CURTISS-WRIGHT

Rugged Consoles & Workstations for Defense Missions

Design, Test, Manufacturing, Qualification, & Integration Services

Curtiss-Wright offers over 25 years of expertise in delivering comprehensive, turnkey systems for U.S. Navy ships, ensuring reliable and efficient solutions tailored to specific requirements. Exceeding the requirements of MIL-DTL-901 for shipboard machinery shock testing, the application-specific portfolio ranges from payload-ready enclosures to fully integrated solutions that utilize a modular approach to drive affordability, program velocity, and risk reduction.

To meet each system's specific form, fit, and functional requirements, everything from rack design features to electrical components, cabling, and ancillaries is customized. Applying a well-vetted approach to both build-to-print and build-to-specification fabrication, product development through system integration leverages the efficiency of reusing proven technology building blocks to make electronics installation faster and more cost-effective. These highly configurable elements span enclosure construction, mechanical protection, thermal cooling methods, temperature control, EMI/EMC, electrical power conditioning, and isolation. Using ruggedized COTS enclosure solutions further simplifies development, integration, and installation processes, bridging the gap between ship interfaces and the electronics payload. Prioritizing standardization, modularity, and hatchability enables affordable modernization and minimizes installation challenges within space-constrained environments.

Standardization: With standardized physical interfaces, these enclosures provide consistent and simplified design experiences. The uniformity ensures seamless integration, regardless of the specific electronics utilized. Mechanical interfaces, such as predefined input/output connector panel sizes, enhance usability. Standardized power conditioning and distribution facilitate efficiently addressing system requirements. Additionally, readily available cooling solutions can adapt to various needs, promoting efficiency and reliability while keeping electronics within operational limits.

Modularity: The commitment to standardized interfaces fosters a modular design, allowing for easy removal and replacement of electronics chassis without any cabinet modifications. This leads to reduced downtime and simpler maintenance. Power harnesses can be rerouted effortlessly, and cooling solutions can be adjusted to accommodate evolving heat dissipation needs. As technology advances, these enclosures support the rapid integration of higher-performance electronics, enabling enhancements to system capabilities with minimal effort. Hardware upgrades can occur on board, while software upgrades are achievable through a simple network connection.

Figure 1: Curtiss-Wright's Family of Common Cabinets

Hatchability: The challenges associated with the size and weight of ruggedized enclosures are effectively addressed in the design. Disassembly and reassembly capabilities allow for installation in tight spaces without the need for special tools. This feature facilitates navigation through hatches and doorways, significantly reducing the risk of costly shipyard modifications and potential safety hazards during maintenance. When disassembled, enclosures remain lightweight enough for two personnel to handle easily, eliminating the need for rigging.

Overall, this approach accelerates development projects within standardized rugged enclosures, complete with defined interfaces and durable capabilities. Systems engineers and project managers can focus on selecting hardware and software that meet performance objectives while relying on proven ruggedized enclosures to provide secure environments for critical systems.

As a one-stop shop, Curtiss-Wright accelerates the design, verification, and validation of MIL-SPEC integrated subsystems, streamlining the development and installation of Naval shipboard cabinets. In 2024, over 1,000 cabinets and consoles were successfully delivered to the U.S. Navy, supporting programs such as Consolidated Afloat Network and Enterprise Services (CANES), Ship Signal Exploitation Equipment (SSEE), SQQ-89 Undersea Warfare Combat System, and MOS-MOD (MIDS On Ship Modernization). Every class of U.S. Navy combatant ship today features these reliable enclosures.

Curtiss-Wright supports all stages of cabinet or workstation design, assembly, integration, and testing, providing system-level engineering necessary for the design effort and the verification and validation of the system. This structure accelerates the development, integration, and installation of naval shipboard cabinets and workstations.

Deep design and test expertise in shock and vibration, temperature, EMI reduction, and noise reduction, coupled with a catalog of previously qualified cabinet, workstation, and subcomponent designs, reduces the risk of failure during qualification. Prior to the first article build and testing, computational fluid dynamics (CFD) tools validate heat distribution and rejection, while finite element analysis (FEA) tools validate the structural design.

To manage shipboard shock and vibration challenges relative to COTS packaging, the equipment's known or predicted fragility levels determine the proper solution. A cabinet or workstation may be hard-mounted (no shock mitigation) or shock-isolated (isolators installed at the unit's base to reduce the shock impact). When shock-isolated solutions are required, proprietary software, developed and fine-tuned in-house, calculates the best combination of shock isolators.

