



2013 State of the VITA Technology Industry



March 2013

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*This report provides the reader with updates on the state of the VITA 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 complete series of reports can be found at **Market Reports**. (www.vita.com)*

Business Conditions

In the past few months we have experienced negative signals from the macro-economy. U.S. GDP declined 0.1% in the fourth quarter of 2012. This decline was blamed on slower restocking of inventory at businesses and a 22.2% decline in defense spending.¹ This result came on the heels of 3.1% growth in the third quarter, surprising economists. On March 1 the numbers for U.S. GDP in Q4 were raised to 0.1% growth but that is still below expectations. For all of 2012 the U.S. GDP grew at 2.2%, better than the 1.8% growth rate experienced in 2011. January unemployment in the U.S. rose to 7.9% from 7.8% in December. The forecast is for U.S. GDP to grow 2% in 2013, a growth rate less than 2012.

According to a Eurostat release on February 14, the EU GDP declined by 0.6% in Q4 2012, led by the decline in German GDP of 0.6% and a decline in French GDP of 0.3%. Total 2012 EU GDP declined by 0.5%. The EU has seen negative GDP growth for three consecutive quarters, an indicator of recession.²

Gross World Product (GWP) forecasts for 2012 were cut from 3.2% growth to 2.9% in September. We do not have the closing numbers for GWP at this point, but we are seeing a global slowdown in GDP growth. The alarming part of these numbers was the decline in U.S. and EU GDP.

For now the EU seems to have a handle on their sovereign debt and bank liquidity problems. The Euro has actually been rising in value (vs. the dollar) over the past few months. But austerity (reduced government spending, reduced benefits to citizens, etc.) is wreaking havoc on the European economies. This is no surprise considering that

1 Brad Plummer, "Why defense spending plunged 22% last quarter — and killed GDP", The Washington Post, January 30, 2013, URL: www.washingtonpost.com/blogs/wonkblog/wp/2013/01/30/why-defense-spending-dropped-22-last-quarter-and-shrunk-gdp/

2 The Associated Press, "Eurozone economy shrinks in Q4 as Germany falters", Global News, February 14, 2013, URL: www.globalnews.ca/world/money/eurozone-economy+shrinks+in+q4+as+germany+falters/6442809216/story.html

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government spending in EU countries is over 50% of their total GDP (while consumer spending in the U.S. is greater than 60% of GDP).

Macroeconomic conditions are causing companies in our industry to make macro-level decisions by reducing headcount and R&D investment. Several board/system companies conducted layoffs in Q4. This occurred not only at military-focused vendors (who experienced the 22% reduction in military spending in Q4), but those focused on the industrial and telecom segments as well. In the industrial segment there is excess capacity, so there is little demand to automate older factories or build new ones. Government spending on transportation has declined significantly, especially in Europe, reducing demand for electronics (stop light controls, digital freeway signs, etc.). Telecom spending appears down when you look at the sales of the major telecom vendors like Alcatel-Lucent and Ericsson.

There are other factors involved in the reductions. The military market is transitioning from purchasing board-level products to purchasing systems, causing suppliers to restructure product strategies in response. Profit margins on systems are lower than board-level products as building systems is more labor-intensive and more complex than designing and selling boards. Additionally, the R&D cost of designing an advanced VPX board is approaching \$1 million when considering the complex design, environmental testing, and the software work required. It takes more time to recover that R&D investment on boards, thus extending the payback period. Designing those expensive boards and integrating them into a larger system sale increases revenue and speeds-up the recovery of the R&D costs for the board. These financial realities are affecting business models in our industry.

The most pressing problem we face today, affecting the military markets, is the U.S. budget negotiation in Congress. The deadline for budgets (including military) was March 13, but the House has proposed a 3-month extension to the Senate. Additionally, the President has called for an interim short-term budget to be passed immediately. That would give Congress more time to hash-out the tax increases and spending cuts. But either proposal on the budget negotiations will create major problems. As of March 1, we are now in “sequestration”. Where the budget talks go from here is totally unknown.

The prime contractors have been holding on, waiting for the budgets to determine which military programs are funded and which are not. That clarity would allow them to make specific headcount reductions and plant closures related to the unfunded programs. They cannot wait another six months or more to make those adjustments. Without the clarity of a budget, the primes will have to do their reductions in the dark without specific information.

We remain in a state of uncertainty and confusion in the military markets for now. There is no need to speculate without more clarity on where we are going.

“We remain in a state of uncertainty and confusion in the military markets for now.”

Markets

MIL/Aero

The military market conditions changed quite a bit in the fourth quarter of 2012. We saw a 22.2% reduction in military spending over Q4 2011 and we remain in a fog of uncertainty and confusion. The solution to the “fiscal cliff” did not include any new information about future military budgets. We are anticipating some clarity by the end of March, the deadline for the federal budgets. But news reports say the House of Representatives is offering the Senate a 3-month extension on the national budget deadline, moving the decision date from March to June. The prime contractors are waiting to see which programs are funded and which are not before they make any headcount reductions. If this 3-month extension on the federal budgets goes through, the primes have no choice but to make headcount reductions in the dark. They cannot continue to wait and pay the overhead, not with the memory of 22.2% reductions in military spending in Q4 2012 on their minds.

