in April where he singled-out programs for cuts.<sup>7</sup> He has drastically changed the Pentagon's spending priorities. This will have a transformative effect on the embedded military COTS market. Period.

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The big surprise was the termination of the FCS manned ground vehicle program, which the Defense Department made official in late May.<sup>8</sup> Many of our members had a stake in this program with VITA's latest technologies and standards. However, the primary problem Gates has with this program is the contracts with the lead systems integrators: Gates did not like the terms of the contracts, particularly their very unattractive fee structures which give the government little leverage to promote cost efficiency. Because the vehicle part of the FCS program is currently estimated to cost over \$87 billion, he believes we must have more confidence in the program strategy, requirements, and maturity of the technologies before proceeding further.<sup>9</sup> Therefore, I anticipate that the DoD will re-define the missions and vehicles involved and restart this effort in about 18-24 months.

The 2010 U.S. defense budget makes it crystal clear that procurement strategy and practices of the U.S. military are about to change significantly. The priorities outlined in the budget reflect a transition to a military strategy and a supporting procurement procedure that will be designed to spend more to fight "small wars" and counter insurgencies such as the current conflicts in Iraq and Afghanistan, and less to defend against conventional wars from large foes such as Russia or China.

The defense budget still contains many programs that VITA members will benefit from in 2009.<sup>10</sup> Programs involving UAVs and many existing system upgrades (Aegis, Predator, Global Hawk, etc) will provide many opportunities for VITA's members for this year and many more years to come. Significant budget increases for ISR equipment also offer new opportunities for our members' products. As we scale-down operations in Iraq and Afghanistan, we will need to observe these regions as they rebuild with their own forces taking control of their countries. The U.S. will assume an intelligence-gathering position and share information with those governments in the future, as we reduce our troop levels in the regions.

The deployment of unmanned vehicles (UAV, UGV, UUV) in these conflict regions has been mind-boggling. Thousands of Global Hawks, Hunters, Predators, Talons, Reapers, UCAS, Swarms, CRAMS, PRAWNS, Skynet, PackBots, Warriors, Ravens, SWORDS, and many other platforms are being developed and deployed. The Center for Strategic and Budgetary Assessment estimates the "black budget" (the classified part of Pentagon spending) will reach \$34 billion in 2009. Further, they say that the number of unmanned ground systems in use went from zero, at the beginning of the present conflicts, to 5,000 units by the end of 2006. In addition, they predict that the number of these deployed systems will reach 12,000 units by the end of 2009. By 2016, they claim that purchases of unmanned platforms of all kinds will reach over \$100 billion.

FCS - Future Combat Systems  
UAV - Unmanned Aerial Vehicle  
UGV - Unmanned Ground Vehicle  
UUV - Unmanned Undersea Vehicle  
EOD - Explosive Ordnance Detail  
IEDs - Improvised Explosive Device  
ISR - Intelligence, Surveillance and Reconnaissance  
PSYOP - Psychological Operations

<sup>7</sup> Robert Gates, Secretary of Defense, "Defense Budget Recommendation Statement," U.S. Department of Defense, 4/6/09, URL: [www.defenselink.mil/speeches/speech.aspx?speechid=1341](http://www.defenselink.mil/speeches/speech.aspx?speechid=1341)

<sup>8</sup> U.S. Army Posture Statement, Addendum G - Modernization U.S. Army, 5/7/09, URL: [www.army.mil/aps/09/addenda/addenda\\_g.html](http://www.army.mil/aps/09/addenda/addenda_g.html)

<sup>9</sup> "Future Combat System (FCS) Program Transitions to Army Brigade Combat Team Modernization," U.S. Department of Defense, 6/23/09, URL: [www.defenselink.mil/releases/release.aspx?releaseid=12763](http://www.defenselink.mil/releases/release.aspx?releaseid=12763)

<sup>10</sup> U.S. Department of Defense, Fiscal Year 2010 Budget Request, URL: [www.defenselink.mil/comptroller/budget.html](http://www.defenselink.mil/comptroller/budget.html)

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## Robotic Warriors

We now have robotic anti-sniper platforms that can sense a single fired shot, triangulate back to its origin in microseconds, and eliminate the sniper with ordinance before he takes two steps to run away. We have EOD robots that find and disarm IEDs. Companies are now developing “medic” robots that can retrieve wounded soldiers from the battlefield, pull them into protective containers, start trauma treatments, and carry them back to safety and medical care. We have ISR platforms that can go down a street and sense occupants in a building, how many there are, what weapons they are carrying, and more. We have platforms that can “see through” the clothes of terrorists and detect explosives strapped to their bodies or hidden weapons. Many of these platforms are deployed with traditional weapons onboard (shotguns, grenade launchers, M-4 carbines, machine guns, etc) to provide assault capability when needed.



