



WHITE PAPER

Military and aerospace qualified 4K resolution large-area displays

Proven 4K visualization for airborne, naval
and ground mobile platforms



EXECUTIVE SUMMARY

Spectra Defense Technologies' family of military and aerospace qualified 4K resolution large area displays delivers mission-optimized visualization for the most demanding operational environments.

Purpose-built for airborne, naval, and ground mobile platforms, these displays enable operators to process high-density sensor data with exceptional clarity, reduce cognitive load, and make faster, more informed decisions in mission-critical scenarios.

Engineered to perform in extreme thermal, mechanical, and electromagnetic conditions, Spectra's 4K display solutions bridge the gap between modern sensor fidelity and operator visualization, transforming complex data into actionable intelligence across the full spectrum of defense operations.

In this white paper, we'll review:

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2. Technology overview
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THE CHALLENGE: OPERATIONAL NEED



ARD24 – 24”
COMPACT



ARD27 – 27”
PRIMARY OPERATOR



ARD32 – 32”
COLLABORATIVE MISSION DISPLAY

Operational context

Military platforms operate in extreme and highly dynamic environments where traditional commercial displays cannot survive or perform reliably.

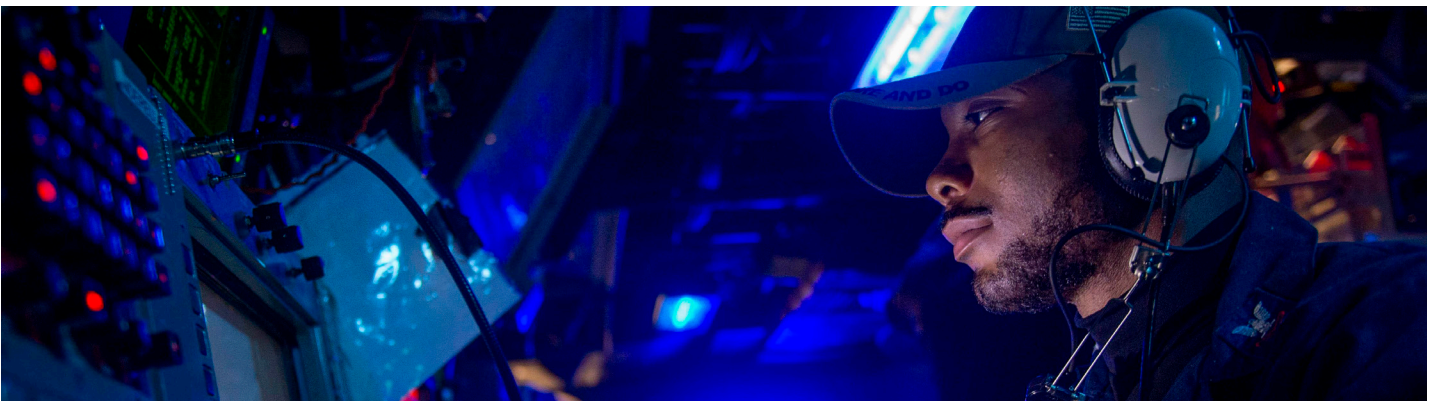
Across airborne, naval, and ground mobile domains, operators require high-resolution visualization of mission-critical data, often immediately upon system power-up and under severe environmental stress.

