



Case Study  
Intel® Core™ microarchitecture  
COTS Aerospace & Defense



## Standards-Based COTS Solutions for Aerospace & Defense

Curtiss-Wright enhances its COTS aerospace and defense product line by adding the energy-efficient performance of Intel® Core™ microarchitecture

**Challenge** The heart of the US Defense Department's transformation initiative is a set of aerospace and defense (A&D) applications that impose rigorous requirements for high-performance computing with reduced size, weight and power (SWaP). The DoD and its prime contractors are now focused on meeting the challenge of spiral technology insertion by deploying computing and communications solutions that combine leading-edge technologies, embedded lifecycle support and low cost.

Meeting the demands of high-bandwidth signal processing, high-resolution video and computationally complex battlefield and vehicle management systems imposes technical challenges for contractors, who must deliver validated hardware and software that provides value-added capabilities, while performing within severe time-to-market and budgetary constraints.

**Solution** Curtiss-Wright Controls for Embedded Computing is now meeting this challenge by expanding its product line of commercial off the shelf (COTS) single-board computer (SBC) solutions to include the performance and power management advantages of Intel® Core™ Duo processors. Curtiss-Wright, an Affiliate Member of the Intel® Communications Alliance, is using Intel® multi-core processors validated with Intel® chipsets as the foundation for new single board computers designed to meet the evolving requirements for a broad range A&D systems.

Curtiss-Wright products based on Intel multi-core processors include a 3U CompactPCI\* board that can operate as a system controller, peripheral processor or an I/O processing node and a 6U VME64x board that, with the addition of a hard drive, becomes a full-featured modular computing platform. Both SBCs are designed for rugged air- or conduction-cooled systems. Curtiss-Wright cites the fact that Intel multi-core processors deliver substantial gains in performance per watt, help reduce time-to-market while providing the cost advantages of standards-based COTS technology with embedded lifecycle support.

“One of the foremost advantages of Intel Core Duo processors is significantly improved floating-point performance, an essential requirement for high-speed digital signal processing.”

Jason Smith  
Product Marketing Manager  
Curtiss-Wright Controls

**“Our extensive code base of symmetric multiprocessing applications runs on Intel multi-core processors without code alterations. Intel Core microarchitecture maximizes the performance of applications with very large data sets.”**

Jason Smith  
Product Marketing Manager  
Curtiss-Wright Controls

## **Meeting the Demands of A&D Systems**

A&D systems are raising the bar for computational performance and communications bandwidth. The modern battle space is a demanding environment characterized by high-speed networks of sensor arrays, increasing use of video and high-speed signal processing, high-resolution displays and sophisticated graphical interfaces. Moreover, today's A&D systems must be designed to help battlefield commanders continuously maintain real-time situational awareness of thousands of moving vehicles, portable systems and potential targets.

In addition to its computational performance and bandwidth, any computing or communications system designed for use in a tank, an Unmanned Aerial Vehicle (UAV), a manned aircraft or carried by a soldier will be rigorously evaluated according to how big it is, how much power it consumes and how much it costs. These are some of the primary motivations for Curtiss-Wright's adoption of Intel® Core™ microarchitecture.

## **Curtiss-Wright Adopts Intel® Core™ Microarchitecture**

With a company heritage spanning 75 years, Curtiss-Wright Controls is one of the defense industry's most well-known and highly respected suppliers of commercial and rugged-grade COTS computing solutions, from board-level products to fully integrated subsystems. Curtiss-Wright provides its customers with expertise in conduction cooling, high-speed I/O, high-density computing, specialized chassis designs, custom and component engineering services and full embedded lifecycle support.

## **From Multiple Processors to Multi-Core Architecture**

For the past 10 years Curtiss-Wright has manufactured boards in dual- and quad-CPU configurations that provide the ability to dedicate one or more processor cores to the task of simultaneously handling real-time operating systems and applications, in addition to conventional or non real-time operating systems and software. The availability of Intel multi-core processors enables Curtiss-Wright to evolve these multi-CPU designs to achieve higher compute density, reduced chip count and lower platform bill of materials cost, with dramatically reduced power consumption.

Within the A&D environment, these applications range from high-definition video processing, synthetic aperture radar, and cryptographic processing to real-time analysis of acoustic and image signatures. All of these applications require the ability to rapidly scan large databases, placing demands on the computing platform for high levels of floating-point processing performance and high-bandwidth connections to large amounts of shared addressable memory. Intel multi-core processors and chipsets enable Curtiss-Wright to benefit from the technology spiral of Moore's Law while staying within acceptable power budgets. Going forward, Curtiss-Wright anticipates processors that will implement more cores to achieve higher performance, as Intel's silicon geometries continue to shrink.