Even Hollywood, the paragon of pacifism and anti-war rhetoric, is getting in on the act. Arthur C. Clark, noted science fiction writer (“2001: A Space Odyssey”), once stated: “Any sufficiently advanced technology is indistinguishable from magic.” Combine the lethality of a weapon with a face, and you have a great “PSYOPs” tool. There are efforts under way now to capitalize upon the psychological effects of warrior robots on our enemies. Designers are covering the robots with outer skins that look like the monsters in the movies “Alien” and “Predator”. The Hollywood crowds are developing even more bizarre, disgusting, scary, and menacing faces for our platforms, to give them a personality and to strike fear into the Jihadists’ minds. This is an extension of WWII, when the pilots and ground crews painted shark-jaws on the noses of their propeller-driven fighter planes. We have just begun to explore the psychological impact of hordes of robotic warriors going after enemy soldiers.

“Swarm” capabilities are being developed for UAVs, UGVs, and UUVs. A group of UAVs would behave like a swarm of bees: once a target is identified, a number of the UAVs attack while the others continue scouting for another target. The UGVs would behave similarly, like ants. The same goes for UUVs at sea: they take on the behaviors of a school of predatory fish. That means we will have hundreds, if not thousands, of these platforms deployed in conflict areas. Moreover, we are developing coordinating tactics based on nature. We even have snake-like UGVs that can crawl inside pipes, into buildings, to find and monitor enemy positions.



It is clear that the U.S. will continue to develop and deploy new unmanned robotic technologies for military applications for many years to come. Many tens of thousands of these platforms will be deployed in many regions, not just the Middle East. In addition, we will continue to develop platforms that are even more sophisticated in the future. We are in the infancy of unmanned platform development for military applications. This will be a major market, worldwide, for many decades to come. Moreover, their deployment will not be by the U.S. forces alone. Our allies will want access to these magical, menacing, and effective technologies.

Consequently, the MIL/COTS market will grow faster and be more profitable than any other market segment in our industry. Those vendors who ignore this trend do so at their own peril. We will continue this “robotic warrior” revolution for many decades to come, and we will “magic” our enemies to death.

*“It is clear that the US will continue to develop and deploy new unmanned robotic technologies for military applications for many years to come.”*

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## Industrial

We did see some decline in sales and shipments in the industrial segment in the first half of 2009. There is no need to automate processes or plants when worldwide demand for goods is down. This segment is particularly exposed to difficulties, especially those vendors selling commodity motherboards and small form factor products. These vendors have very high variable costs (i.e., the GPM is very low, maybe 6-12%), and any drop in sales reduces free cash flow dramatically.

Europe's primary demand segment for boards has always been industrial markets (give or take a little demand in telecom). However, the EU recently announced that the industrial output for the 16 countries in the federation saw declines of 19.3% in March, 21.6% in April, and 17% in May of 2009. The June numbers are not yet released, but another decline is expected. Europe now seems to be in the center of the recession storm as other world economies start to stabilize.

There may be two emerging market opportunities that drive this segment. The first is the "smart grid," or the revamp of the power distributions systems to make the utilities more efficient. When completed, such a smart grid will employ millions of embedded computers, from the home, to the substations, to the power generators. A recent report from the Electric Power Research Institute to the National Institute of Standards and Technology (NIST) maps key opportunities for U.S. engineers.<sup>11</sup> Both GE and Emerson are targeting this market opportunity from a corporate level and both these companies have traditional embedded board divisions. If either of these industrial behemoths taps its embedded board groups for computer technology, that could make it tough for outsiders. Additionally, I worked on the "smart meters" with Westinghouse back in the 1970's (when microprocessors first came to be), and the power grid has become even more antiquated and inefficient since then. I have difficulty believing that utilities will somehow get motivated to invest in systems that are more efficient since they have not shown such motivation for decades. They only seem motivated to ask the utility commissions for rate increases.