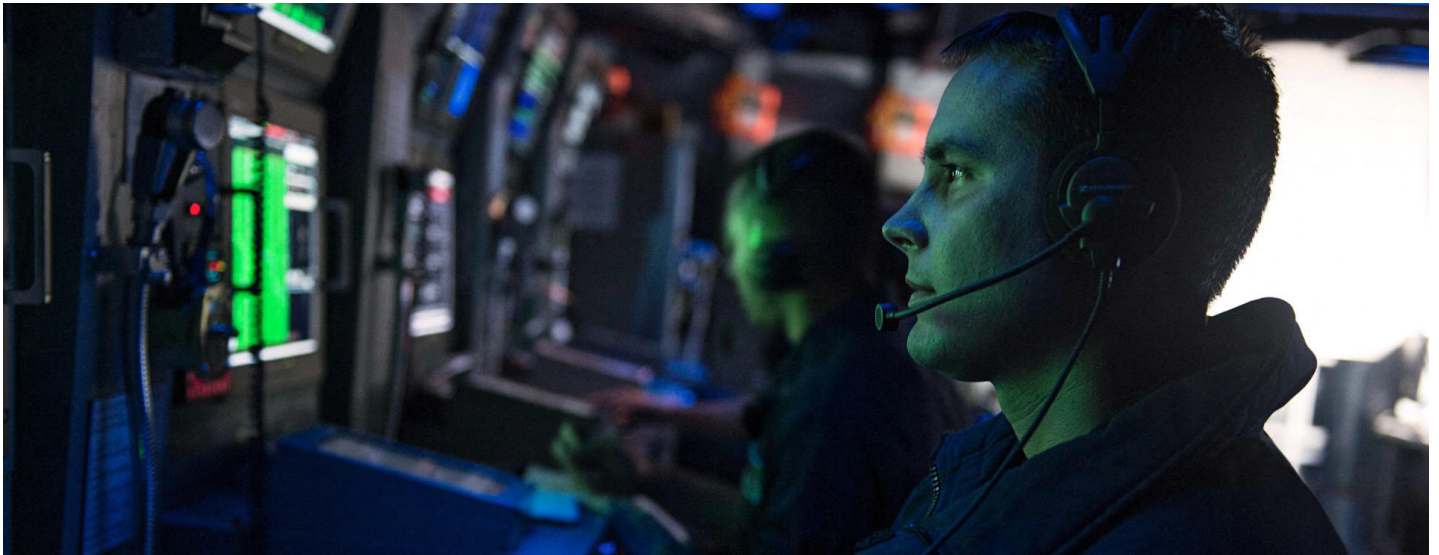
The ARD series incorporates advanced thermal management to deliver full 4K clarity within seconds of power-up, ensuring rapid operational readiness from cold-start conditions through sustained mission execution.

Ground mobile. Displays must withstand low-frequency, high-amplitude vibrations from tracked or wheeled vehicles traversing rough terrain, as well as high-G gunfire shock and ballistic shock events.

Airborne. High-frequency turbine vibrations and the dynamic structural loads experienced during takeoff, landing, and maneuvering, across both fixed-wing and rotary-wing aircraft, require specialized mounting and ruggedized internal components to prevent delamination, solder fatigue, or circuit-board stress failures.

Naval. Systems must endure the slamming effects of high-sea states and the massive mechanical shock pulse generated by near-miss underwater explosions or deck-mounted weapon discharges.





Key challenges for operators and integrators

High-ambient sunlight. In cockpits and open-vehicle cabins, solar loading can cause excessive heat buildup on aluminum housings. Combined with high-brightness backlighting, internal display temperatures can rise to the point where Liquid Crystal Display (LCD) crystals temporarily clear — turning the screen black instead of displaying usable imagery.

Cold start. Systems in unpressurized bays or arctic ground environments must reach operational capability from temperatures as low as -40°C , often necessitating internal heaters to ensure liquid crystal responsiveness.

Mechanical stress. Military platforms generate extreme mechanical energy that can easily cause standard commercial electronics to fail through delamination, solder joint fracture or connector degradation.

Electromagnetic compatibility (EMC) and interference. To ensure full electromagnetic compatibility (EMC), the system meets MIL-STD-461 requirements for both conducted and radiated emissions, preventing interference with communications, radar, and other

mission-critical sensors by maintaining a tightly controlled emissions profile.

Atmospheric and chemical resistance.

Display longevity depends on resistance to salt fog and corrosion, sand and dust infiltration, humidity and condensation from rapid altitude changes, and high-pressure chemical washdown procedures common on ground mobile and rotary-wing platforms.

Human-machine interface in motion.

