



Market Research

VITA Market Developments

Quarterly Report
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Embedded Market Research



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Brian Arbuckle Autobiography

Brian Arbuckle is a market analyst specializing in embedded computing. Brian has an engineering degree from the University of Warwick and an MBA. His career has spanned marketing management roles in industry for electronic and mechanical components and systems and communications networks. He has worked in analyst roles for technical market research organisations, IHS Markit and Informattech and in recent years has authored an annual market research report on the embedded computing industry.

Forward

VITA has commissioned this market research to gather information on data related to the most popular of VITA standards. We are planning quarterly updates on trends, contracts, and products. A survey is underway to gather market numbers from key suppliers to the industry.

This paper reviews highlights and developments during the first trading quarter of 2021 and the trends that are driving technology development for VITA technology boards and systems.

Introduction

The world of industry and business continues to be affected by the global pandemic, the impact on financial results is beginning to crystallize as results for 2020 are published. Vendors of VITA technology products have benefited from the relative strength of the military embedded systems market while witnessing disruption in the commercial aerospace industry so severely affected by national lock downs and international travel restrictions. VITA members continue to publish good results as defense spending budgets and programs have to date been well supported.

Following the change in administration, demands to combat Covid, and stimulate the economy directly, the outlook for US defense spending growth longer term is less clear. In the last week of March, President Biden signed a \$1.9 trillion Covid-19 relief package, almost three times the size of the annual US budget. The only noticeable growth in overall defense spending is occurring in Europe and Asia but budgets are small in comparison to that of the US.

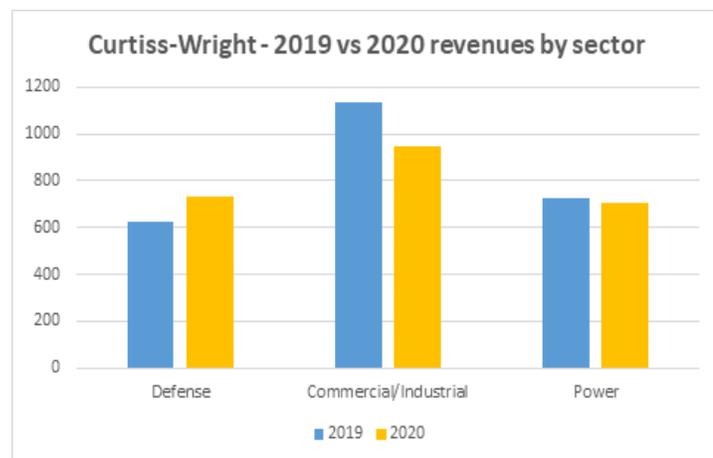
Financial Results

Results published by two of the major players in the military embedded technology market, indicate that the defense market in 2020 has remained buoyant while the other markets have suffered.

Curtiss Wright Corporation has reported 10-K figures for December 31, 2020 which feature a 17% increase in defense division sales compared to a 17% drop in commercial/industrial sales and 2% drop in power division sales from 2019. Operating income in the defense division has risen 2% while the commercial/industrial division has suffered a 55% drop and power a 14% drop in the same period.

Curtiss-Wright reports in their latest 10-K that defense sales increased \$184 million, or 17%, to \$1,263 million, as compared to the prior year period, primarily due to higher sales in the naval defense and aerospace defense markets. The naval defense market benefited from higher sales of \$56 million on the Virginia-class and Columbia-class submarine programs, as well as the impact of the acquisition of 901D Holdings, LLC, which contributed incremental sales of \$46 million. Sales in the aerospace defense market increased primarily due to higher foreign military sales of \$14 million as well as higher sales of \$14 million on the F-35 fighter jet program.