*"There may be two emerging market opportunities that drive this 'Industrial' segment."*

The second opportunity is in the redesign of the Air Traffic Control (ATC) system. The present system is antiquated and was overloaded before the recession.<sup>12</sup> Bad economic conditions have led airlines to dramatically reduce the number of flights and operational aircraft. While the load on the system is now within capacity, there are too many humans in the loop. There are proposals to allow planes to fly direct from city to city, rather than following the Jeppeson-defined "highways in the sky", with all the different "intersections" requiring controllers make many course and altitude corrections along the way to avoid collisions at those intersections. Computers can replace many of the human-based analysis and decision-making processes involved in air traffic control and accomplish them more efficiently. Air traffic controllers are subject to severe stress and burnout, giving even more reason to update and computerize the system. Nevertheless, the funding for such upgrades comes from the federal government and there are too many social programs, stimulus packages, and bailouts clamoring for funds today. The FAA continues to forecast long term aviation growth, despite global economic conditions.<sup>13</sup>

These are the only two possible "next big things" that could paint a more prosperous future for the industrial segment, as I see it. I doubt if either of these opportunities will develop until the next decade, or later. Without a major application driver, I do not see much growth and opportunity in this market segment for the next few years.

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11 Don Tuite, "Smart-Grid Report Maps Opportunities For U.S. Engineers," Electronic Design, 7/23/09, URL: [electronicdesign.com/Articles/Index.cfm?AD=1&ArticleID=21465&bypass=1](http://electronicdesign.com/Articles/Index.cfm?AD=1&ArticleID=21465&bypass=1)

12 Audie Cornish, "Funding Debate Stalls Air Traffic Control Upgrade," NPR, 4/10/09, URL: [www.npr.org/templates/story/story.php?storyId=102914658](http://www.npr.org/templates/story/story.php?storyId=102914658)

13 FAA, "FAA Aerospace Forecast, Fiscal Years 2009-2025," U.S. Department of Transportation, 2009, URL: [www.faa.gov/data\\_research/aviation/aerospace\\_forecasts/2009-2025/media/2009%20Forecast%20Doc.pdf](http://www.faa.gov/data_research/aviation/aerospace_forecasts/2009-2025/media/2009%20Forecast%20Doc.pdf)

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## Medical

Medical applications have been a small target segment for our industry over the years. Most of the applications were for backplane-based products used in MRI, CAT, and PET equipment. However, much of that market has migrated to motherboards (for image reconstruction) in the past few years. The “next big thing” in medical will be “HoMedics,” or home-based consumer medical equipment. A device, much like a laptop computer, will be placed in the patient’s home and attached to the internet. A user will be able to attach a blood pressure cuff and EKG pads to the unit, in addition to their blood sugar meter if they are diabetic. The data captured by the unit can be sent to the patient’s doctor over the internet. The doctor can set high-low parameters for vital signs measured by the home device for each patient. If the readings are out of range as set by the doctor, the patient will be contacted. This concept can eliminate millions of dollars in insurance claims for people with chronic medical conditions and allow doctors to focus on acute patients. Doctors will charge a small monthly fee for these remote monitoring services and equipment rental.

*“The “next big thing”  
in medical will be  
“HoMedics.”*”

Most of these HoMedic devices are built from commodity small form factor products or PC motherboards. Since the medical equipment makers have already shifted to inexpensive commodity PC-based electronics, I don’t see much opportunity for backplane board makers in this market. The servers in the doctors’ offices will be commodity servers loaded with the appropriate medical software. Consequently, I see no major trends in the medical equipment industry that will benefit traditional board companies in the near future, even if such a HoMedics trend develops in earnest.

*“I see no major trends in the  
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that will benefit traditional  
board companies in the near  
future.”*”

## Telecom

As I’ve mentioned in previous sections, the telecom board segment was most negatively affected by the downturn in economic activity in 1H09. Some telecom-oriented AdvancedTCA vendors are competing on a Navy program to replace the commercial servers/routers used for general administrative systems on all Navy ships. These systems keep personnel records, ship’s inventory, etc., as well as used for sending emails home. They can be made in China and RoHS compliant. They are just commodity servers so there are no serious specification requirements to pass. So, some telecom vendors are finding small niche applications for their technology in benign MIL environments.

Previously, I referenced research reports that say the cellphone markets in the developed world will saturate by 2013. That means that we are at the peak of the “S” curve, and growth in both cellphone shipments and subscribers is leveling off. Cellular equipment and services will reach the maturity phase in this timeframe, and growth will be difficult for both equipment makers and service providers. Verizon seems to see this and has embarked upon an effort to capture business from the power/utility companies. They claim that the utilities should not install their own RF networks to extract data from smart grid controllers, or to send commands to those controllers. Verizon wants the utilities to use their existing cellular networks to accomplish those functions.<sup>14</sup>

While this seems like a good idea, there are a myriad of reliability and security concerns with controlling the smart grid through the existing cellular networks. One only needs to look at the collapse of the communications systems during Hurricane Katrina, and the aftermath, to question this initiative. Also, consider that most telecom executives are under indictment or in jail for financial felonies, that the utility execs run monopolies sanctioned by the states, and you have a recipe for something really smelly. Regardless, Verizon’s recent efforts are a clear sign that cellular equipment and services companies are seeing the end of unbridled growth. They are trying to find new customers for their cellular bandwidth, as well as new partners in their next phase of financial malfeasance. What better choice than the power utilities?