There is no point in going over promising military applications and technologies as presented in previous reports. Instead, let’s continue our study of UAVs (Unmanned Aerial Vehicles) until the March or June announcements give us better direction and clarity on budgets, funded programs, and surviving platforms.

The History of Armed UAVs

In previous reports, we explored the history of UAVs in the military, the inventors who developed them, and how they are deployed. Most UAVs today perform intelligence data collection, SIGINT (Signals Intelligence), and IMINT (Imagery Intelligence) collection. Unmanned aerial platforms can also destroy the targets they find with the lethal ordinance they carry. Arming UAVs is not a new concept. U.S. officials started developing UAVs as weapon platforms back in early 2000 as a tool to use in the hunt for Usama Bin Laden (UBL). (Usama is the official name used by the FBI and CIA (Central Intelligence Agency), not the Osama promulgated by the media.³)

UBL was linked by CIA intelligence sources to the 1998 U.S. embassy bombings in East Africa (Nairobi, Dar es Salaam) and other terrorist acts.⁴ He was soon placed on the FBI's most-wanted list. The Clinton administration decided that they wanted to know where he was and bring him to justice. UAVs were to play a crucial role in this mission. U.S. leadership was reluctant to put "boots on the ground" to find UBL, considering that it would require political agreement in the U.S. and in the country where UBL might be found. Plus it would require permission to use the airspace over a country in which the capture-kill mission troops would need to fly. Such negotiations and approvals with other nations could delay rapid-response to intelligence reports. It could also expose and jeopardize the operation, a significant security risk.

The National Security Council (NSC) directed the CIA to develop a reconnaissance system that could reliably locate and identify Bin Laden for a follow-on military operation to capture him. The Counter Terrorism Center (CTC) of the CIA was given the task of developing the system and the mission characteristics that would avoid political and security problems. The NSC gave the CTC only nine months to develop the new system and the mission profile.

After considering long-range optics (satellites), land-based sensors, and balloon-based optics, the CTC finally decided that a UAV sensor platform was most appropriate for the reconnaissance (locate and identify) mission segment. The Special Activities Division (SAD) of the CIA had a small UAV they had been playing with but were reluctant to give it up. So the CTC went to the Air Force who had an early version of the Predator (RQ-1) that was used for intelligence missions in the Balkans.⁵ Air Force officials were happy to relinquish this bird; the top Air Force brass disliked any aircraft that did not rely on a human pilot with hands directly on the controls. At the time this Air Force-owned UAV was just sitting in a hangar without planned missions.



Predator B is powered by a turboprop engine and can carry a greatly increased payload.

The early Predator had a wingspan of 55 feet, a length of 27 feet, was powered by two snowmobile engines turning a single propeller, had a maximum airspeed of 138 MPH, could fly at altitudes up to 25,000 feet, stay airborne for 40 hours, and could carry a payload of 450 pounds. It used a satellite link for flight control and transmission of collected intelligence data (images) back to the flight operators. The CTC set up a new command center with large video screens and established their satellite ground-station links. They constructed a base for the Predator somewhere in Uzbekistan. It was now time to start flying and testing.

Mission Accomplished (Almost)

At first they flew the bird over different locations in Afghanistan, testing the maneuverability of the Predator and the communications links, transmitting the video images to the command center. In the summer of 2000, the Predator was flying over Tarnak Farms⁶ near Kandahar, Afghanistan — a known al Qaeda (AQ) facility — based on HUMINT (Human Intelligence) reports that UBL would be there. Military and political officials still refused to authorize a combat team to fly in and take UBL if he did show up. Sure enough, a convoy of vehicles approached the facility, UBL

³ FBI Most Wanted Terrorists, URL: www.fbi.gov/wanted/wanted_terrorists/usama-bin-laden

⁴ "1998 United States embassy bombings", Wikipedia, URL: en.wikipedia.org/wiki/1998_United_States_embassy_bombings

⁵ "Predator RQ-1 / MQ-1 / MQ-9 Reaper UAV, United States of America", Airforce-technology.com, URL: www.airforce-technology.com/projects/predator-uav/

⁶ "Tarnak Farms", Wikipedia, URL: en.wikipedia.org/wiki/Tarnak_Farms

got out of a car, greeted his men, and walked into a building. The CTC officials at the command center could clearly identify him from the video images sent from the Predator circling high above UBL's head.

The CTC analysts immediately informed the White House and the DoD that they had UBL's location and had positively identified him. The closest weapons that could successfully hit the Tarnak Farms facility were cruise missiles onboard U.S. Navy ships in the Indian Ocean.⁷ However, it would take 6 hours to hit the facility, considering the time it would take for the ship to come into launch range and the flight-time of the Cruise missile. The CTC could not guarantee that UBL would still be there in 6 hours so they terminated the potential operation.

