Engineering Capabilities

Curtiss-Wright Defense Solutions is a long established technology leader in the development of rugged electronic components and systems for commercial and defense applications. Serving as a technology and integration partner to its customers, Curtiss-Wright provides a full range of advanced, highly engineered solutions from modular open systems approaches to fully custom optimized solutions. Our unmatched capabilities ensure the success of your program's system development and integration.

Curtiss-Wright's advanced capabilities are classified into three categories:

1. Engineering and Manufacturing
2. Program Services
3. Support Services

Curtiss-Wright's Advanced Capabilities

Engineering and Manufacturing

- Systems Engineering
- System Integration and Test Capabilities
- Electrical Engineering
- Software Engineering
- Mechanical Engineering
- Integration of Third-Party Products
- Custom Systems
- CMMI Level 3
- Modified COTS (MCOTS)
- Advanced Cooling Technologies
- HALT/HASS Testing
- Environmental and EMC Testing
- System Design and Consultancy

Program Services

- Program Management
- Contract Mandated Reporting
- Earned Value Management Systems (EVMS)

Support Services

- Product Training and Field Support
- Product Lifecycle Management and Configuration Management
- Quality Control
- Embedded Partners

Systems Engineering

Curtiss-Wright's Systems Engineering discipline supports several stages of a product's lifecycle, and is staffed by experts in motion control, sensors, network-centric systems, platform level system integration and embedded hardware optimization. In the initial stages, Curtiss-Wright works with its customers to perform trade studies and analysis, and to define and capture the system requirements for their applications. At this stage, Curtiss-Wright also identifies the tools and methodologies needed to collect the requirements for the intended use of its customers' final application.

Customer requirements based either on existing Commercial Off The Shelf (COTS)-based products or customized solutions are transitioned to a working system by the architecture defined by the Systems Engineering team. The Systems Engineering team generates and maintains all artifacts related to the requirements gathering and managing of a product including the Requirements Traceability Matrix (RTM), the Interface Control Documents (ICD) and the overall system architecture. During the development stages, the Systems Engineering team acts as an interface between the customer and the System Design team. It supports aspects ranging from concept development through to design and production, and in some cases helps build and maintain prototypes. The team ensures compliance of the systems to various design needs and provides support for risk management and mitigation. At the later stages of the product lifecycle, the Systems Engineering discipline assumes a support role for ongoing operations, generating and updating user manuals and conducting any transitional activities.

System Integration and Test Capabilities

The System Integration and Verification (SIV) group has a wealth of skills and experience, coupled with a rich technical knowledge base, allowing it to meet customers' integration and test requirements.

The SIV group provides the following services:

- **Engineering support for products -** Troubleshoot and debug a wide range of products ranging from:
  - SBCs
  - Discrete I/O cards
  - Gyros
  - Motor controllers
- **Test planning and verification -** Generate test requirements and specifications used to:
  - Design test plans (DVT, HALT)
  - Test procedures (ATP, ESS, QUAL)
  - Design the test equipment to validate that the customer requirements are met
- **Test equipment software -** Modify existing drivers as well as create user-friendly drivers in:
  - Lab view
  - Visual basic
  - Lab windows for all types of test equipment interfaces
- **Qualification testing -** Experience in successful qualification tests on platforms such as:
  - Manned and unmanned flight vehicles
  - Ground vehicles
  - Submersibles
  - Ships

In qualifying defense and commercial vehicles, the SIV group has gained expertise with all the required qualification documents such as:

- **DO-160:** Environmental Conditions and Test Procedures for Airborne Equipment
- **MIL-STD-810:** Test Methods Standard for Environmental Engineering Considerations and Laboratory Tests
- **MIL-STD-461:** Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment
- **MIL-STD-1275:** Characteristics of 28 VDC Electrical Systems in Military Vehicles

Electrical Engineering Expertise

Our expert electrical engineering staff applies technical and creative skills to ensure our products conform to your requirements. We specialize in rapid product design and development for a broad and diverse range of products, building in solutions that lower costs throughout the product's life cycle. Our design capabilities range from single board products and subsystems to full turnkey product designs. Design and analysis modules are utilized to provide optimum designs for test and manufacturing. Our electrical engineering capabilities include:

- 3U and 6U SBC: micro controller, DSP, PowerQUICC™, Intel®, and Power Architecture®
- Communication interfaces (10/100/1000 Ethernet, ARINC 429, MIL-STD-1553, serial port RS-422/485/232, USB, SPI bus, CAN bus)
- I/O interfaces: digital I/O, analog I/O, analog to digital designs, digital to analog designs, synchro, resolver and encoder interfaces
- Power systems: AC/DC power supplies, low voltage (28V) and high-voltage (610V) motor control
- Control and measurements: hand controllers, gyro/rate sensor system, RTD interface
- Backplane designs: OpenVPX, VPX, VPX REDI, VXS, VMEbus, CompactPCI® (cPCI), RF, optical and mixed technology
- Rigid-Flex-Rigid board designs
- Radiation hardened and electro-magnetic pulse tolerance designs
- High-performance circuit board simulation and design
- FPGA and CPLD design
- Component analysis (RoHS compliance, parts obsolescence)
- Advanced signal integrity analysis for high-speed signaling greater than 10 Gbaud per pair

Software Engineering

Our software engineering staff has extensive development experience with all aspects of the real-time embedded software lifecycle, including diverse requirements such as DO-178B Level A. Curtiss-Wright specializes in rapid product design and development with software ranging from SBC Board Support Packages (BSPs) to fully qualified application software for complex embedded systems.

Capabilities include:

- Development and integration of custom Operating Systems (OS)
- Modification of vendor OS (Wind River® VxWorks®, Wind River GPP Linux®, Embedded Windows® XP)
- Custom BSPs
- Optimization of vendor BSPs
- Extensive Built-in Test (BIT) Library, Control System Component Libraries
- Diverse application software products: data recording, network attached storage, motor control, flight control, gyro, network communication, ammunition handling, control and sensor management

Our experienced staff also specializes in supporting customers' on-site integration. Our software engineering processes ensure quality through peer reviews, independent software quality assurance and configuration management.

Mechanical Engineering

The members of the Curtiss-Wright Mechanical Engineering Design team have an average of 25 years of experience in electronic packaging for harsh military environments, such as Nuclear Biological Chemical (NBC), Electromagnetic Interference (EMI), shock, vibration, temperature and radiation. Our team's thorough understanding of these environments our customers receiving a robust design our customers receive a robust design that will meet end user requirements. We have expertise in employing technologies that include castings (Rubber Plaster Mold (RPM) and investment), precision machine parts, sheet metal, hydraulic and hydro-pneumatic, rigid-flex circuitry, rapid prototyping, specialized surfaces and others. Design concepts receive a thorough peer review and are also analyzed using Finite Element Analysis (FEA) and Computational Fluid Dynamics (CFD) software to ensure that the design will meet requirements the first time, maintaining cost and schedule by avoiding costly redesigns.

Integration of Third-Party Products

When specific features are required for your application that are not directly addressed by Curtiss-Wright COTS products, we can integrate third-party solutions into our systems. In these cases, Curtiss-Wright will test interoperability of our cards and systems with third party products, eliminating your risk and reducing your integration costs.

Custom Systems

Curtiss-Wright has the system integration expertise to create specific system solutions with tailored, optimized functionality for a specific platform or program. Our experienced Systems Design and Integration teams will analyze your system requirements and conduct trade studies to identify appropriate board level products, analyze data paths and select suitable cooling approaches. Further, we have a proven ruggedization technology pedigree that is utilized by our systems to ensure the final solution will provide high performance levels in your specified operating environment.

Example custom systems we have developed include:

- Advanced Mission Management System
- Ammunition Handling Controller
- Turret Drive Servo and Stabilization System
- Sensor Management Computer, Sensor and Payload Management
- Electronic Support Measures
- Ground Vehicle Control System
- Sensor Data Management
- Recording
- Secure Data-at-Rest (DAR)

CMMI Level 3

Curtiss-Wright in Santa Clarita, CA is appraised to CMMI (Capability Maturity Model Integration) Maturity Level 3. CMMI is a process improvement approach that provides organizations with the essential elements of effective processes. CMMI models are collections of best practices that help organizations to improve their processes. These models are developed by product teams with members from industry, government and the Software Engineering Institute (SEI).

Adhering to CMMI practices helps Curtiss-Wright dramatically improve its effectiveness, efficiency and quality. Receiving CMMI Level 3 appraisal is an important accomplishment in the aerospace and defense market. Prime contractors increasingly seek sub-contractors who are able to meet CMMI Level 3 requirements to provide assurance that solid and proven processes are in place for software and system development.