This Verizon initiative also suggests that the basic cellphone will be ubiquitous, the next digital clock. You cannot buy an appliance today that doesn’t contain some version of a digital clock. That is because those clocks are basically cheap or free (i.e., they come on the die of some other chip). Consequently, all those smart grid controllers would

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<sup>14</sup> Gary Kim, Contributing Editor, “Verizon Sees Smart Grid Potential,” TMCnet.com, 3/4/09, URL: [fixed-mobile-convergence.tmcnet.com/topics/mobile-communications/articles/51678-verizon-sees-smart-grid-potential.htm](http://fixed-mobile-convergence.tmcnet.com/topics/mobile-communications/articles/51678-verizon-sees-smart-grid-potential.htm)

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contain a cellphone. This is not out of the realm of possibility. As consumers have disconnected their landlines at record pace, all the residential alarm service companies (Brinks, IDT, etc.) have developed alarm boxes that contain cellphones to notify the exchange of a break-in, fire, etc. This trend that has been on the increase for a number of years.

But, these initiatives do not offer the opportunities for the telecom board vendors that market researchers and press editors hype-up. This segment of the board and systems business will be the least profitable and slowest growing segment for years to come.

## **Impact of the Semiconductor Industry**

It is clear that depending on the traditional semiconductor supply chain for parts that can run for 10-15 years in MIL/COTS applications is becoming impossible.

Aside from the declining semiconductor shipments previously noted in this report, there is a major trend occurring in semiconductor markets that will affect our industry over the next few years. The decline in traditional MPU (microprocessor unit) shipments comes from the declining volumes of laptop and desktop PCs being sold. The reasons for these declines are partly the economic conditions worldwide, but the larger reason is the transition away from PCs, toward mobile internet devices (MIDs). The volume markets for MPU makers shifted from PCs to cellphones and are now shifting to netbook computers. Intel missed the market window for MPUs in cellphones. That market is controlled by Texas Instruments, Samsung, Marvell, ST-Ericsson, Qualcomm, Renesas, Freescale, and Nvidia, all using some form of a RISC-based ARM processor core. Remember that Apple bought PA Semiconductor last April to control their own MPU architecture in future iPhones and netbooks. Nevertheless, the smart phone will evolve into the netbook computer before 2013. Both Apple and Intel see this trend. So do Texas Instruments, Nvidia, Freescale and Qualcomm, who have all released MPUs for the netbook market, according to SEMICO Research Corporation's June 25, 2009 newsletter.

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Will Strauss (Forward Concepts), in his June 24, 2009 newsletter states, “The entire semiconductor market is now driven by DSP technology, since without it there would be no digital wireless, no multimedia, no VOIP and no internet access of any kind.” CEVA and Tensilica lead the pack in DSP cores, with claims of 400 million and 350 million shipped to their respective customers. CEVA is mostly in cellphone basebands (like the Sony Ericsson handsets and all of the Apple iPhones), and Tensilica is mostly in cellphone audio and video graphics chips. Tensilica is also moving into cellphone basebands with recently announced design wins at Fujitsu, Panasonic, and NEC for FFTs, FIR filters and matrix operations used in cellular base stations, femtocells, digital media broadcast receivers, and software-defined radios. All the ARM-based cellphone processors will start looking like DSP machines as the smart phone develops into the netbook computer.

It's interesting to note here that Intel has had several chances to focus on DSP-type processors, but terminated each one. Some of you are old enough to remember the i860 and i960-based VME boards that were popular with the military in the 80's and 90's. Both CPUs were terminated: Intel targeted them at the workstation market, which failed miserably. In addition, Intel got access to the ARM cores when they bought a DEC division years ago (the X-scale architecture). However, they sold that off to Marvell, who is a major cellphone chipset vendor today. Now, Intel is pushing the Atom into those market spaces as their future fortunes in PCs, laptops, and servers declines.