Alleviating the cost and schedule burden of customers building and maintaining lab environments for integration, software load, and unit testing, Curtiss-Wright maintains an entire team of electrical integration staff that can conduct factory acceptance testing (FAT) and customer software loads in-house. This process reduces end-customer steps and allows units to be deployed directly to the field.

Staff technicians and Quality Control (QC) inspectors certified to IPC/WHMA-A-620 and J-STD-001 are part of a dedicated electrical cabling and integration team working in a fully electrostatic discharge (ESD) protected per MIL-STD-1686C area that uses Six Sigma Black Belt expertise to ensure all electrical work and inspections meet these standards. Automated test equipment performs all testing simultaneously (Continuity, Dielectric Withstanding, and Insulation Resistance), removing the human element and reducing the risk of discrepancy during unit deployment. These production efforts culminate in an integrated solution that is fully capable of meeting the mechanical, electrical, and functional requirements of the customer's specifications. Customer end-use requirements guide the development and implementation of functional verification testing of the integrated unit. This often includes crafting custom test software and acquiring test equipment to simulate/stimulate the system to test all circuit functions or fully exercise the customer's mission-ready software.

As a one-stop shop partner, fully integrated and qualified solutions are delivered to the door or dock and ready for the mission. This end-to-end approach focuses on reducing risk to alleviate burdens on its customers and allows them to focus on mission-level development and deployment. In-house integration and test capabilities reduce customer costs by adding value directly at the assembly location.

Figure 2: Fully integrated enclosure

Consoles Common Display Systems

Qualification

- EMI: MIL-STD-461E
- Humidity: MIL-STD-810F, Method 507.4
- Vibration: MIL-STD-167-1A
- Shock: MIL-S-901D, Grade A, Class I/II
- Thermal cycling: MIL-STD-810F, Method 501.4
- Drip proof: MIL-STD-810F, Method 506.4
- Salt fog: MIL-STD-810F, Method 509.4
- Fungus: MIL-STD-810F, Method 508.5
- Airborne noise: MIL-STD-740-1B
- Ship motion and attitude: DOD-STD-1399, section 301A
- Structure-borne noise: MIL-STD-740-2B
- Safety: MIL-STD-882D

USS Navy Fleet

The Platform: The United States Navy fleet comprises approximately 470 active service or reserve ships. The vessels range from the massive Ford-class aircraft carrier, which stretches over 1,000 feet, to the Los Angeles-class submarine, which slithers 900 feet below the ocean surface.

An Innovative Approach: Curtiss-Wright developed and produced console part numbers CON-CA-1044 and CON-CA-1312 for the common display system (CDS) product family, including displays that can be implemented across all U.S. Navy ships. CDS consists of information-display configurations based on standardized, interchangeable components. It allows sailors to access various applications at different classification levels from any console. Simultaneously, displaying information classified at multiple independent security levels decreases the number of required systems on board a ship, reducing the cost of ownership and maintenance requirements.

- Access to applications at any platform display workstation
- Users can chat in multiple security domains on the same console
- Configurable design with common components, reducing part count and lowering operating costs
- Open architecture design enables quick technical insertions
- Adaptable to any environment
- CON-CA-1044: three horizontal displays (Variant A)
- CON-CA-1312: two vertical displays (Variant B)

CON-CA-1312

CON-CA-1044

Consoles for Gun Fire Control Systems

Qualification

- EMI: MIL-STD-461E
- Vibration: MIL-STD-167-1A
- Shock: MIL-S-901D, Grade B, Class I
- Thermal cycling: MIL-STD-810F, Method 501.4

Littoral Combat Ship (LCS)

The Platform: The U.S. Navy designed the LCS-class for operations in the littoral zone (close to shore). The Freedom-class represents one of the two littoral combat ships built for the U.S. Navy.

An Innovative Approach: Curtiss-Wright developed and produced console part number CON-CA-2216 for the gun fire control system to complement the MK 110 57mm gun mount in the LCS Freedom ships. The FCS-57, an electro-optical-based fire control system, interfaces with shipboard sensors and systems to deliver command and control, navigation, and stabilization. The system targets intermediate caliber gun weapon system (GWS) for the LCS Seaframe. The configuration approach maximizes the reuse of fire control components from currently fielded systems and fire control developments from current programs of record.