Intel is combining the benefits of two high-performance execution cores with the added benefit of intelligent power management features to deliver significantly greater performance/watt over previous generations of Intel® processors. At the same time, Intel is maintaining backward software-compatibility with its earlier 32-bit processors. For Curtiss-Wright, the familiar Intel® architecture instruction set also enables the advantage of software commonality throughout a product line of Intel®-based solutions.

From Curtiss-Wright's perspective one of the foremost advantages of Intel Core Duo processors is significantly improved floating-point performance, an essential requirement for high-speed digital signal processing. The Intel Core Duo processor is an ideal solution for SMP, running multi-threaded applications and providing the foundation for multi-tasking environments such as in-vehicle management systems. The two independent processing cores can support multiple operating systems simultaneously using Intel® Virtualization Technology<sup>A</sup> to provide design flexibility for custom applications. The use of Streaming SIMD Extensions 3 (SSE3) enhances the performance of multimedia applications. Additional instructions improve thread synchronization, complex arithmetic, graphics, and video encoding. Both Intel Core Duo and Intel® Core™ Solo processors include ball grid array (BGA) packaging, which is ideally suited to ruggedized, convection-cooled embedded configurations.

## Energy-Efficient Performance

Integrating two execution cores into the Intel Core Duo processor provides a significant performance improvement while remaining in a thermal envelope that is similar to Intel® Pentium® M processors.

To minimize power consumption, the address and data buffers turn off during intervals when there is no activity. Enhanced Intel SpeedStep® technology allows a system to dynamically adjust the processor's voltage and core frequency, which decreases average power consumption and reduces average heat production. Intel® Advanced Thermal Manager supports new digital temperature sensors and thermal monitors on each execution core to enhance thermal monitoring accuracy.

Utilizing Intel® Dynamic Power Coordination, application software or the operating system can change the sleep state of each of the execution cores, enabling the processor to achieve the ideal balance between performance and power dissipation. The Intel Core Duo processor's dynamic power management capabilities are especially useful in unmanned applications, such as UAVs, where energy-efficient performance translates to longer-term mission effectiveness.

## Embedded Lifecycle Support

As a leading supplier of COTS systems, Curtiss-Wright is keenly aware of the demand for cutting-edge technology that delivers maximum performance for every dollar expended, while meeting the requirements of multi-year A&D technology insertion cycles including system-building, writing software and testing. While COTS solutions provide Curtiss-Wright customers with the benefits of with leading-edge technology, lifecycle support is another critically important requirement, which can run counter to the general view of COTS components as relatively short-life products.

Intel ensures a minimum five-year active life on embedded components, with 18-month last-time-to-buy notification, for a total of six and a half years of embedded lifecycle support. Curtiss-Wright supports products for longer than 7 years, depending upon customer needs.

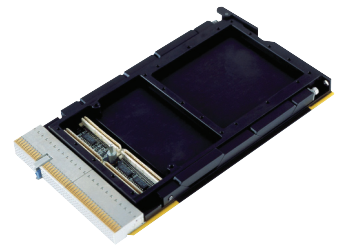
## Intel Advantages: Platform Validation and Tools

Intel's "platform" initiative describes the platform-level validation of the Intel Core Duo and Intel Core Solo processors with a chipset consisting of the Intel® 7520 memory controller hub (MCH) and Intel® 6300ESB I/O controller hub (ICH). The use of the validated platform configuration and Intel and software development tools provided Curtiss-Wright with a seamless hardware and software integration path.

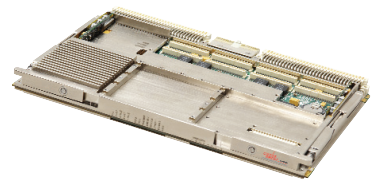
By adhering closely to Intel's platform reference design, Curtiss-Wright was able to boot and run three operating systems with completely functional peripherals in a matter of a few days.

In addition to providing support for multiple embedded operating systems, Intel provides software libraries optimized for the Intel Core microarchitecture. These software components include math, image processing and signal processing libraries, complemented by tools chains with compilers, thread analyzers, a performance analyzer and solutions from Intel's extensive third-party ecosystem, including members of the Intel Communications Alliance.