Modified COTS (MCOTS)

The rapid pace of technological innovation combined with customer demands for the latest technologies within shorter development times and limited budgets create major challenges for system designers and integrators. To address these challenges and achieve engineering excellence, defense and aerospace System Integration teams around the world are leveraging best-in-class technologies for their custom military designs and custom rugged computers. With an extensive library of market-leading COTS intellectual property, a multi-million dollar development and test infrastructure, and an experienced world class engineering team, Curtiss-Wright Modified COTS (MCOTS) products offer unmatched design and development expertise for tailored rugged computers. By combining its market-leading experience and expertise with its strong embedded industry partnerships, the MCOTS team makes it easier for you to design and develop efficient, high-performance, state-of-theart rugged military electronics.

Advanced Cooling Technologies

As components in our industry continue to shrink, their power density continues to grow, making cooling components more and more challenging. To accommodate these thermal challenges, Curtiss-Wright has developed a wide range of advanced cooling techniques to ensure the absolute best thermal performance and maximum reliability from our solutions.

We have developed:

- air-flow through (AFT) for standard VPX modules
- highly conductive material for enclosures in the CoolWall® technology
- a special implementation of heat pipes
- alternate thermal paths from standard conduction modules to minimize thermal resistance
- liquid-cooled chassis and liquid-cooled cards
- and are in process of developing even more new and exciting technology in this area.

HALT/HASS Testing

Nearly 100% of the products produced by Curtiss-Wright Defense Solutions are destined for the military market or the most demanding civil applications. In all applications, these solutions must be comprised of the most reliable hardware possible. Among many other tasks we employ to increase reliability, Curtiss-Wright mandates that a comprehensive ESS test plan is developed for all products to ensure that the Curtiss-Wright manufacturing process consistently produces production units in compliance with all performance requirements. In many cases, Highly Accelerated Life Tests (HALT) are used to determine the ultimate life of the product, and based on that information, Highly Accelerated Stress Screening is performed. These tests will be used to define test profiles for the ESS program which will be run on every single product built.

Environmental and EMC Testing

Curtiss-Wright offers full environmental testing of its systemlevel products to MIL standards including MIL-STD-810 and DO-160. Testing is performed either at Curtiss-Wright facilities or at the premises of accredited test contractors.

System products developed by Curtiss-Wright are all designed to meet applicable requirements from MILSTD-461 and/or DO-160 for EMI/EMC. Compliance to these standards is achieved through solid input power filtering, proper output filtering, proper conductive sealing of the enclosure and assurance that bonding requirements are met. All testing for these requirements is done at certified facilities and detailed test reports are developed to document the testing methodology and results.

System Design and Consultancy

Curtiss-Wright works with our customers to determine the best architecture for your platform needs, providing the right balance of performance, flexibility and cost is achieved. Our field application engineers and product specialists have an in-depth knowledge of our product range, helping you to move rapidly and reliably to your optimum solution.

Program Services

Program Management

Curtiss-Wright is a program-centric organization. A complete set of management tools is employed to provide the necessary visibility into all areas of technical scope, schedule and budget to ensure program success. These tools include:

- Work Breakdown Structure (WBS)
- Integrated Master Schedule (IMS)
- Work authorization
- Earned Value Management System (EVMS)
- Requirements management
- Technical performance measurement
- Change management
- Risk management
- Data management

Every program is assigned a Program Manager who is responsible for program performance. In all cases, the Program Manager has direct access to the highest levels of company management including the General Manager. The Program Manager acts as the focal point for interface with the customer and facilitates team communication. Our responsive organizational structure provides for close management of all project activities and agile decision making. This allows us to react quickly to changes or problems and allows upper management to be fully aware of key project activities. This is accomplished through both informal and formal processes. Our team approach enables project team members to have full authority to accomplish their tasks while interacting with senior company management on a daily basis. This provides a level of communication and visibility that is not found in larger organizations. Additionally, it enables the team members to leverage the wealth of technical and business experience of our senior managers.

Contract Mandated Reporting

The Program Management personnel at Curtiss-Wright employ industry standard management and reporting processes that cover the requirements of a broad segment of its customers. Curtiss-Wright provides programmatic and technical reporting based on the individual requirements of the programs ranging from government and military customers to commercial users and other agencies that may require customized reporting processes. On the programmatic side, Curtiss-Wright has regular monitoring and reporting processes on schedule and budgetary facets of program. An Earned Value Management System (EVMS) is used for most programs per mandate and reporting is conducted based on frequencies dictated by the contract. Technical reporting includes items such as First Article Inspections (FAI), maintaining a Failure Reporting and Corrective Action System (FRACS) and Supplier Audits for adherence to quality assurance requirements. Per end-customer requirements and contract needs, Curtiss-Wright participates in Program Design Reviews (PDR), Critical Design Reviews (CDR), System Design Reviews (SDR) and other meetings to provide support for its products and services.