The CTC could have accomplished all phases of their mission in just six months, from the time that the NSC issued their directive, if only one appropriate weapon had been close by. Our intelligence, military, and political officials learned a very valuable lesson that day — perfect tactical intelligence has a very short lifetime. After the Kandahar incident, the Clinton Administration redefined its policy that UBL could only be killed if that outcome occurred as part of a capture operation.

The White House wasn't forced to make the decision to fire the cruise missile since the closest weapons were out of range. Yet, the unanticipated success of the CTC's work suggests that the White House was completely caught off-guard. Technology and some smart, motivated people outpaced the administration's expectations. The Tarnak Farms incident also initiated the review of international law and the rules for use of unmanned weapons.⁸

The Armed UAV is Born

The CIA is in the intelligence business and the CTC had done a stellar job of developing and implementing a complex intelligence platform ahead of schedule and at low cost. And they found the target the system was designed to find: UBL. However, the weapons-platform owners (the Navy in this case) could not operate on that intelligence in time. It was now clear that the CIA/CTC needed their own kinetic (explosive) weapons on-board the Predator with the authority to use them in certain situations. Consequently, the experience in Kandahar redefined and initiated a major expansion in the CIA's mission. The CTC had to integrate an intelligence system - the existing Predator platform - with a weapons system that was undefined at this point. It would also mean that the integrated intelligence-weapons platform would be under the operational control of the CIA, not the Army, Navy, or Air Force.

A CIA terminal ballistics expert was brought in to evaluate all of the smaller weapons that could be mounted on the Predator. She was a quiet, older woman whom everyone referred to with the affectionate appellation, "The Black Widow." After studying pressure curves, blast radius figures, fragmentation patterns, and kill radius data on appropriate weapons in the U.S. arsenal, she decided that the Hellfire Missile was the best option.⁹ At this time, the Hellfire had been used effectively for 15 years as a weapon on attack helicopters to neutralize enemy artillery and tanks on the ground. Each missile weighed 100 pounds, including the 20-pound high-explosive (HE) warhead. Two missiles could be attached to the Predator, one under each wing. The missiles, combined with the on-board laser targeting system and the mechanical hangers on the wings, had to weigh less than the 450 pound payload limit of the RQ-1 Predator.



Wikipedia: A model of a Hellfire's components.

The Hellfire missile was owned by the Army, not the Air Force that owned the Predator. So the CTC went to the Redstone Arsenal to begin the task of integrating the missile system onto the Predator airframe. They found a MIT-schooled mechanical engineer there, with the affectionate appellation of "Boom Boom", who was a superb engineer with an affinity for explosives. In December of 2000, the CIA brought the Predator to Redstone and started the design of the Hellfire hanger attachments along with the integration of the targeting/fire control system. By February of

7 "Tomahawk (missile)", Wikipedia, URL: [en.wikipedia.org/wiki/Tomahawk_\(missile\)](https://en.wikipedia.org/wiki/Tomahawk_(missile))

8 Jeffrey S. Thurnher, "The Law That Applies to Autonomous Weapon Systems", American Society of International Law, January 18, 2013, URL: www.asil.org/insights130118.cfm

9 "AGM-114 Hellfire", Wikipedia, URL: en.wikipedia.org/wiki/AGM-114_Hellfire

2001, “Boom Boom” had finished the design and implementation. The first real-world test shots with the Hellfire hit the targets perfectly.

Within 14 months the CTC division of the CIA had taken an Air Force UAV, an Army missile, and a CIA intelligence system, and integrated them into the first armed UAV weapons platform. While there were many sightings of UBL over the next years, none of them contained the verifiable intelligence to justify a mission to use the Predator, certainly not like the intelligence they had at Tarnak Farms that day in the summer of 2000.¹⁰

Armed UAVs Today

The single-sensor optical system on that original Predator had a very narrow field of view, limiting its capabilities. All the major systems onboard the MQ-1 Predator have now been upgraded with much better optics and enhanced capabilities since the CTCs first armed UAV took to the air.¹¹ More than 200 Predators are now in operation and have flown in hundreds of combat missions. The proliferation of this lethal UAV almost seems commonplace as every few weeks we read about an MQ-1 armed Predator taking-out specific named terrorists in Yemen, Pakistan, or Afghanistan.

The Air Force and the CIA both fly the armed Predators now. In the beginning, only the CIA could fly the birds and fire on specific intelligence-identified targets (i.e., terrorists). It is unclear from the literature if the Air Force now has the authority to fire the weapons at human targets. They may have authority to fire upon enemy military physical targets like tanks, communications facilities, artillery, and military vehicles. Most of the reports about Predators firing on named terrorists claim the bird was flown by CIA personnel, suggesting that only the CIA could fire on specific human targets (HUMTAR), while the Air Force can only fire at physical enemy military targets (PHYSTAR). At this point, the authority to use armed UAVs as assassination tools seems to reside exclusively with the CIA.