Operators in cramped vehicle interiors may not view the screen head-on, requiring wide viewing angles with accurate color and contrast. Touchscreens and bezel buttons must be calibrated for use with heavy flight or tactical gloves while resisting false inputs from water droplets or vibration.

Optical performance and clarity.

Optical clarity is maintained through specialized anti-glare and anti-reflective glass treatments that minimize reflections without degrading 4K resolution. Combined with optical bonding, these enhancements maximize contrast and deliver impact resistance against strikes or airborne debris.

TECHNOLOGY OVERVIEW

Product family introduction

Spectra's family of military and aerospace qualified 4K resolution displays includes both compact and large-area configurations designed to meet the diverse requirements of modern mission systems. This portfolio spans smaller form factors, including 15" and 17" class displays for space-constrained environments, as well as larger formats optimized for high-density data visualization.

While compact displays support distributed architectures and installations where size and weight are critical constraints, this paper focuses specifically on Spectra's large area 4K Ultra High-Definition (UHD) display solutions in the 24", 27", and 32" size classes.

These large area displays are engineered to deliver maximum visual real estate, enabling operators to view, process, and interact with multiple high-resolution data streams simultaneously. Each system is built with highly efficient LED backlighting, supports a wide range of high-speed digital and trusted analog video interfaces, and can be fully customized to meet program-specific requirements.

Core architecture

The ARD series is built on a platform of Thin-Film Transistor (TFT) LCDs with dual-mode LED backlighting, supported by military-grade electronics capable of processing video signals up to 4096×2160 with multi-window support. Power supplies comply with MIL-STD-704 and MIL-STD-1275 standards.

Key differentiating technologies

True color representation. The ARD 4K displays feature 10-bit color depth — reproducing 1.06 billion colors — providing the widest color range available for true-to-life video presentation

of sensor imagery and operational data to operators. This level of color fidelity ensures that subtle variations in thermal signatures, terrain features and target indicators are preserved from sensor to screen.

Remote control and mission system integration. The ARD 4K displays are intelligent visualization and control hubs, not passive monitors. Serial and Ethernet protocols allow integrators to remotely configure and control display parameters, optimizing the operator's visual presentation for specific use cases. Optional touchscreens and programmable bezel buttons connect to mission-critical actions through an integrator-defined concept of operations.

Extremely wide temperature range. An advanced passive thermal management architecture enables rapid warm-up from cold-soak conditions as low as -55°C, ensuring fast and reliable video availability. Efficient heat diffusion from high-efficiency LED backlights prevents LCD overheating even in +71°C ambient environments with full solar loading.

Advanced coatings and optical bonding. A multi-film, multi-layer optical stack ensures glare-free and reflection-free viewing while also preventing human hazards in the event of display damage. Optical bonding maximizes contrast, enhances durability and provides significant impact resistance.

Ruggedization. Our aerospace-grade aluminum chassis with IP66 sealing delivers robust protection against dust and water while enabling efficient thermal transfer to external surfaces. Conformal-coated, RoHS-compliant electronics and fully potted internal connections provide exceptional durability and long-term reliability in demanding high-vibration environments.



CORE FEATURES AND CAPABILITIES



Optimized form factor ¹

Each display is designed with minimal bezel thickness to maximize the active viewing area within the tightest platform envelopes. The result: an optimized viewing angle that enables the largest possible screen directly in front of the operator without increasing the overall installation footprint.

Customization ²

All aspects of an ARD product can be customized to meet program-specific requirements including bezel design, button layouts, video I/O configuration, connector types and installation provisions.

Environmental compliance ³

The ARD series delivers proven performance across military environments with comprehensive qualification artifacts that simplify platform installation approvals. Documented compliance to MIL-STD-810H, DO-160G, MIL-STD-461G and MIL-STD-3009 reduces technical and schedule risk.

Robust mounting and retention ⁴

Stainless steel captive 10-32 bolts are qualified to perform against 40G+ shock events. Optional front-mounted handles ensure secure handling during installation. MIL-DTL-38999 and hardened industrial I/O connectors with positive retention mechanisms provide IP66 protection and assured signal quality. A 200×200mm VESA bolt pattern on the rear housing offers an alternative mounting option.