Commercial sales (aerospace, power generation and general industrial) decreased \$281 million, or 20%, to \$1,128 million, primarily due to the ongoing impact from the COVID-19

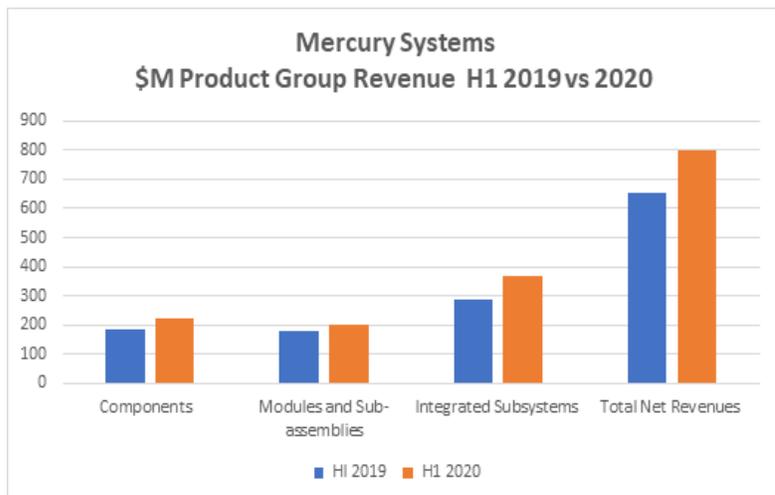
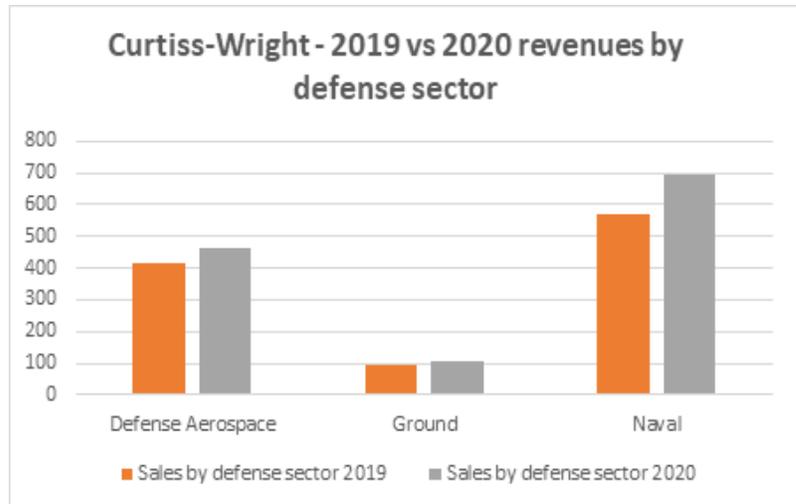


pandemic, which resulted in lower sales across all markets. In the commercial aerospace market, the company experienced lower demand for actuation and sensors equipment as well as surface treatment services, which resulted in sales decreases of \$67 million and \$29 million, respectively. Sales in the power generation market decreased primarily due to lower domestic and international aftermarket sales of \$37 million.

Lower demand in the general industrial market for industrial vehicle, industrial valve, and

industrial control products resulted in sales decreases of \$41 million, \$36 million, and \$16 million, respectively. Sales in the general industrial market were also negatively impacted by lower demand for surface treatment services, which resulted in a sales decrease of \$17 million.

Mercury Systems reported 6-month figures in January. Total revenues increased \$45.1 million, or 12.1%, to \$416.3 million during the six months ended January 1, 2021, as compared to \$371.2 million during the six months ended December 27, 2019. The increase is primarily due to \$37.0 million of additional organic revenues primarily related to integrated subsystems across radar and C4I applications, within land and naval platforms. The increases in organic revenues were primarily driven by a ground radar program, LTAMDS, an airborne program and the Patriot program, which were partially offset by decreases in a classified missile program, AIDEWS and F16/SABR programs.



Contract and Design Win Announcements

Not all defense contracts are announced publicly and for those that are, not all identify details of embedded computing technology on board! VITA management encourages members to be as explicit as they can in their news releases to reinforce customer confidence in the standards through highlighting examples of deployments. Only contract wins that specifically mention VITA-standards are reported below.

Airborne Systems

In early February, Abaco Systems, Inc. announced a design win with an initial value of \$505K, and a lifetime potential of \$4.5M supporting a major defense prime upgrade to an existing

Side Head Up Display platform in AC-130J gunships. This Side HUD application is to enable operational visibility of the battlespace for the platform. Abaco's newest high performance embedded computing system, the MAGIC1A in a 3U OpenVPX boxed form factor, was chosen after a competitive selection process. Abaco has delivered ~50 legacy MAGIC1 systems over the past several years for this application.