In November of 2012, the U.S. Navy initiated carrier testing of the next generation of UAVs - the Northrop Grumman X-47B.¹² This jet-powered UAV is considerably larger than the Predator and has a payload of 4,500 pounds, ten times the payload of the CTC Predator carrying the Hellfire missiles.¹³



Source: Northrop Grumman, X-47B UCAS Control Display Unit Testing, Pax River, Fall 2012

In April and May of 2011, the Air Force flew the new Boeing Phantom Ray jet-powered UAV at Edwards Air Force Base, California.¹⁴ The Phantom Ray is a large UAV, compared to the Predator, carrying a payload of 4,500 pounds. It is becoming clear these new Air Force and Navy platforms are being designed to carry the more traditional larger ordinance- e.g., laser-guided bombs, GPS-guided munitions for combat missions typically flown by manned fighter jets. There are many more UAVs in development today, including micro and micro-miniature devices.¹⁵

10 Henry A. Compton, *The Art of Intelligence*, The Penguin Press, New York, 2012, pp. 148-160

11 “RQ-1A/MQ-1 Predator UAV”, Defense Update, URL: defense-update.com/products/p/predator.htm

12 Jonathan Skillings, *Carrier-bound X-47B drone passes remote-control test*, C/NET, November 15, 2012, URL: news.cnet.com/8301-11386_3-57550660-76/carrier-bound-x-47b-drone-passes-remote-control-test/

13 “Northrop Grumman X-47B”, Wikipedia, URL: en.wikipedia.org/wiki/Northrop_Grumman_X-47B

14 Chris Haddox, *Phantom Ray make first flight*, Boeing, May 9, 2011, URL: www.boeing.com/Features/2011/05/bds_phantom_ray_first_flight_05_04_11.html

15 “Unmanned combat air vehicle”, Wikipedia, URL: en.wikipedia.org/wiki/Unmanned_combat_air_vehicle

While the Air Force and Navy are preparing to field armed UAVs under their control, the Army also has armed UAV platforms in development. The Cobra UAV and the new Raytheon Pyros guided bomb have been tested.¹⁶ The Army will soon field armed UAV helicopters on the future battlefield.¹⁷

The Lawyers Get Involved

We are seeing what appears to be U.S. administration policy already in place that delineates between which targets a DoD-controlled UAV may engage (warfare) and which targets are reserved for the CIA's armed drones (assassinations). The CIA/CTC's Predator technology eclipsed the expectations and policies of the Clinton Administration back in the summer of 2000. However, they were not ready for the political and legal implications of remotely controlled automated warfare.

And neither are the Geneva Convention and Hague World Court, the organizations that write the rules of war and prosecute offenders.¹⁸ Today we have humans "in the loop" on our armed UAV missions - a human initiates launching the missile or dropping the smart bombs on the target from a remote location. There will come a day, and soon, when more advanced UAVs will be totally autonomous. They will be capable of finding and destroying targets without human involvement. That is when technology will eclipse the policies and rules of the Geneva and Hague bodies.¹⁹

More difficulties for the Geneva and Hague lawmakers will appear when advanced versions of ground-based robotic autonomous warriors like TALON²⁰ and MAARS²¹ (previously known as the SWORDS program) are developed and tested. We can also anticipate unmanned tanks and artillery platforms without any stretch of the imagination (Unmanned Ground-based Weapons Platforms, or UGWPs), topics for another report. Armed UAVs are just the harbinger of things to come.

Telecom

In spite of the general mediocrity and boredom in the telecom equipment markets, there have been some slightly less nauseating developments recently. The Gross Profit Margin (GPM) for telecom equipment vendors continue to fall²² and there is talk about telecom and Information Technology (IT) markets merging (read: cloud computing and the data center transition). In the cloud, users have a "smart terminal" (a cellphone, a pad computer, etc.) that simply captures and formats keystrokes. That data is then sent to a computer that houses the software and storage devices to process the data in the cloud. The results are sent back to the user's smart terminal at some point in the future (depending on how much you pay the computing provider). The "cloud" concept is just the same-old time-sharing services of the 1970's using HASP (the Houston Automatic Spooling Priority for those of you with mainframe experience and gray hair). Cloud computing faces many challenges; security and privacy, service delivery and billing, interoperability and portability, reliability and availability, and performance and bandwidth cost.²³ Stand-by for more as we learn how to live and deal with this developing computing model.

"The "cloud" concept is just the same-old time-sharing services of the 1970's using HASP"

16 Tamir Eshel, "Pyros Demonstrates Lethality, Low Collateral Damage in End-to-End Test", Defense Update, August 7, 2012, URL: defense-update.com/20120807_pyros-demonstrated-lethality-low-collateral-damage-in-end-to-end-test.html

17 "Unmanned Little Bird (ULB) Helicopter UAV, United States of America", Army-Technology.com, URL: www.army-technology.com/projects/littlebirdhelicopter/

18 Sean Davies, "Drone warfare and the Geneva Convention", Engineering and Technology Magazine, August 15, 2011, URL: news.cnet.com/8301-11386_3-57550660-76/carrier-bound-x-47b-drone-passes-remote-control-test/

19 "Locked and loaded - the ethics of armed drones", Airforce-technology.com, September 21, 2011, URL: www.airforce-technology.com/features/feature130337

20 Aaron Saenz, "The Present and Future of Military - TALON Robot", SingularityHUB, November 30, 2009, URL: singularityhub.com/2009/11/30/the-present-and-future-of-military-talon-robot-video/