Flexible video inputs and outputs ⁵

The displays support a full range of open standards for analog and digital video transmission including DVI-D, HDMI, DisplayPort and 3G-SDI. In military platforms where mission systems may deviate from industry standards, the ARD series can accommodate non-standard signal requirements. ARINC 818 fiber optic video inputs reduce weight and signal integrity issues associated with long cable runs on mobile platforms and other environments where signal integrity is paramount.

TECHNICAL SPECIFICATIONS

MODEL COMPARISON

	ARD24	ARD27	ARD32
Display size	23.8" diagonal	27.0" diagonal	32.0" diagonal
Aspect ratio	16:9	16:9	16:9
Resolution	3840×2160	3840×2160	3840×2160
Video inputs	4 inputs, quad video processing	4 inputs, quad video processing	4 inputs, quad video processing
Width	22.3" (566.4mm)	25.5" (647.7mm)	29" (736.6mm)
Height	13.1" (332.7mm)	15.1" (383.5mm)	18" (457.2mm)
Depth	2.9" (73.7mm)	3.9" (99.1mm)	3.3" (83.8mm)
Weight	~19.5 lbs	~22 lbs	~33 lbs
Power (max)	60W	75W	130W
Mounting	Panel mount, captive 10-32	Panel mount, captive 10-32	Panel mount, captive 10-32

INTERFACE AND CONNECTIVITY

Video / data interfaces	Power requirements
Video: DVI-D, HDMI, DisplayPort, 3G-SDI	DC or AC power input options
Remote control / BIT: RS-232, Ethernet	MIL-STD-704A/F compliant
HMI: RS-232, USB	MIL-STD-1275 compliant
Optional: ARINC 818 fiber optic	DO-160G compatible

ENVIRONMENTAL AND RUGGEDIZATION PERFORMANCE

Parameter	Specification / range	Standard
Operating temperature	-40°C to +71°C	MIL-STD-810H / DO-160G
Storage temperature	-55°C to +85°C	MIL-STD-810H / DO-160G
Shock	20G operational, 40G crash MIL-STD-901D capable	MIL-STD-810H / DO-160G
Vibration	Rotary wing, ground mobile and fixed wing profiles	MIL-STD-810H / DO-160G
Altitude	45,000ft operational	MIL-STD-810H / DO-160G
Harsh environment	Humidity, salt fog, blowing sand and dust, fungal growth	MIL-STD-810H / DO-160G
EMI/EMC	Conducted and radiated emissions/susceptibility, ESD, lightning indirect effects	MIL-STD-461G / DO-160G
Environmental protection	IP66	IEC 60529 / DO-160G



APPLICATIONS AND USE CASES

The ARD24, ARD27 and ARD32 displays are engineered for high-density data environments where 4K clarity must be maintained under extreme mechanical and environmental stress. Their large-format screen sizes make them suited for situational awareness across three primary military domains.



Airborne: flight test and mission management

In the aerospace domain, these displays serve as the primary interface for complex sensor suites and flight data monitoring.

Intelligence, surveillance and reconnaissance (ISR). The ARD series is suited for fixed-wing or rotary platforms where operators analyze high-definition streaming video from gimbal-mounted electro-optical/infrared (EO/IR) sensors.

Flight test instrumentation (FTI). 4K resolution enables flight test engineers to monitor real-time telemetry and high-speed video data during airframe certification or weapons integration trials with the fidelity required to capture anomalies.

Tactical airlift and tankers. The displays can be deployed in cargo or boom-operator stations to provide high-fidelity views of refueling or paratroop zones in low-light conditions.



Ground mobile: vehicle modernization and command

The ARD series provides the ruggedized screen real estate necessary for the transition to glass-cockpit architectures in armored and tactical vehicles.