What this tells me is that the bulk of microprocessor design talent is tied-up designing low-power DSP-based MPUs for the MID market. That says the prospects for newer, faster, more powerful MPUs (used in desktops, servers, and laptops) are dim. Intel's recent purchase of Wind River indicates to me that they want to control the OS environment and API for smart phones and netbooks, much as Apple is doing with their iPhone (and whatever MPU the previous PA Semi guys come up with). Additionally, this says that both Intel and Apple are ignoring the other OSes developed for smart phones and netbooks (i.e., Mobilan/Linux, Google/Android, Nokia/Symbian). Moreover, all these moves certainly put Microsoft out in the cold as an option on netbooks and smart phones.

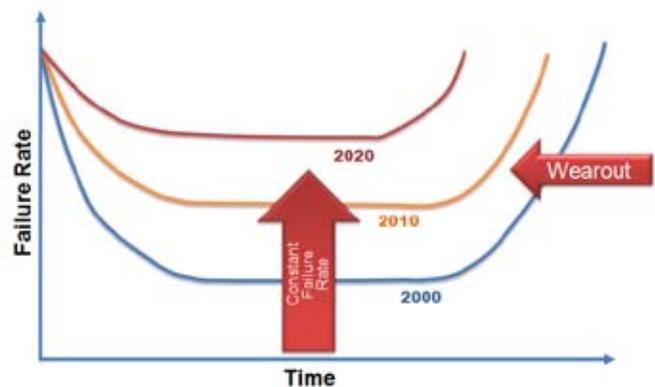
So, as I follow these events at the macro-level, I see that our industry will need to speed-up adoption of FPGAs, DSP-based processor cores, and multicore processing techniques in the near future to fill the gaps being left in general purpose microprocessors roadmaps. This includes homogenous multicores (multiples of the same DSP core inside the FPGA), as well as heterogeneous-core implementations (a GPU or microcontroller core, along with a DSP core in the FPGA). It doesn't look like Intel is spending a lot of time on high-performance processor design (except for adding more x86 cores to a single die). The Power Architecture roadmap is fuzzy at best (Freescale focused on microcontrollers for automotive applications, IBM focused on game-box and server CPUs). Sun and their SPARC architecture got bought by Oracle, a database software company. The future of the high-end processor market, which drives our product design cycles, is very unclear right now. Will the high-end processors of the future be tuned-up search engine machines or database-focused processors? That wouldn't be very applicable to our ISR/SIGINT/aerospace military applications.

*“I see that our industry will need to speed-up adoption of FPGAs, DSP-based processor cores, and multicore processing techniques.”*

I believe that a great number of MIL/COTS applications will migrate to DSP-based cores and multicore-based systems, running in FPGAs, in the future. That would mitigate the huge obsolescence problems we have endured using generic processors over the past few years, it will allow those applications to follow the macro-trend toward DSP-oriented CPUs and it would allow a continuing path toward high levels of processing power (without dependence on Intel or Freescale). I have said for many years, in previous white papers and other articles, that FPGA implementations are the future of advanced military platforms. A recent article backs up my assertions.<sup>15</sup>

I do not believe that the MPU makers have any interest in MIL/COTS markets and applications. But, they do have cores and technology that board and system builders in our industry can integrate to serve those MIL/COTS applications more effectively.

Over 60% of all semiconductors shipped today go into consumer devices. That percentage will increase. I have written articles about “bathtub” curves, showing that every time the semiconductor manufacturers reduce their geometry (i.e., 90nm, 65nm, 45nm, 22nm, etc), the MTBF on the parts declines and approaches about 3 years of operational life. That is acceptable for short life cycle consumer products and thus the semiconductor manufacturers have no incentive to raise their MTBF numbers. The consumer product OEMs probably have no problem with lower MTBF numbers since they desire to get consumers to buy replacement gadgets every 18 months.



Source: L. Condra, Boeing; J. Qin and J.B. Bernstein, U of Maryland

Some of you may remember my “Innovate Outside Traditional Semiconductor Offerings” (IOTSO) program announcement two years ago at the Critical Embedded Systems Conference in Scottsdale, AZ. We must shift away from traditional semiconductor suppliers and their products and move to DSP-based multicore FPGAs, much like our industry did with I/O cores. I think we have about two more years to become proficient with cores and homogenous/heterogeneous multiprocessing before the semiconductor trends create big problems for CPU board and system vendors.

<sup>15</sup> Jessica Davis, Contributing Editor, “FPGAs storm military spending,” EDN, 7/14/09, URL: [www.edn.com/article/CA6670749.html?nid=3351&rid=9447059](http://www.edn.com/article/CA6670749.html?nid=3351&rid=9447059)

The semiconductor industry, having seen a 15-23% decline in shipments the first half of 2009, has been reducing costs and capacity. Older fabs were closed, and few new fabs opened (with exceptions like Intel). As these companies reduce capacity to meet reduced demand, it would suggest that we will see a shortage of capacity in 2010, when the demand for chips is forecast to bounce back. That shortage of capacity will cause long lead times and higher prices on the devices used by our industry.<sup>16</sup> And so the cycle continues.