Land-based systems

In January, Abaco Systems, Inc. announced an initial award of a \$900K design win, with a lifetime potential win of several million, for a ground control interface supporting Space Force's Protected Tactical Satellite (PTS) communication program. PTS serves as a next generation anti-jamming satellite communication system to support war fighters globally. The win contains Abaco's VP868 FPGA card, as well as the FMC172 FPGA mezzanine card. The VP868 serves as a high performance 6U OpenVPX compliant plug-in module with advanced digital signal processing capabilities.

Following this award, in February Abaco announced a multi-million-dollar design win for sixty units of the VP430 radio frequency system-on-chip (RFSoc), direct RF processing system which will be used on a counter fire target acquisition radar upgrade. This new generation of counter fire sensor increases the ability to respond to newly identified threats and changing missions which enables more efficient counter measures. Abaco's conduction cooled, rugged, chip down, RF processing board is built on a 3U VPX form factor.

In late March it was announced that Ametek Inc. in Berwyn, Pa., has agreed to acquire Abaco Systems from Veritas Capital for a reported \$1.35 billion. According to Ametek, Abaco Systems has annual sales of approximately \$340 million.

Product Announcements

VPX Technology and SOSA™ Technical Standard

The sensor community served by the SOSA Technical Standard relies heavily on VPX modules, so defining a minimum set of 3U and 6U VPX slot and module profiles for the standard was a natural starting point. By defining these profiles, along with implementation rules for common utility functions such as power, control signals, and maintenance ports, the SOSA Consortium established the elements that define the basic building- blocks of SOSA systems, namely plug-in cards (PICs) and backplanes. As the initiative continues to move forward, several new products have been launched by the VITA community. Many of these products were announced in conjunction with the Open Group FACE™ and SOSA Consortia Technical Interchange Meeting held virtually on March 23.

In January, Abaco Systems Inc. introduced its first 3U VPX Ethernet switch with alignment to SOSA Technical Standard. In March, Abaco Systems announced the VP831 as the next generation of its VP889, a 3U VPX FPGA board, with 100G Ethernet on a design which is aligned with the SOSA Technical Standard. This release provides customers with an upgrade path to the latest technology, providing more bandwidth and increased processing capabilities at a lower power and size. Abaco also launched the MAGIC1A, a high-performance embedded computer (HPEC) with a modular, scalable approach to system design and architecture; based on 3U-VPX technology.

Interface Concept introduced the ComEth4412a, a 3U VPX dual plane hybrid PCIe Gen 3 and 40 Gigabit Ethernet Switch, developed in alignment with the SOSA Technical standard. The

ComEth4412a 3U VPX board is compliant with the SOSA/VITA 65.0 switch profile SLT3-SWH-6F8U-14.4.15.

Epiq Solutions, an engineering firm developing cutting-edge RF tools for detailed insight into RF environments and wireless threats, introduced the Sidekiq™ VPX400, a SOSA-aligned RF transceiver solution designed to support the rapid development of converged SIGINT/EW platforms. The Sidekiq VPX400 provides a complete antenna-to-bits, multi-channel, phase-coherent RF transceiver solution in a single 3U VPX form factor.

Illustrating a great example of collaboration within the VITA community, Pentek, Inc. announced in late March, a development platform, the Model 8256, that is aligned to the SOSA Technical Standard. The Model 8256 is a 3U VPX platform with IPMI and connectivity for RF and optical interfaces. The Model 8256 is ideal for application development with Pentek's Quartz® RFSoc data acquisition and processing boards. Pentek's SOSA aligned products facilitate interoperability, re-use, and rapid technology insertion, all consistent with the SOSA Consortium's approach and vision.

Several Pentek partners and key contributors to the emerging SOSA Technical Standard were involved in the development of this platform. Pentek teamed up with Elma Electronics for backplane and system management components, Interface Concept for backplane switch modules, Concurrent Technologies for single board computer modules, and Crossfield Technology for IPMI and chassis management support; all specifically designed to be in alignment with the SOSA Technical Standard.

Backplane Technology

Elma Electronic Inc. has added two 3U backplanes to its growing family of products aligned to the SOSA Technical Standard. Available populated with or without VITA 67.3 connectors for timing and RF connectivity, the 6-slot and 8-slot backplanes provide the foundation for complex, high-speed signal processing systems.