The console includes:

- PC104 single board computer (1.91 GHz, 32 GB SATA, 8 GB RAM, and a MIL-STD-1553 interface)
- 8-port Gigabit switch
- 17" touchscreen display with a resolution of 1280 x 1024 @ 60 Hz

CON-CA-2216

Consoles for Machinery Control Systems

Qualification

- EMI: MIL-STD-461E
- Humidity: MIL-STD-810F, Method 507.4
- Vibration: MIL-STD-167-1A
- Shock: MIL-S-901D, Grade A, Class I/II
- Thermal cycling: MIL-STD-810F, Method 501.4
- Drip proof: MIL-STD-810F, Method 506.4
- Salt fog: MIL-STD-810F, Method 509.4
- Fungus: MIL-STD-810F, Method 508.5
- Airborne noise: MIL-STD-740-1B
- Ship motion and attitude: DOD-STD-1399, Section 301A
- Safety: MIL-STD-882D

USS Arleigh Burke-Class Destroyers (DDG)

The Platform: The U.S. Navy built the Arleigh Burke-class of guided missile destroyers around the Aegis combat system and the SPY-1D multi-function passive electronically scanned array radar.

These multi-mission destroyers excel in anti-aircraft warfare with their powerful Aegis radar and surface-to-air missiles. They also dominate anti-submarine warfare using towed sonar arrays, anti-submarine rockets, and anti-submarine warfare (ASW) helicopters. Additionally, they engage in anti-surface warfare with a harpoon missile launcher and perform strategic land strikes with Tomahawk missiles.

An Innovative Approach: Curtiss-Wright developed and produced console part number CON-CA-1236 for the machinery control system (MCS) for each DDG ship. Modernizing the MCS consoles transforms them into universal control consoles with 4-display multi-modal workstations. The new design consolidates the electric plant control console, propulsion and auxiliary control console, engineering officer of the watch console, and two shaft control unit consoles into just two (2) sets of universal control consoles for each ship.

CON-CA-1236

Hardware for Machinery Control System

Qualification

- EMI: MIL-STD-461E
- Humidity: MIL-STD-810F, Method 507.4
- Vibration: MIL-STD-167-1A
- Shock: MIL-S-901D, Grade A, Class II
- Thermal cycling: MIL-STD-810F, Method 501.4
- Drip proof: NEMA 250, Type 4
- Fungus: MIL-STD-454N, Requirement 4
- Airborne noise: MIL-STD-740-1B
- Safety: MIL-STD-882D

An Innovative Approach: Curtiss-Wright developed and produced the machinery control system (MCS) hardware for the LHA-6, LHA-7, and LHD-8 ships. The MCS controls the major shipboard systems, including the highly automated propulsion, electric plant, and fuel fill systems. The equipment supplied includes fifty-six data acquisition units, five machinery control system LANs, one on-board trainer, two gas turbine workstations, fourteen local operating panels, one pilot house local operating panel, four diesel generator workstations, four machinery control consoles (seated), and two machinery control consoles (standing) located throughout the vessel.

The consoles include:

- Chassis: 12-slot VME or 4-slot VME 64-bit backplane
- VME power supply (6U x 8HP, 400W, 90A combined output current)
- Keyboard with audio amplifier
- EMI line filter

Consoles for Pilot House Local Operating Panels (PHLOPs) USS America (LHA-6)

The LHA-6, the first of the America-class amphibious assault ships for the U.S. Navy, is the flagship of an expeditionary strike group or amphibious ready group. This warship carries Marine expeditionary units into battle and deploys them ashore with helicopters and V-22 Osprey tilt-rotor aircraft, supported by F-35B Lightning II aircraft and helicopter gunships.

LOP-CA-968

Consoles for Diesel Generator Workstations and Machinery Controls USS Tripoli (LHA-7)

The LHA-7, the second America-class amphibious assault ship built for the U.S. Navy, is the flagship of an expeditionary strike group or amphibious ready group. The ship carries a Marine expeditionary unit into battle and deploys them ashore with helicopters and V-22 Osprey tilt-rotor aircraft, supported by F-35B Lightning II aircraft and helicopter gunships.

CON-CA-1674

Consoles for Machinery Controls (Seated) and Gas Turbine Workstations USS Makin Island (LHD-8)

The USS Makin Island (LHD-8), a Wasp-class amphibious assault ship, embarks, deploys, and lands elements of a Marine landing force in an amphibious assault using helicopters, landing craft, and amphibious vehicles. The USS Makin Island also performs sea control and power projection as secondary or convertible missions.