Semiconductor industry pundits are all scrambling to come-up with the next big

thing, or the next big market. So far, they have suggested that the semiconductor industry recovery is based on inhabitants of third-world countries buying all the faddish trashy consumer products (especially cellphones).<sup>17</sup> I have problems with this scenario. I think they are grasping at straws when they hype this idea.

The situation in semiconductors does not bode well for our industry. The companies in the commodity board markets (motherboards, small form factor, telecom, industrial) have been competing on price during 2009 to keep or gain business. As prices for semiconductors go up and deliveries stretch out, the squeeze on the sales numbers and the already low margins of these commodity-product companies in 2010 will escalate. While 2009 is rough, 2010 could be even worse.

<b>Worldwide Semiconductor Capital and Equipment Spending Forecasts</b>						
<b>(Millions of Dollars)</b>						
	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>
Semiconductor Capital Spending	44,012	24,296	29,384	39,512	47,264	42,122
Growth (%)	-30.5	-44.8	20.9	34.5	19.6	-10.9
Capital Equipment	30,659	16,616	21,438	29,485	34,704	29,757
Growth (%)	-31.7	-45.8	29.0	37.5	17.7	-14.3
Wafer Fab Equipment	24,214	12,819	16,207	22,401	26,983	23,582
Growth (%)	-32.8	-47.1	26.4	38.2	20.5	-12.6
Packaging / Assembly Equipment	4,000	2,135	3,034	4,050	4,484	3,565
Growth (%)	-24.5	-46.6	42.1	33.5	10.7	-20.5
Automated Test Equipment	2,446	1,662	2,197	3,035	3,238	2,610
Growth (%)	-31.2	-32.0	32.2	38.1	6.7	-19.4
Other Spending	13,353	7,680	7,946	10,027	12,560	12,364
Growth (%)	-27.6	-42.5	3.5	26.2	25.3	-1.6

Source: Gartner (June 2009)

## M&A Updates

In spite of unusual economic conditions in the first half of 2009, we did see some M&A activity in our industry:

- *January 2009: Elma (a packaging/backplane vendor) bought ACT/Technico to expand more into the systems integration business.*
- *April 2009: SIE (Europe) bought Carlo Gavazzi-Mupac, a packaging vendor.*

Other significant events in the first half, according to information I have received, are:

- *March 2009: Rittal (a packaging/backplane vendor) closed their Kaparel facility*
- *June 2009: Emerson closed their Madison, WI facility (the old Heurikon/Artesyn operation).*

As you can see, the packaging/backplane industry was the most active segment in the first half of 2009 in M&A activity. No board or systems vendors were involved in M&A during this period, especially those in the MIL/COTS segment.

MIL/COTS has been the most active segment for M&A for some time. I believe that the activity from packaging/backplane companies during the first half of 2009 reflects the continuing disastrous decline in telecom sales and the low margins associated with that commodity business. Many packaging/backplane companies over-invested in the telecom segment during the past 5 years, more than the board vendors. This conclusion

*“MIL/COTS has been the most active segment for M&A for some time.”*

<sup>16</sup> David Manners, “Capacity issues loom, says SEMI,” ElectronicsWeekly.com, 7/9/09, URL: [www.electronicweekly.com/Articles/2009/07/09/46473/capacity-issues-loom-says-semi.htm](http://www.electronicweekly.com/Articles/2009/07/09/46473/capacity-issues-loom-says-semi.htm)

<sup>17</sup> Ron Wilson, Executive Editor, “Now what: a renewed growth strategy for the semiconductor industry,” EDN, 7/9/09, URL: [www.edn.com/blog/1690000169/post/1140046514.html?nid=3351&rid=9447059](http://www.edn.com/blog/1690000169/post/1140046514.html?nid=3351&rid=9447059)

may be further justified by Emerson's closure of the Heurikon facility, since Emerson (the old Motorola Computer Group) is very focused on telecom sales.

This activity also supports my position that the telecom segment of our industry is continuing to decline and suffer the most in these uncertain economic times, compared to other segments (like industrial, medical, MIL/COTS, etc). I believe this conclusion is correct: telecom continues to decline as consumers cut back on spending, consumers do not see the benefit of more expensive 3G services, nor are they willing to pay for expensive 3G cellphones and services. This conclusion seems to apply to the telecom markets in all mature developed nations, not just the U.S.. Cheap base stations and cheap voice-only cellphones are still selling in undeveloped countries.