21 Joel Stonington, "World's Most Advanced Robots", BloombergBusinessweek Technology, November 5, 2010, URL: images.businessweek.com/slideshows/20101101/world-s-most-advanced-robots.html#slide13

22 Matt Walker, "Weakening prospects for telecom vendors lead some to IT", OVUM, February 5, 2013, URL: ovum.com/2013/02/05/weakening-prospects-for-telecom-vendors-lead-some-to-it/

23 Jack Rosenblum, "Top Five Challenges Of Cloud Computing", CloudTweaks, August 27, 2012, URL: www.cloudtweaks.com/2012/08/top-five-challenges-of-cloud-computing/

Oracle (led by President Mark Hurd of previous HP fame) bought Acme Packets in January for \$1.7 billion.²⁴ This might be a sign of the merger between the telecom and IT markets. It's hard to figure out exactly what Oracle is trying to do here, but I am sure we will see some amazingly obscure explanations for this acquisition in the future. And that explanation will consist of a plethora of diagrams with lots of lines coming out of the "cloud" to yet another plethora of unspecified boxes full of electronics. I hate those diagrams . . .

In early February, the U.S. FCC (Federal Communications Commission) announced a plan to open-up the white-space RF spectrum between TV channels for a free "super Wi-Fi" network across the country.²⁵ This will enable everyone to use this super-free network and stop paying their cellphone carrier and internet-access cable company for connection services. The new open spectrum could be of great interest to Google, Apple, Yahoo, Facebook, municipal governments, and others who have no interest in charging for connection to the phone and Internet networks, but do have interest in advertising and other service revenue. The FCC proposal has thrown ATT, Verizon, Cox Communications, CenturyLink, Comcast, and a host of other access providers into grand mal seizures. It seems you cannot get a seat on a flight into Washington DC these days because telecom carrier and cable company lobbyists are flying-in to fight this proposal in droves. This process should be fun to watch.

Also in February, France Telecom-Orange announced that they have activated their 400G optical network between Paris and Lyon with equipment made by Alcatel-Lucent.²⁶ From the news articles, they seem to be using 44 wavelengths on optical fiber (multimode) delivering 17.6 Tbps. The primary customer for all this bandwidth is RENATER, a public interest group with the goal of connecting all the major technology, research, and educational institutions in France. Additionally, this incredibly expensive optical network should allow all those connected academics to make dinner and hotel reservations for their holidays much faster. Robustness could be a problem here: one Frenchman with a backhoe, preoccupied by listening to old Edith Piaf music on his iPod while digging can bring this network down for weeks or months.

"Robustness could be a problem here: one Frenchman with a backhoe, preoccupied by listening to old Edith Piaf music on his iPod while digging can bring this network down for weeks or months."

Other notable telecom events in the past few months:

- *Alcatel loses 1.37 billion Euros, CEO resigns*²⁷
- *Ericsson profitability was negatively impacted by operating losses (Editor comment; Read - continues to lose piles of money)*²⁸
- *Huawei replaces Ericsson as top telecom gear maker in the world,*²⁹ (Editor comment: ships a free box of fortune cookies with each telecom equipment order)

The key take-away from all this information is that the margins of the telecom equipment vendors are falling like a refrigerator down an elevator shaft and their financial fortunes are diminishing. And, China is overtaking traditional telco equipment providers worldwide.

24 John Rath, "Deal News: Oracle Acquires Acme Packet", Data Center Knowledge, February 5, 2013, URL: www.datacenterknowledge.com/archives/2013/02/05/acquisition-news-oracle-ibm-451-group-twitter/

25 Andrew Couts, "State of the Web: Why the FCC's 'Free Super Wi-Fi' Plan is Probably Too Good to Be True", Digital Trends, February 5, 2013, URL: www.digitaltrends.com/web/state-of-the-web-the-truth-behind-the-fccs-super-wi-fi-plan/

26 "France Telecom Activates 400G Paris-Lyon Wavelength with Alcatel-Lucent", Converge Network Digest, February 6, 2013, URL: www.convergedigest.com/2013/02/france-telecom-activates-400g-paris.html

27 Eric Savitz, "Alcatel-Lucent Confirms CEO Exit; Posts Q4 Loss; Shrs Off", Forbes, February 7, 2013, URL: www.forbes.com/sites/ericsavitz/2013/02/07/alcatel-lucent-confirms-ceo-exit-posts-q4-loss-shrs-off/?partner=yahootix

28 Ericsson, "Ericsson Fourth Quarter and Full Year 2012 Report", Ericsson, URL: www.ericsson.com/res/investors/docs/q-reports/2012/12month12-en.pdf

29 James Bourne, "Huawei largest telecom equipment vendor, beats Ericsson", Telecoms Tech, August 2012, URL: www.telecomstechnews.com/news/2012/jul/25/huawei-largest-telecom-equipment-vendor-beats-ericsson/