Next-generation combat vehicles. In platforms where closed-hatch operations require drivers and commanders to view a stitched, 360-degree high-resolution camera feed, 4K resolution preserves critical detail across the full field of view.

Mobile command posts. Within expandable shelter systems or tactical vans, the ARD32 serves as a central tactical display for Blue Force Tracking (BFT), drone feed aggregation and logistical planning.

Unmanned Ground Vehicle (UGV) control. Large area displays allow remote operators to manage multiple robotic assets simultaneously, using 4K resolution to split the screen into several high-detail picture-in-picture feeds.



Naval and maritime: high-sea state operations

In naval environments, the primary constraints are durability against salt corrosion and the ability to process massive amounts of radar and sonar data.

Combat Information Center (CIC). The ARD27 and ARD32 are suited for console integration on destroyers or cruisers, displaying integrated undersea warfare data or weapon system interfaces.

Bridge navigation and electronic charting. A large, sunlight-readable surface supports Electronic Chart Display and Information Systems (ECDIS) for navigating restricted waters or during high-speed littoral maneuvers.

Unmanned surface/underwater vehicle (USV/UUV) tenders. Support vessels use ARD displays to monitor status and video feeds of autonomous underwater assets during mine-clearing or hydrographic survey missions.





USE CASE

The detection-to-engagement gap in C-UAS operations

Platform

Armored vehicle with a Remote Weapon Station (RWS) featuring a 30mm cannon and an integrated EO/IR sensor mast.

The problem

In high-intensity urban or woodland environments, drone attacks often begin with a saturate-and-strike tactic. The Fire Control Officer's (FCO's) legacy 1080p display is saturated with clutter — birds, wind-blown debris and smoke. A small First-Person View (FPV) drone at 1,500 meters occupies only a 4x4 pixel block on a standard HD screen. By the time the FCO visually confirms it as a threat rather than a bird, the drone may have entered its terminal dive phase, leaving only seconds to react.

Compounding the challenge, the FCO must simultaneously monitor a 360° radar track, the slew-to-cue EO/IR camera and weapon status — all while the vehicle traverses uneven terrain.

The solution: ARD27 4K targeting hub

The vehicle is upgraded with an ARD27 4K ruggedized display at the FCO station, linked to a high-fidelity EO/IR gimbal.

Pixel density advantage. At 4K resolution, the same drone at 1,500 meters now occupies a 16x16 pixel block — allowing the FCO to identify the structural silhouette and payload hundreds of meters earlier than on an HD screen.

Intelligent picture-in-picture. The FCO quad-splits the 27" screen: wide-angle situational awareness camera, 4K narrow-field-of-view spotter focused on the primary threat, an AI-driven threat table showing range and bearing of tracked targets and fire control symbology with ammunition count.

Stabilized visuals. Low-latency processing ensures fluid video as the turret stabilizes the cannon. The FCO uses the optically bonded touchscreen to touch-to-track, instantly slewing the weapon to the most dangerous drone in the swarm.

The outcome

The FCO identifies the lead drone as a threat at 2,000 meters, places the reticle with precision using the 4K feed and engages with proximity-fuzed airburst rounds. 4K resolution allows immediate Battle Damage Assessment (BDA) — the FCO clearly confirms the engagement and instantly shifts focus to the next target.

Key takeaway

In C-UAS operations, resolution equals distance equals time. The ARD series provides the visual standoff distance required to identify and defeat modern autonomous threats before they reach the vehicle's inner-tier defenses.

SELECTION GUIDE

When selecting a large area ruggedized display for a military platform, the decision-making process extends beyond screen size. It encompasses how the display survives and integrates into a complex, multi-domain system. The ARD24, ARD27 and ARD32 are built to the same specifications, making size, weight and power the primary differentiators.

Size, weight, power and cost (SWaP-C)

While the diagonal size is fixed at 24”, 27” or 32”, the total envelope — including bezel width, depth and mounting provisions — determines whether side-by-side or top-bottom configurations are possible within a platform’s operator console. In airborne applications, every ounce affects fuel economy and center of gravity.