Perhaps the most interesting events in the first half was the M&A activity in the supplier infrastructure to the board business:

Parent	Target	Market Focus	Date
Kontron	Thales Computer	MIL/COTS	January 2008
Curtiss-Wright	Pentland Systems	MIL/COTS	February 2008
Adlink Technology	Ampro Computer	Industrial control	March 2008
Interconnect Systems Inc.	Nallatech	MIL/COTS	May 2008
Finmechanica	DRS	MIL/COTS	May 2008
Curtiss-Wright	VMETRO	MIL/COTS	August 2008
Kontron	Intel rack mount server group	Telecom	October 2008
Elma	ACT/Technico	System integration	January 2009
SIE	Carlo Gavazzi-Mupac	Packaging	April 2009
IDT	Tundra Semiconductor	RapidIO chipsets	April 2009
Intel	Wind River Systems	Embedded	July 2009
Mentor Graphics	Embedded Alley	Linux	July 2009

- April 2009: Tundra Semiconductor (the supplier of VME controller chips) was bought by IDT Semiconductor (after IDT exceeded an offer made by Gennum).
- June 2009: Intel bought WindRiver Systems, the supplier of the VxWorks kernel and development tools.
- July 2009: Mentor Graphics announced the acquisition of Embedded Alley, a Linux integrator and developer.

The acquisition of Tundra by IDT is a continuation of the consolidation in the semiconductor industry. Predictions are that the semiconductor industry will continue to consolidate, down to maybe 50 total semiconductor companies, in the next few years. The smaller innovative semi conductor companies cannot compete in high-volume/low-margin markets, thus driving more shakeouts. I believe that IDT will continue to support the VME controller product line. We still represent reasonable demand for those products and with good margin, especially for the MIL segment.

*“I believe that IDT will continue to support the VME controller product line.”*

The acquisition of WindRiver by Intel is of more concern to us. Most board vendors have a significant investment in VxWorks code, especially in the MIL/COTS segment. VxWorks has been ported to, and runs on, many processors, not just on Intel chips. My central concern is about the Power Architecture support. Will Intel continue to support the Power Architecture processors? Will IBM or Freescale feel comfortable sharing their Power Architecture roadmaps for software development planning purposes?

Furthermore, the numbers seem to suggest that the WindRiver sale was a distressed sale. Intel paid \$884 million for WindRiver's \$360 million in sales, or a multiple of 2.46. Back in 2004, Harmon Automotive paid \$138 million for QNX Software System's \$25 million in annual sales, or a multiple of 5.52, twice the multiple of the WindRiver purchase.<sup>18</sup> This lower multiple tells me that WindRiver believed they could not grow the company or their stock price above the offer made by Intel so they subsequently sold out. I doubt that Intel has any interest in continuing the previous

<sup>18</sup> Charles Murray, "Harman acquires QNX Software Systems," EETimes, 11/1/2004, URL: [www.eetimes.com/showArticle.jhtml?articleID=51201922](http://www.eetimes.com/showArticle.jhtml?articleID=51201922)

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WindRiver business model of selling seats for tools and licenses for OS kernels. This low multiple also seems to say that WindRivers foray into Linux may have caused some serious leaks in their sales and profitability. That all leads me back to my concern about continuing support for VxWorks on Power Architecture processors.

I expect to see M&A activity slow in the second half of this year, with the possible exception of some fire sales, companies in financial trouble selling assets. Business conditions are still very shaky, and we are all hopeful that they will improve in the second half of 2009. I believe that the uncertain economic conditions will continue to dampen any M&A activity in the remainder of 2009.

*“I expect to see M&A activity slow in the second half of this year, with the possible exception of some fire sales.”*