100-CA-1675

Consoles for Health Monitoring Systems

Qualification

- EMI: MIL-STD-461E
- Humidity: MIL-STD-810F, Method 507.4
- Vibration: MIL-STD-167-1A
- Shock: MIL-S-901D, Grade A, Class II
- Thermal cycling: MIL-STD-810F, Method 501.4
- Drip proof: MIL-STD-810F, Method 506.4
- Salt fog: MIL-STD-810F, Method 509.4
- Fungus: MIL-STD-810F, Method 508.5
- Airborne noise: MIL-STD-740-1B
- Ship motion and attitude: DOD-STD-1399, Section 301A

USS Gerald R. Ford

The Platform: The USS Gerald R. Ford (CVN-78), the lead ship of the U.S. Navy's supercarriers, is the premier forward asset for crisis response and early decisive striking power in major combat operations. Gerald R. Ford-class aircraft carriers and carrier strike groups deliver the core capabilities of forward presence, deterrence, sea control, power projection, maritime security, and humanitarian assistance.

An Innovative Approach: Curtiss-Wright developed and produced console part number CON-CA-956 for the ship's advanced arresting gear's health monitoring assessment and prognostics system. The digital control system provides built-in test and diagnosis, reducing maintenance and manpower requirements compared to its predecessor. The architecture enhances reliability and safety margins, allowing sailors to focus on other areas of need. The system also enables the arrestment of a broader range of aircraft, from the lightest unmanned aerial vehicles to the heaviest manned fighters.

The console includes:

- Rugged server
- 9-port 10/100/1000BASE-TX Ethernet switch
- Dual 21" displays with a 1600 x 1200 @ 60 Hz resolution
- Keyboard with trackball
- Fan tray
- EMI filter

CON-CA-956

Rugged Navigation and Mapping Tables

Qualification

- EMI: MIL-STD-461E
- Humidity: MIL-STD-810F, Method 507.4
- Vibration: MIL-STD-167-1A
- Shock: MIL-S-901D, Grade A, Class II
- Thermal cycling: MIL-STD-810F, Method 501.4
- Drip proof: MIL-STD-810F, Method 506.4
- Fungus: MIL-STD-810F, Method 508.5
- Airborne noise: MIL-STD-740-1B
- Structure-borne noise: MIL-STD-740-2B
- Ship motion and attitude: DOD-STD-1399, Section 301A

USS Arleigh Burke-Class Destroyers

The Arleigh Burke-class DDG ships include an AN/SQQ-89A(V)15 Undersea Warfare (USW) System. The active/passive sonar combat system is installed on various ASW capable platforms, such as frigates, destroyers, and cruiser-type vessels. The system detects, locates, tracks, and engages targets. It transmits and receives acoustic signals to classify targets, perform time motion analysis, and control own-ship weapon settings. It also correlates multi-sensor tracks, manages target tracking, and forwards data to the ship's command and decision system. The latest configuration of the sonar combat system is being fielded to the Constellation-class guided-missile frigate (FFG) platform.

An Innovative Approach: Curtiss-Wright developed and produced part number 901D-CC-NMT for the navigation and mapping table for the USW system of the DDG ships. The digital table supports applications that require displaying large amounts of sensor data in a rugged environment. It can be used for navigation, mapping, ISR debriefing, deployment tracking, and video conferencing. The console includes:

- 46" rugged touchscreen display with 1920 x 1080 @ 60 Hz resolution
- Fiber video I/O
- USB extender
- TX/LX media converter
- Video scaler and encoder
- Web-enabled I/O controller
- Printer
- Servers
- Gigabit Ethernet switch
- 3.75k VA power conditioner

901D-CC-NMT

Consoles for Shore-Based Training Facilities

Qualification

- Human Engineering: MIL-STD-1472G

Littoral Combat Ship Shore-Based Training Facility

The Platform: The shore-based training facility (LTF) provides integrated bridge and combat systems tactical scenario training for sailors serving on an LCS. This facility includes three components, which can operate independently or together to create more complex training scenarios.

An Innovative Approach: Each trainer section replicates the basic layout and design of the LCS command and control, propulsion control systems, and a bridge. The console includes video screens that can reproduce every U.S. Navy homeport and almost every routine port of call worldwide.
Curtiss-Wright developed and produced console part number CON-CA-1307 for the LCS shore-based qualification training console.