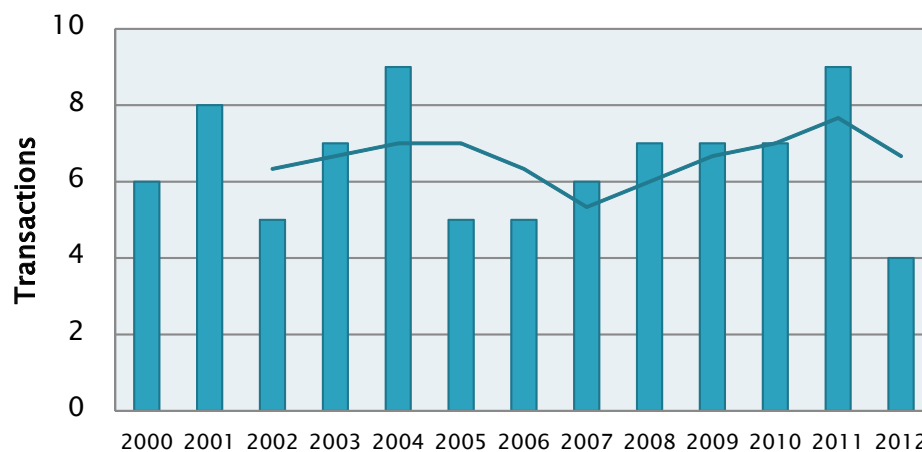
Mergers and Acquisitions

As stated in previous reports, the macroeconomic conditions and the looming military budget cuts have dampened the M&A activity in our industry. One exception is the November 2012 purchase of Chandler/May, previously a board and mezzanine vendor, by Lockheed Martin.³⁰ Chandler/May transitioned from designing and building boards for UAVs to a designer and maker of small UAV platforms and control systems. This acquisition could be seen as outside our industry, even with Chandler/Mays history as a board vendor.

M&A activity will remain subdued until we have more clarity on the military budgets. We need to know what programs will and will not be funded before activity will reemerge. When we do have some clarity, we could see a surge in M&A activity. Companies who supply funded programs will become more valuable. Likewise, companies who supply unfunded or diminished funded programs will likely decline in value and attractiveness.

One of the primary markets for our industry is the UAV segment, but there is speculation related to reduced funding for many UAV programs.³¹ These reductions could be as high as 25% for 2013 through 2016. We will have to wait and see what the budget numbers say. Then we can evaluate the environment for M&A opportunities more clearly.

Mergers & Acquisitions



Changing Business Models

Let's look at the fundamental changes in business models in our industry. Some companies diversified themselves over the years by technology, making boards compliant to many different industry standards (CompactPCI, AdvancedTCA, VME, VPX, PMC/XMC/FMC, motherboards, small form factor, etc.) and selling them across all end-application segments. This strategy creates big logistics and profitability problems, especially with the commodity characteristics of the products built to some of these standards. The net effect is much lower GPM for companies who went this route and huge product management issues. Those who adopt a technology-diversification strategy are in a constant engineering dilemma: where do they spend their R&D dollars? With our industry being extremely fragmented across technologies and standards, this path will drive any Engineering VP and CEO crazy.

“Those who adopt a technology-diversification strategy are in a constant engineering dilemma: where do they spend their R&D dollars?”

³⁰ Press Release, “Lockheed Martin Acquires Chandler/May, Inc.”, Lockheed Martin, November, 2012, URL: www.lockheedmartin.com/us/news/press-releases/2012/november/1113hq-chandler-may.html

³¹ Lolita C. Baldor, “Military weighs cutbacks, shifts in drone programs”, U.S. News & World Report, February 11, 2013, URL: www.usnews.com/news/politics/articles/2013/02/11/military-weighs-cutbacks-shifts-in-drone-programs

Some companies diversify by target market, making products specifically for industrial, transportation, telecom, or certain military market segments. That turns out to be just another technology diversification strategy, since each end-use market requires products compliant to different industry technology standards. The net effect of a target-market strategy is the same as a technology diversification strategy: lower GPM. Our industry does not lend itself to multiple target-market strategies very well, as many companies have discovered.

Some companies take a technology-diversification or target-market strategy and modify it with a geographical diversification strategy (i.e., selling certain technology products, or products targeted at specific industry segments, in target countries around the world). That, as it turns out, makes the problems associated with a technology-diversification or target-market strategy even worse. Costs, risks, and complexity rise when dealing with different currencies. Dealing with different languages and laws make logistics issues increase radically.

As we can see, the basic diversification strategies all exhibit significant problems and shortcomings. Our industry is too fragmented, across both technologies and different end-applications, for these basic strategies to be effective. Market segmentation exercises lead one into a quagmire of conflicts. None of our industry market segments are large enough to offer economies of scale to leverage low GPM products into decent profits. Additionally, technologies change across the target-market segments at different rates: the grass is always greener and growth is always better in segments other than the one you are supporting.

“The basic diversification strategies all exhibit significant problems and shortcomings.”