## Summary

- *From a macro-economic standpoint, predictions are that the U.S. will stabilize in Q-3 of 2009, but we will still show declining GDP numbers for the upcoming quarter and for the year. Europe seems to be behind the U.S. by 3-4 months, the EU industrial output has been declining in the 17-21% range for the past 3 months and they may be going through the financial storm now that the U.S. endured in the first and second quarters of 2009. While the decline in economic activity is slowing in the U.S., the other market regions may be entering a tough period compared to their previous experience.*
- *From a micro perspective, the shining star in the board business during the first half of 2009 was the MIL/COTS segment, which showed significant growth in sales and shipments. The worst performing segment, according to my anecdotal data, continues to be the telecom sector, showing very significant and continuing declines in sales and shipments. The industrial segment is also showing declines in sales and shipments of boards and boxes, but not as bad as in the telecom sector. Both the industrial and telecom segments may fall even further if the EU economic activity continues to decline.*
- *The medical equipment markets have always been a very small segment of the board business. With this segment's transition to cheap PC motherboards, I see this market only available to commodity motherboard vendors with very low margin expectations.*
- *The defense budgets show great promise and opportunity for MIL/COTS vendors. Even though the FCS Vehicle Program has been terminated, it will be reviewed and restarted in the next 18-24 months. Meanwhile, the tremendous growth in UAVs, refresh programs (with VME), the new KC-X tanker program, the Aegis upgrades, helicopter platform upgrades and new systems, and the tremendous increase in SIGINT systems are all fueling good growth and profitability for many of VITA's members. I expect to see the MIL/COTS segment to outperform the other segments of the board business for the foreseeable future, at least for another 2-3 years.*

In this report, I have outlined the next four “Big Things” that could bolster sales of board-level products and packaging:

1. *The large scale adoption by the military of unmanned platforms (UAVs, UGV's, UUV's, robotic soldiers, etc). This transition is under way, possibly lasting for decades.*
2. *The “smart grid” and the integration of renewable energy sources will happen, but at a very slow pace. There may be some business for industrial board makers here, but the major power equipment suppliers like GE and Emerson may control this market with their own embedded board groups. If I were an industrial board vendor, I would not count on this initiative to carry sales and profits in the future.*
3. *The upgrades and revamping of the Air Traffic Control system will also happen at some point, but not in the near future. The system is within capacity now, and the government is prioritized on spending tax dollars on critical economic programs and healthcare initiatives. These and other programs will retard the interest in redesigning and deploying a new ATC system for many years to come.*

4. Home medical equipment usage will definitely increase. But, until we see the outcome of the new healthcare plans in Congress, it is hard to say how much emphasis will be placed on home medical equipment. Again this market will grow and this transition will occur, but it will take a long period of time. Also, the entrenched medical equipment vendors (HP, GE, Siemens, Abbott Labs, Becton-Dickinson, etc) will control the markets for such equipment. I would not count on this market transition to contribute any significant growth for years to come for board vendors focusing on this segment.

## Business Models

It is clear that the high-volume/low-margin business models of the telecom board vendors is failing: there are no volume orders. With very high variable costs (and the consequential low gross profit margins), companies maintaining such strategies will suffer financially and decline. Some vendors may leave the industry this year or next. Since all telecom equipment and services are consumer-oriented products and consumers have reduced their spending levels, I do not see any drivers for a significant telecom recovery any time soon.

As we have seen, the diversification strategies instituted by larger board companies are also failing. Increases in MIL/COTS boards sales cannot possibly offset the huge declines in telecom and industrial board sales seen over the past year. Additionally, telecom and industrial markets demand cheap low-margin commodity products and there are very few high-margin niches to pursue in those areas. Companies with diversified products and target markets may be forced to abandon some of those segments in the very near future. Some of the larger board vendors have established elaborate networks of representatives and distributors in developed countries. The only thing I see that diversified board companies can do now, with their commodity low-margin products, is to diversify geographically. They could focus on developing nations (Western Europe, Russia, South America, parts of Asia), but that requires the development of new channels, people who know the language and the customs, and understanding how they do business. This increases the risk of slow or non-payment, currency exchange exposure, and dealing with third-world government officials.

The business model that works for our product types, in both tough times and good times, is the low-volume/high-margin model (i.e., the niche strategy), found in segments like MIL/COTS. Of all our market segments, the military markets are the only place where you can add intellectual value to your products. Other board market users (industrial, telecom, medical) buy the cheapest processing cycles they can find. If companies in the commodity segments, who only add manufacturing value, do not transition to a niche strategy and find markets where they can add intellectual value, they will have serious growth and profitability problems for the next few years.

## The future of military systems

Over the next few years, the only market that will show growth and prosperity will be the MIL/COTS segment. For those who want to better understand the platforms and transitions of the military to robotic unmanned systems, they should get a copy of the latest book on the topic, "Wired for War" by P. W. Singer. This book was released in late 2008 and is very timely with a host of information on developments and trends in military systems.

## Epilog

This industry has shown amazing resilience to difficult economic conditions in the past. But these times are very different from previous experience. I believe that the board markets, in general, will move back to their original roots of profitable "niches", and away from the commodity high-volume/low-margin models introduced by the telecom and industrial motherboard segments. Those commodity models have shown that they have very little ability to adapt to severe economic conditions.

*"I believe that the board markets, in general, will move back to their original roots of profitable "niches".*

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