CON-CA-1307

Consoles for Tactical Unmanned Aerial Vehicle (UAV) Systems

Qualification

- EMI: MIL-STD-461E
- Humidity: MIL-STD-810F, Method 507.4
- Vibration: MIL-STD-167-1A
- Shock: MIL-S-901D, Grade B, Class I/II
- Thermal cycling: MIL-STD-810F, Method 501.4
- Fungus: MIL-STD-810F, Method 508.5
- Airborne noise: MIL-STD-740-1B
- Ship motion and attitude: DOD-STD-1399, section 301A

MQ-8 Fire Scout Unmanned Aircraft System

The Platform: Fire Scout, a combat-proven unmanned UAV helicopter, delivers real-time intelligence, surveillance, and reconnaissance (ISR), target acquisition, laser designation, and battle management to tactical users without relying on manned aircraft or space-based assets. Fire Scout operates from any air-capable ship or land base to support persistent ISR requirements.

An Innovative Approach: Curtiss-Wright developed and produced console part number CON-CA-1611 for the Fire Scout's control segment (CS) of the vertical takeoff and landing tactical unmanned aerial vehicle system (VTUAV) installed in Navy air-capable ships. The control segment and its subsystems serve as the operational focal point for using the VTUAV system. The CS of the VTUAV system and associated equipment provide the system operators with all necessary software systems, displays, controls, communications, landing system elements, and external interfaces to effectively employ the VTUAV system and integrate its operations into the Navy battle space. These systems deploy on U.S. Navy ships such as LCS, destroyers, and frigates.

CON-CA-1611

Consoles for Airborne Operator Workstations

Qualification

- Environmental conditions: DO-160G
- Human factors: FAA HFDG
- Flammability: FAR Part 25.853
- Environmental engineering: MIL-STD-810G
- Human engineering: MIL-STD-1472F
- Altitude: -1,000 to 15,000 ft MSL
- Temperature: -20° to 50°C

ATR 42-500

The Platform: The French-Italian aircraft manufacturer ATR produces the ATR 42-500, a twin-engine turboprop short-haul regional airliner. The aircraft typically serves as a regional airliner, but it also performs roles such as corporate transport, cargo aircraft, and maritime patrol aircraft.

An Innovative Approach: Curtiss-Wright developed and produced console part number CON-CA-1577 to convert an ATR 42-500 to a surveillance plane. Three consoles mount to standard 25" wide fixed seat rails. To minimize weight for aircraft installation, the workstation features a modular design, allowing the worktable drawer and DZUS rail control panel to be mounted on either side.

CON-CA-1577

Consoles and Multi-Level Security Display Workstations

Qualification

- MIL-STD-1310H shipboard bonding, grounding and other techniques for electromagnetic compatibility and safety
- CNSSAM 01/13 red/black installation guidance
- Vibration MIL-STD-167-1A
- EMI/RFI MIL-STD-461G
- Human engineering design criteria for the C4ISR system, subsystems and equipment IAW MIL-STD-1472H

Offshore Patrol Cutter

The Platform: The U.S. Coast Guard (USCG) developed the Offshore Patrol Cutter (OPC) as part of the integrated deep water system program. The OPC performs various USCG missions, including ports, waterways, coastal security (PWCS), defense operations, maritime law enforcement (drug/migrant interdiction and other law enforcement), search and rescue, marine safety, and environmental protection. For defense operations, the OPC fulfills roles ranging from theater security cooperation to deploying with an expeditionary strike group (ESG) or supporting a combatant commander in various ways. The cutters also support Arctic operations.

An Innovative Approach: Curtiss-Wright developed and produced console part numbers CON-CA-1819 and CON-CA-1821 for the command and control (C2) multi-level security thin client (MLSTC) installed on USCG OPC. The thin clients, and a low-end terminal, provide a graphical display and user entry interface for the end user, with system functionality provided by computers and systems located elsewhere. The display MLSTC workstations house electronic components for classified and unclassified sections.

The consoles include:

- 4-port TEMPEST KVM switch with KVM extenders
- CON-CA-1819: dual 23" TEMPEST displays with a 1920 x 1080 @ 60 Hz resolution
- CON-CA-1821: three 23" TEMPEST displays with a 1920 x 1080 @ 60 Hz resolution
- CAC readers
- Audio amplifiers
- Task light
- EMI filters
- Power supplies

CON-CA-1821

CON-CA-1819

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