So what new strategy makes sense? A GPM strategy resolves many of the problems associated with traditional strategies. GPM strategies integrate both the technology and target-market focus into a single more effective strategy. Stay away from low GPM commodity technologies. Avoid low GPM target market segments. Eliminate low GPM geographic markets. In other words, find the high GPM niches in technology, end-application, and geographic market segments. The market for board products is not a homogeneous market. It is a market that consists of many small unique niches, some of them attractively profitable and others marginally profitable. Focus on the growth in profit margins, not growth in sales. Pursue profitable customers, eliminate unprofitable prospects and present marginal customers.

“A GPM strategy resolves many of the problems associated with traditional strategies.”

One way to accomplish the transition to a GPM strategy is to become a systems vendor. Designing a high-performance VPX processor card today is approaching \$1 million in R&D costs (considering the complexity of designing with high-frequency fabrics, advanced cooling techniques, advanced processors like GPGPUs, the extensive testing for temperature, shock, and vibration, the testing software, the drivers and operating system ports, and the number of engineers involved). If you are selling just this board, the revenue received will be low for a long period of time and that will extend your payback period (to recover your total R&D costs). A longer payback period yields a lower return on investment. If you integrate that board into a system, with the packaging, backplane, power supply, and application-appropriate functions on other boards, the selling price of the system is much larger. The larger dollar amount of the system sale will reduce your payback period, increase your ROI, and increase your overall profitability.

Industry pundits have talked about this transition from a board industry to a systems industry, mostly from a technology or market segment perspective. As R&D costs to design complex boards go up, ROI time extends if you are not a systems vendor. If you keep a board vendor mentality, you must minimize your resources in engineering and design products using a “reference design” from some processor company. All the other board-vendor-mentality competitors have access to the same “reference design” and minimize their R&D costs too. That, in turn, creates a low GPM commodity market for the products from the beginning. We see this result every day in commodity markets like telecom, industrial, small form factor, transportation, and other low-GPM market segments. Just a cursory look at the financial statements of some of the public companies in our industry will prove this point.

Going to a GPM strategy makes a lot of sense today, considering the poor macroeconomic conditions, the decline in European GDP, the uncertainty in the military budgets, and the general lack of clarity across all market segments. There are only three ways to make money in this industry, based on the values you add to your product:

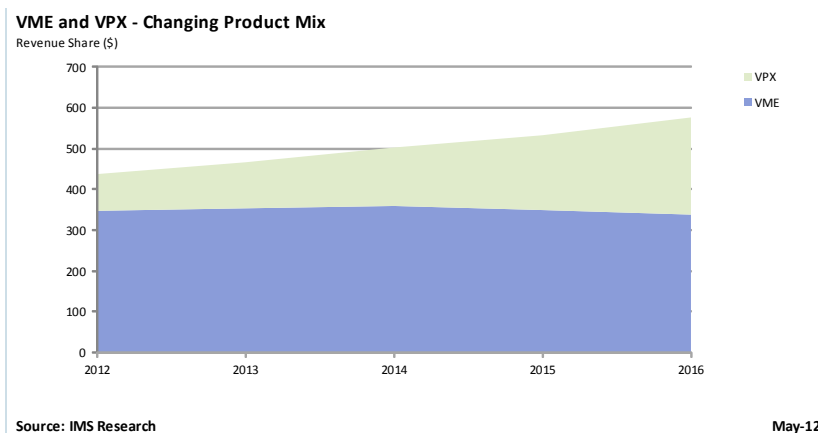
- **Manufacturing Value:** The world rewards manufacturing value-added at about 8% GPM. If you doubt this statement, look at the financial statements of the CEMs (Contract Electronic Manufacturers). The only way to make any money based on manufacturing value-added is to produce huge volumes. Our markets are not high-volume markets. They are all niches. If you are spinning-out products with a few engineers, on different form factors, based on some commonly available processor reference design, don't fool yourself. Those products contain only manufacturing value-added and your GPM will approach 8%.
- **Service Value:** Integration of different boards, chassis, backplanes, power supplies, and software is a service value-added function. The market rewards integration at about 20-25% GPM. But integration is labor-intensive and much of the labor used is expensive engineering talent. These engineers must multi-task over numerous integration projects to keep labor costs from getting out of control. This creates an inherent limit to the growth and size of a pure integration company. Also, integration companies are competitively vulnerable to companies selling systems.
- **Intellectual Value:** Designing innovative solutions, with very high-performance processors, interconnects, and advanced cooling techniques, creates intellectual value-added products. The GPM of these products can approach 70% and averages about 50% in our industry. The volumes are low, but the margins are very attractive. Intellectual value-added products provide the best kind of differentiation in competitive markets and are the foundation of a GPM strategy.

How do you initiate a GPM strategy if you are presently in a low-GPM market segment? It is easy. As a CEO or VP, you need to insure that your people discard all their previous commodity low-margin thinking and experience, and whole-heartedly support the transition plan to higher GPM products and markets. To facilitate this change in mental attitude, adopt a "scorched earth" policy as you exit. You will continue to receive RFQ's (request for quotation) from previous marginal customers and commodity-buying prospects to bid on low-margin orders. Quote a price 10-15% below what you think your commodity-thinking competitors will bid and quote the customer an 18-month lead-time. The customer cannot live with the lead-time you have quoted, but he will take your price, which he likes, and beat your competitor's brains out with it. That will make the order even more unprofitable for whoever takes it. As you exit a low-margin market segment, remove as much profit as you can from any orders you see as you move into higher GPM products and markets. That technique should make the transition easier and much more fun for the sales team.