Earned Value Management Systems (EVMS)

The Curtiss-Wright Earned Value Management System (EVMS) meets the intent of the Industry Guidelines for Earned Value Management Systems ANSI/EIA-748-98. The EVMS system uses the Integrated Master Plan (IMP) and Integrated Master Schedule (IMS) as its foundation. The IMP provides the integration of Statement of Work (SOW) tasking, traceable to the Work Breakdown Structure (WBS), identifying the program's accomplishment criteria to the program's significant accomplishments required to meet the significant events. The IMS provides all tasks (in WBS form) time-phased and resource-loaded. The schedule is electronically integrated with our costing tool, MPM, and yields the Performance Measurement Baseline (PMB).

With the establishment of this project baseline, the Earned Value (EV) method for each work package is established. Budgets are time-phased by task and by department with applicable EV methods for each work package rolling up to control accounts, and then rolling to reporting elements in the financial report. A Control Account Manager (CAM) will be assigned at each control account level to ensure cost and schedule compliance. Microsoft Project is then utilized to update the IMS on a weekly basis with captured performance data. The use of EVMS provides improved insight into the relationship between technical scope, cost and schedule performance and early warnings of potential issues. The EVMS tool also allows management thresholds to be established, to easily bring visibility to significant changes or trends in performance. This in turn allows the Curtiss-Wright Systems team to identify variances quickly and implement corrective actions, and maintain focus on cost and schedule performance.

On a weekly basis, each CAM provides updates to the IMS including percent complete and expected start and completion dates by task. Cost and schedule reporting is performed in compliance with the contractual SOW and Subcontractor Data Requirement List (SDRL) requirements. Weekly reporting includes updates to planned effort (Budgeted Cost of Work Scheduled - BCWS), effort performed (Budgeted Cost of Work Performed - (BCWP), and actual expenditures (Actual Cost of Work Performed - ACWP), as well as information for internal labor and major subcontractors. Our EVMS tool supports all the standard cost reporting format reports. EVMS reporting provides Cost and Schedule Performance Indices (CPI/SPI) as well as cost and schedule variance reports which illustrate performance variances for both the current reporting period, as well as the program cumulative to date.

Support Services

Product Training and Field Support

Curtiss-Wright offers full product documentation and customer training, working with you to ensure that you have the knowledge necessary to understand, integrate and use our systems. We will work with your system architects, commissioning staff and end users to make sure that every aspect of the system is covered.

Product Lifecycle Management

A comprehensive lifecycle management strategy is the key to safeguard programs and mitigate the challenges associated with leveraging COTS technology for long-term mission-critical systems. Curtiss-Wright's Lifecycle Services help identify and reduce the risks of COTS component obsolescence, provide control over product configuration changes when required and extend the availability of product builds and repairs to meet program demands.

Lifecycle Services include:

- Visibility and Control via configuration management
- Longevity of Supply (LOS) and Longevity of Repair (LOR)
- Counterfeit protection
- Variant creation
- Component storage and handling

Quality Control

Curtiss-Wright employs a formal AS9100C and ISO-9001 registered quality system. Engineering data, purchase orders and manufacturing planning documents are reviewed prior to release to ensure that engineer and QA requirements are properly included. Each section of the Curtiss-Wright Quality Manual is audited at least annually to verify compliance with Curtiss-Wright's procedures. The Curtiss-Wright quality system is under the surveillance of Defense Contract Management Command (DCMA) and customers. Both Curtiss-Wright and sub-tier supplier facilities are available for government and customer surveillance during the life of a contract.

Embedded Partners

Curtiss-Wright collaborates with product vendors and technology providers to offer customers complete, integrated solutions to their system development challenges as well as unique insights into technology trends that they require for planning their future products. The Curtiss-Wright Partner Program is a product and service collaboration between us and complementary embedded computing product vendors and technology providers. It is an extension of Curtiss-Wright's commitment to full circle customer support and it is designed to improve a customer's out-of-the-box experience with commercial and rugged grade COTS computing solutions. With the Curtiss-Wright Partner Program, customers see Curtiss-Wright and its partners as one continuum, providing a seamlessly integrated solution based on the knowledge, experience and expertise of Curtiss-Wright and its technology and association partners.