Chassis Technology

Pixus Technologies has developed an OpenVPX chassis platform supporting speeds above 100GbE and 2500W of cooling. The 9U RiCool chassis platform for 6U OpenVPX boards features dual hot-swappable 191 CFM fans for cooling up to 2500W. The design allows the use of rear transition modules (RTMs) in all slots. Rear-pluggable power supply units, available in various wattage and output options, provide power for the VPX and custom rails.

Pixus introduced a versatile alarm card for fan and voltage monitoring and control. The alarm card can be used in various OpenVPX, VME/VME64x, CompactPCI, cPCI Serial, and other open standard architecture chassis platforms.

VME Technology

Interface Concept announced the ComEth4000e, a new 6U VME 1/10/40 Gigabit Ethernet Switching board, dedicated to defense and industrial high-computing applications. The ComEth4000e Gigabit Ethernet switch features 10/40 Gigabit Ethernet ports made available via special mezzanine boards, on a 1-slot or 2-slots 6U VME form-factor (air-cooled configuration).

XMC Technology

In February, Pentek Inc. announced the newest member of its highly popular Jade® family of high-performance XMC FPGA modules. The Jade Model 71891 XMC module is an L-Band RF tuner with two 400 MHz A/Ds based on the high-density Xilinx Kintex UltraScale FPGA. The

Model 71891 is designed for connection directly to SATCOM or communications system L-band signals.

EIZO released Condor NVP2009AxX, a rugged XMC graphics/GPGPU card with a field programmable configuration of analog and digital outputs. The rear XMC pin-out is compatible with VPX systems that follow VITA 46.9 x12d+x8d+24s.

Defense Budgets and Spending

(Source: Janes.com)

United States

While the US defense budget will remain largely flat for 2021, the outlook for 2022 and beyond is somewhat under pressure. On March 16, fifty-two congressional Democrats asked President Biden to reduce the Pentagon budget for FY 2022 to prioritise spending on fighting Covid-19 and an economic crisis. Rather than requesting a flat Pentagon budget, the lawmakers urged Biden to seek a significantly reduced Pentagon topline, or total funding. The FY 2021 National Defense Authorization Act (NDAA) capped the Pentagon's budget for this year at \$740.5 billion, including overseas contingency operations (OCO) spending.

After releasing a shipbuilding plan in December 2020 that called for a significant fleet increase, US Navy (USN) officials say they now expect a course change with the arrival of the new administration led by President Joe Biden. "The last administration had a very aggressive focus on shipbuilding," acting Navy Secretary Thomas Harker said on February 2nd, during his keynote address at the National Defense Industrial Association (NDIA) 2021 Virtual Expeditionary Warfare Conference. In March, US lawmakers urged navy officials to refurbish warships and better utilize existing force assets. Members of the House Armed Services Committee (HASC) cautioned US Navy (USN) officials against retiring warships too early and pushed the service to find ways to modernize the existing fleet structure. HASC members warned USN officials against investing too much in unmanned systems at the expense of effectively maintaining the existing force of aircraft carriers and guided-missile cruisers or upgrading the carrier-embarked air wings.

A US Army aviation leader is confident the service's Future Attack Reconnaissance Aircraft (FARA) and Future Long-Range Assault Aircraft (FLRAA) efforts will continue into fiscal year 2022 despite a possible flat Pentagon budget. "As long as (they) remain an army priority, which I believe (they) will, then we will continue to find ways to execute these programmes," Brigadier General Robert Barrie, the programme executive officer (PEO) for aviation, said on March 17, during the Association of the United States Army's (AUSA's) annual Global Force conference. "The [Future Vertical Lift (FVL)] lines of effort are the priority for army aviation from a materiel development side and that is the clear guidance from army senior leaders from Army Futures Command as well as from Fort Rucker [the US Army Aviation Center of Excellence]." Bell is developing its 360 Invictus for FARA while Sikorsky is offering its Raider X co-axial rotor aircraft. Sikorsky-Boeing is offering its Defiant X rigid co-axial helicopter for FLRAA, while Bell is offering its V-280 Valor tiltrotor.