Thoroughly tested and validated software that is familiar to most programmers reduces development costs, accelerates time-to-market and has the added advantage of enabling Curtiss-Wright to focus its resources on key value-added features. These include multiple air and conduction-cooled ruggedization levels and features including built-in self-test (BIST), software controlled dynamic power management, thermal monitoring and power monitoring. Curtiss-Wright also provides customers with international support and ensures longevity of supply with lifecycle management.



"Eos" SCP/DCP-1201 3U cPCI SBC



"Zeus" SVME-1901 6U VME SBC

## Curtiss-Wright Products Based on Intel® Core™ Microarchitecture

Curtiss-Wright Controls has announced two single board computer products based on the energy-efficient performance and scalability of Intel Core Duo and Intel Core Solo processors:

### “Eos” SCP/DCP-1201 3U cPCI SBC\*

The Curtiss-Wright Controls SCP/DCP-1201 is a multifunctional 3U CompactPCI board designed to meet the needs of unmanned and mobile platforms that require a combination of high-performance, rich I/O and low power consumption. This compact form factor single-board computer includes an Intel Core Duo processor (or Intel Core Solo processor) at 1.67 GHz at 15W. Power consumption is 38W Typ. for the system equipped with the Intel Core Duo processor. The board can be configured for conduction- and air-cooled configurations.

The Eos SCP/DCP-1201 can operate as a system controller, peripheral processor or I/O processing nodes and includes a PCI Mezzanine Card (PMC) site for system expansion that supports a 64-bit PCIx interface. Support for a PMC site on a single 3U SBC enables integrators to significantly reduce the volume and cost of their subsystem solutions. As a system controller, the SCP/DCP-1201 is available in either a single- or two-slot configuration. With the addition of a SATA or USB hard drive and a PMC video card, the SCP/DCP-1201 becomes a full-featured platform.

### “Zeus” SVME-1901 6U VME SBC\*

The Zeus SVME-1901 single-board computer from Curtiss-Wright Controls supports one Intel Core Duo or Intel Core Solo processor. With an Intel Core Duo processor, the SVME-1901 acts as a dual-CPU 6U VME64x air-cooled board that meets requirements for a VME board with rich I/O interfaces, video and disk drives and expanded memory for applications processing. The board can be configured in both conduction- and air-cooled configurations. With the addition of a SCSI, SATA, or USB hard drive, the SVME-1901 becomes a full-featured computing platform.

Software for the SCP/DCP-1201 and SVME-1901 SBCs includes board support packages (BSPs) for operating system environments including Microsoft Windows XP Embedded\*, Solaris\* and Linux\*. Curtiss-Wright’s Intel-based SBCs will also support real-time operating environments, such as RT Linux and WindRiver VxWorks\*.

### On the Roadmap: Intel® Core™2 Duo Processors

With its energy-efficient performance characteristics and support for SMP applications, the Intel Core Duo processor provides an ideal solution for 3U and 6U embedded systems. The next-generation Intel® Core™2 Duo processor provides further performance enhancements with low power, and is designated by Curtiss-Wright as a drop-in replacement for the Intel Core Duo processor in its embedded designs. Curtiss-Wright anticipates that the next generation of Intel Core 2 Duo processors will provide a significant performance improvement per watt.

### Conclusion

Curtiss-Wright has added Intel embedded multi-core platform solutions to its embedded product portfolio to meet requirements of its aerospace and defense customers, with the cost advantages and leading-edge technologies of COTS building blocks. Intel Core Duo processors deliver performance per watt that meets the rigorous SwaP requirements of A&D systems. In addition to the benefits of low power consumption and high performance, Intel Core Duo processors provide embedded lifecycle support and the advantages of Intel’s multi-core product roadmap, which will provide even greater levels of energy-efficient performance.

### Learn More About Intel Multi-Core Processors and Curtiss-Wright Controls

More information about Intel multi-core processors and energy-efficient performance can be found on the Web at: <http://www.intel.com/go/military>

More information about the Intel® Communications Alliance, a community of communications and embedded developers and solutions providers, can be found at: <http://www.intel.com/go/ica>

More information about Curtiss-Wright Controls can be found at: <http://www.cwembedded.com/>

\*Intel® Virtualization Technology requires a computer system with an enabled Intel® processor, BIOS, virtual machine monitor (VMM) and, for some uses, certain platform software enabled for it. Functionality, performance or other benefits will vary depending on hardware and software configurations and may require a BIOS update. Software applications may not be compatible with all operating systems. Please check with your application vendor.

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