Video latency

In environments such as UAV piloting or target tracking, the delay between sensor capture and display rendering is mission-critical. The ARD internal controller handles high-frame-rate 4K (60Hz+) without introducing stutter or lag.

I/O versatility and legacy support

Military platforms often mix cutting-edge and decades-old technology. The ARD series supports modern digital inputs (DisplayPort, HDMI) while offering pull-through support for legacy analog and specialized military signals. Optional ARINC 818 fiber optic video addresses long cable runs in naval environments.

Thermal management

Large area 4K displays generate significant internal heat, and military environments often lack active air conditioning. The ARD series uses passive cooling with thermal-reflective coatings and high-efficiency heat sinks to maintain a 100% duty cycle at +71°C, achieving a thermal delta sufficient to prevent LCD clearing.

NVIS and dimming

Compliance with MIL-STD-3009 for Night Vision Imaging System (NVIS) compatibility is essential for covert and nighttime operations. The ARD series achieves a dimming ratio enabling output from sunlight-readable brightness (1000+ nits) down to near-zero for full-dark operations.

Environmental survivability

Customers evaluate three primary stressors: shock and vibration performance to MIL-STD-810H for the specific platform profile, EMI/EMC compliance to MIL-STD-461G and IP66 sealing for dust, water and post-mission washdown resistance.

Human-machine interface

Mission requirements determine whether the display needs multi-touch Projected Capacitive (PCAP) or resistive touch for use with heavy gloves. Many operators prefer physical bezel keys for menu navigation in high-vibration environments where touchscreen use is difficult.

CHOOSING THE RIGHT MODEL

All three models are built to the same environmental and performance specifications. The decision comes down to available platform real estate:

Model	Best for	Sweet spot
ARD24	Space-constrained installations, airborne consoles, multi-display arrays	Most compact footprint; ideal where weight and bezel width are the primary constraints
ARD27	Fire control stations, multi-purpose operator consoles, ISR analyst workstations	Versatile mid-size; balances screen real estate with manageable SWaP
ARD32	Command centers, CIC consoles, mobile command posts, primary tactical displays	Maximum viewing area for multi-window and quad-split operations





CONCLUSION

The Spectra ARD series delivers mission-critical 4K visualization by bridging the gap between high-density sensor data and actionable intelligence in the harshest environments on Earth. By integrating these ultra-high-definition displays into airborne, naval and ground mobile platforms, system integrators can reduce operator cognitive load and maximize situational awareness while maintaining strict compliance with MIL-STD environmental and EMI requirements.

Part of the Spectra data continuum

The ARD display series is one element of the end-to-end Spectra data lifecycle. From data acquisition and recording to encrypted network-attached storage and edge computing, Spectra products work together across the capture, process and display continuum to deliver complete mission system solutions.

NEXT STEPS >>>

For additional information on 4K large displays, including system integration considerations, environmental performance, and configuration options, Spectra's engineering team is available to support technical discussions.

With a proven architecture spanning the 24" to 32" range and full customization capability, the ARD series supports legacy platform modernization and next-gen system design.

Every display is built on the same foundation of ruggedized construction, wide-temperature operation and flexible I/O — differing only in the amount of screen real estate delivered to the warfighter.

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Learn more at spectradefense.tech



About Spectra Defense Technologies

Spectra Defense Technologies is a global provider of proven C5ISR solutions for aerospace and defense customers. With over 35 years of proven performance and differentiated expertise, we deliver fully integrated mission systems, data recorders, secure networking, edge computing, robust data-at-rest encryption and advanced visualization that capture, process and display mission-critical data across air, land, sea and space. Backed by engineering, sales, and production teams in North America and Europe, Spectra combines global reach with agile innovation to meet evolving end-user needs with speed and precision. Guided by a culture of innovation and deep customer partnership, we build enduring trust through open-architecture designs, technical excellence and resilient systems designed to meet today's mission needs and anticipate tomorrow's demands for the U.S. DoW, NATO, European defense organizations and allied partners worldwide.