Europe

European Defense Agency (EDA) countries hit a record high, since the 2007 financial crisis, in defense spending. Total defense expenditure for nearly all EU countries in 2019 was the highest level in more than a dozen years, according to the EDA, which released the new figures on January 28, 2021.

The German government approved the benchmarks for the federal budget on March 24, including the defense budget and funding plan until 2025. This includes a 2022 defense budget totalling \$58 billion, a 5% increase from 2021. Germany's Defense Minister said the increase is necessary to fill capability gaps and counter threats from unmanned aerial vehicles and hypersonic weapons, as well as in cyberspace, resulting from decades of cuts.

Sweden will embark on a major recapitalization of its surface combatant force following the conclusion of the 2021–25 defense bill process. Passed by Sweden's parliament, the Total Defense Bill will deliver "substantial reinforcement" in capabilities, equipment, personnel, and organisation, and signals "a significant and necessary change of direction" for the country's total defense posture, according to the Swedish Armed Forces. As a result, the Royal Swedish Navy (RSwN) will receive a funding increase of more than 60% budget across the 2021-25 period.

A larger common-funded NATO alliance budget to cover expanded D&D measures, including accelerated technological innovation and capability development, is part of Secretary General Jens Stoltenberg's NATO 2030 plan for modernising and boosting NATO's defense posture. Stoltenberg said allies must agree that they "need more resources to do more". NATO's common annual fund is split into three budgets: civil, military, and infrastructure, of which the military budget is currently worth approximately \$1.6 billion.

Asia Pacific Region

The United Kingdom is aiming to further expand its presence in the Asia-Pacific over the coming few years by deepening its relationships with regional countries. This commitment is a response to growing Asian security concerns and is intended to support increased efforts to expand defense and security trade links in the region and related industrial collaboration activity. Such expansion is also being targeted on the back of recent growth in UK defense sales to the Asia-Pacific.

UK defense exports to the region in 2018 were estimated to be worth 2% of total UK defense exports during that year, according to a report published in October 2020 by UK Defense and Security Exports (UKDSE) – a part of the government's Department for International Trade (DIT). The UK regards BAE Systems' program to supply Hunter-class frigates to Australia as an example of the partnership approach it wants to promote in efforts to boost exports in the Asia-Pacific. The report also showed that by 2019 UK defense sales to the region were estimated to have grown to 6% of total UK defense exports, behind the Middle East, Europe, and North America.

According to the report, the UK's total defense exports were worth \$15.4 billion in 2019, meaning sales to the Asia-Pacific in that year were worth approximately \$923 million. Total UK security exports in 2019 were valued at \$10.07 billion, with security sales to the Asia-Pacific, including cyber defense, worth \$1.15 billion. The Asia-Pacific ranks third in terms of UK security export regions behind Europe and North America, but the report notes that the region "is a notable market to focus on".

China

China's defense budget in 2021 will increase by 6.8% to \$209.4 billion, according to the Chinese government. The expenditure – the first within China's new five-year plan – was announced on March 5th.

The new defense budget marks the sixth year in succession when the defense budget has increased by less than 10%. However, growth in the budget is also indicative of China's economic resilience to the effects of the Covid-19 pandemic.

China's 2021 defense budget represents the largest growth in military spending since 2019 and is a slight increase over the 6.6% growth recorded in 2020. China's official defense budget last year was \$190 billion and was the lowest rate of growth recorded for many years. In 2019 China's defense budget increased by 7.5%. The 2021 defense budget is notable because it is the first within the country's new 14th Five Year Plan (FYP), which runs from 2021 to 2025. China's objective during this period is to "make major strides in the modernisation of national defense and the armed forces".

The plan is also aimed at accelerating the PLA's transition from "mechanisation" towards "informationization" and "intelligentization". This is reference to a shift from military platform modernisation towards the adoption of digital and networked systems, and the integration of 'intelligent' systems utilising technologies such as artificial intelligence.

What does this announcement mean for long-term Chinese military expenditure? China's new defense budget marks an end to its recent slowdown. However, it does not represent a significant departure from the country's previous military-expenditure trajectory. At current rates of expansion, total Chinese defense spending can be expected to exceed \$309 billion by 2024.