Market Estimates

VPX markets

In 2011, we were expecting the VPX market to hit the inflection crossover point with VME in 2013. Market conditions have obviously delayed that inflection. In January, at Embedded Tech Trends 2013, IMS Research shared new data on the VPX market. From their research, it appears that VME will continue stronger than expected, with the inflection point moved out beyond 2016. This could change depending on the outcome of budget allocations for defense programs slated to use VPX technology.



Summary

For most embedded board and systems companies, Q1 has been very good for sales and design-ins. We are now in the shadow of “sequester” and government pundits are all claiming doom and gloom ahead. However, sequester is turning out to be just another Y2K or the predicted end of the Mayan long-count calendar . . . so far. The U.S. stock market is hitting new all-time highs while consumer confidence surveys say the economy is weak. We have a lot of disparity between the macroeconomic conditions and the microeconomic observations. This disparity is like a stretched rubber band: it has to snap back at some point and release the energy (eliminating the large differences). We just don’t know if the snap back will be fast or slow, where it will happen, or when.

Present conditions are testing the skill and determination of many embedded board and systems companies today. There are only two basic strategies to consider as we go through this period of uncertainty: trade margin for volume (a commodity-based sales strategy) or trade volume for margin (a GPM-based sales strategy). The GPM of a company is a measure of that company’s efficiency and leverage. 8-10% GPM is very inefficient and offers very little leverage. 20-40% GPM is fairly efficient and creates some leverage. But, 50% GPM (or better) gives a company great opportunities and flexibility in uncertain times. At 40-50% GPM, management can spend its time looking for new market opportunities with new technologies instead of trying to beat a profit out of low-margin sales from commodity technologies in commodity markets. Quit managing low-margin sales, start managing GPM, and your future will be bright no matter what the macroeconomic conditions may be. If you are the market share leader in a low GPM segment, you are just the leper with the most fingers.

“If you are the market share leader in a low GPM segment, you are just the leper with the most fingers.”

We live in a post-industrial world. That is why the margins on commodity small form factor and motherboard products are very low. Look at the financial statements of the industrial (manufacturing) companies: they show low margins, low efficiency, and very little leverage.

We live in a post-telecom world. That is why selling telecom boards and boxes offer very low margins as a reward. Look at the financial statements of the telecom service providers and the telecom equipment makers: they show declining sales, lower margins, lower efficiency, and very little leverage. If you sell products to those markets and customers, you will experience “transference”: you will inherit the business model and the low GPM characteristics of your customer. If you sell to a low-price-driven commodity buyer, they will change you into a low-margin commodity supplier. They will infect you with the “financial typhoid” disease rampant in their industry.

We live in a pre-military world today. We are NOT in a post-military world. The Middle East remains volatile with unstable governments. Most Middle East countries are in civil war. Iran continues to destabilize the region and seeks nuclear weapons. Africa is the new Middle East for the terrorist organizations. North Korea is rattling their sabers again with new nuclear tests, missile launches, and threats against South Korea. China is rising as a new air and naval power. India and Pakistan are still at odds over Kashmir. China and Japan are locking horns over disputed islands in the Pacific. China claims control of the Taiwan Strait. The Russians left Afghanistan and Georgia, but they will show-up somewhere else soon. Even New Jersey is becoming unstable, in the aftermath of Hurricane Sandy and Governor Christie’s radical political shift to the left. We have the potential for more military conflicts in the future, not less. We will need advanced military systems (intelligence platforms and weapons platforms) in the future. We may need fewer of them, but they must be much more capable of carrying out specific missions than the platforms we have today.

The most promising technologies for more advanced RADAR, SONAR, SIGINT, COMINT, ELINT, EW systems are sensors and optical interconnects. Sensor technology is advancing dramatically, creating huge amounts of data to be analyzed. We already have the processing power to handle this data. GPGPUs, Intel processors with AVX (Advanced Vector Extensions), and Freescale processors with AltiVec capabilities give us the horsepower. The problem is that we are I/O bound: these processors can handle more data than today’s I/O interconnects can deliver in realtime. Copper connections, as well as the Neanderthalian protocol stacks on serial fabrics, are the limiting factors

“Copper connections, as well as the Neanderthalian protocol stacks on serial fabrics, are the limiting factors of computing performance.”

of computing performance. We must go to optical connections when data rates exceed 10-15 Gb/s in critical embedded systems and when the advanced processors increase their computing capabilities.

Choosing any option other than a GPM strategy is madness. We live in a fragmented industry of niches. And none of the niches offer the volumes required for a successful commodity volume-based strategy. Ignore all the market research reports on our industry. They all focus on the revenues in the segments, not the margins (i.e., the quality of the revenues). That information, by itself, is worthless. Put the financials of the companies with low-margin/high-volume strategies under a microscope and you will see the “financial typhoid” germs clearly.

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