India

India's defense budget for 2021-22 provides a large increase for procurements from local industry. The new defense expenditure allocated about \$9.7 billion towards local defense acquisitions representing a year-on-year increase of 35%. Local procurements in 2020-21 received a budget of \$6.93 billion. India plans to spend a total of about \$130 billion on military modernization over the next five years, including expanded funding for domestic procurements.

Expanding orders for Indian-made defense equipment is expected to include contracts to supply the Indian Air Force and Indian Army with Hindustan Aeronautics Limited's (HAL's) Light Combat Helicopter. This funding includes a \$6.4 billion contract awarded to HAL in February for 83 indigenously designed Tejas Light Combat Aircraft (LCA) for the Indian Air Force (IAF). HAL is also likely to win soon an order for its indigenously designed Light Combat Helicopter (LCH).

Indonesia

The United Arab Emirates (UAE) is to invest \$10 billion in Indonesia to support the development of strategic sectors, as reported on March 23rd. The planned investment comes as the two countries expand defense-industrial ties. UAE will make the new funding available to Indonesia's sovereign wealth fund – the Indonesia Investment Authority (INA), which was set up in February – in domains that have "potential for growth".

Singapore

The government of Singapore announced on February 16 a 2021 defense budget of \$11.56 billion. The new allocation, which amounts to about 15% of total government outlay for the year, is a 12.7% increase over the revised 2020 defense budget but just a 1.8% increase compared to the original 2020 expenditure. The government made no reference to the cuts in the 2020 defense expenditure, but indicated they were linked with rising economic headwinds, specifically the Covid-19 pandemic.

Middle East and Africa

A challenging economic picture during 2020 and changing dynamics in procurement processes, timelines and requirements may alter the longer-term growth of defense budgets in the Gulf region. The latest analysis from Janes highlights that defense spending in Gulf Co-operation

Council (GCC) countries is to decline by 9.4% in 2021, as countries in the region face pressure due to the impact of Covid-19 and low oil prices but with a swift rebound in coming years.

Janes data shows that defense expenditure for the GCC states rose by 5.4% in 2020, from \$94.9 billion in 2019 to \$100 billion in 2020. However, in 2021 this figure is expected to drop to \$90.6 billion before falling to \$89.4 billion in 2022. A return to growth should mean that spending will return to pre-pandemic levels by 2024. Janes also expects procurement expenditure to decline slightly to \$13.25 billion in 2021, following a 4.5% surge in 2020.

Janes anticipates that localization in key markets such as Saudi Arabia and the UAE will result in near-term changes to the region's defense equipment procurements. Both countries are also working to leverage new technologies in the defense sector – in order to build out their own conventional deterrence capabilities and to reduce the reliance on foreign suppliers. Such technologies include unmanned systems ranging from unmanned aerial vehicles (UAVs) to unmanned surface vessels (USVs) that can patrol maritime domains and improve situational awareness and security.

The Abraham Accords are also expected to open the possibilities of sales of new and advanced equipment to its signatories, helping to increase competition in the Gulf equipment marketplace with technology that is compatible with previously acquired Western systems. Israeli capabilities in a variety of key advanced technological areas, such as UAVs, air defense, and cybersecurity, are all key areas of interest for the Gulf's militaries. Financial and technical collaboration in areas such as AI, big data analytics, and cybersecurity will help to both enable and enhance capabilities, but also address mutual threats through complementary development. The acquisition of the Lockheed Martin F-35A Lightning II Joint Strike Fighter by the UAE following the signing of the Abraham Accords will also help to link the US, Israeli, and Emirati defense industries together.

Summary

There are very few industries that would expect Q1 2021 to be representative of normal trading given the disruption of business due to the pandemic. However, leading VITA member companies have reported significant growth in the military embedded systems market. Whether this growth can continue may depend largely on whether US defense spending on relevant programs is impacted by the demands of Covid relief and economic stimulus spending.

Looking at the significant number of new product releases based on Open VPX technology in alignment with the SOSA™ Technical Standard, it is clear that every effort is being made to embrace US DoD procurement guidance. Given that VME technology has endured for 40 years and is still witnessing new product releases, suggests that, armed with OpenVPX technology, the VITA community has the strength, size and stamina to support the war-fighter into the foreseeable future.



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