

WOLF Advanced Technology

COYOTES AMONGST THE COSMOS: RUGGED COMPUTING FOR INFINITE EXPLORATION

– WHITEPAPER

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INTRODUCTION

In the rapidly evolving aerospace and defense landscape, simply keeping pace with trends isn't enough. Technology is advancing faster than ever, and in mission-critical applications, failure is not an option. Systems must endure harsh environments while meeting uncompromising quality standards—an imperative that demands relentless innovation.

Enter the Coyotes: WOLF's specialists in next-generation rugged embedded systems, small-form-factor design, and bold, practical ideas. Whether on Earth or in orbit, they expand what high-performance embedded computing can do across ground, orbital, lunar, and deep-space operations. Their work spans R&D, rapid prototyping, and new product development for edge computing and AI-enabled imaging.

As WOLF's leaders in mission-critical innovation, the Coyotes' design philosophy centers on efficiency, reliability, and speed to field. Backed by a deep scientific bench—including multiple PhD-level experts—the team delivers industry-standard systems that perform in real deployments, not just in testing. Leveraging VNX+ and small-form-factor architectures, their solutions are built to withstand shock, vibration, and extreme thermal exposure while meeting demanding size, weight, and power (SWaP) constraints. With every program, the Coyotes deliver scalable systems designed to thrive under the toughest conditions.

TECHNICAL ARCHITECTURE

The Coyotes design and manufacture rugged, open-systems embedded architectures across VNX+, VPX, and custom form factors, with rapid development and mission readiness as core priorities. Their approach enables compact, modular solutions ranging from low-power sensor controllers to high-performance processing platforms, tailored to demanding aerospace and defense environments. Leveraging industry standards such as VITA 90 (VNX+) and SOSA, Coyotes systems deliver interoperability, long lifecycle support, and smooth upgradability while remaining flexible enough to meet unique mission requirements.

Coyotes systems integrate rugged embedded compute modules (such as NVIDIA Jetson Orin NX) with reliable backplanes, power supplies, SBCs, and specialized sensor/video I/O modules. PCIe and ethernet connectivity provide secure, high-bandwidth connectivity for protected data logging and high-rate sensors, designed for the edge whenever optimizing SWaP is a necessity, spanning land, sea, air, and space. The team's small-form-factor chassis prioritize weight reduction, thermal efficiency, and resistance to mechanical shock, enabling deployment in space- and payload-constrained environments. These enclosures support modular VNX+ boards designed for high performance and signal integrity, with radiation tolerance addressed through component screening and mission-specific qualification.

Within these systems, low-latency sensor throughput is enabled by FPGA-based frame grabber modules, while ARM processors with embedded GPUs—such as NVIDIA Jetson Orin NX—provide accelerated sensor compute, real-time video I/O, AI inference, networking, and edge data processing. Together, these complementary compute elements deliver the performance required for mission-critical applications where every gram, watt, and millisecond counts.

PRODUCT PORTFOLIO

Drawing on rapid prototyping expertise without compromising build standards, the Coyotes deliver a robust portfolio of modules that includes:

- VNX+ Orin NX boards
- FGX2 modules (for VNX+)
- VNX+ power supplies
- Space-ready systems for LEO/MEO/GEO and deep-space missions

They also provide fully custom solutions, including rectangular or cylindrical VNX+ chassis as small as 4 inches in diameter.

CHART 1. COYOTES' MODULES & FEATURES (SIMPLIFIED)

Module	SKU/Product Name	Processor	Video I/O	Connectivity	Best for/notes
N4XP	VNXP-ORIN-NX	NVIDIA Jetson Orin NX 16GB with embedded Ampere GPU (1024 CUDA, 32 Tensor) + 8-core NVIDIA Cortex ARM64 CPU @ 2 GHz	Camera input: MIPI CSI-2 with D-PHY 2.1, 4 lanes / 10 Gbps. AI/vision/video processing supported via Orin NX Video output: DisplayPort / HDMI. 2x NVENC/ NVDEC up to 4K-UHD encode/ decode	PCIe Gen4 x4 and x1 to rear connector <ul style="list-style-type: none"> • 1000BASE-T Ethernet • USB 3.2 and USB 2.0 • Serial Peripheral Interface (SPI) I/O 	Autonomous secure AI/HPC compute node / SBC for extreme edge. Ideal as primary compute for rugged ISR, aerospace, and space SWaP-constrained platforms.
N180	VNXP-FGX2-VIO	WOLF's FGX2 FPGA	Up to 2x 12G-SDI or 4x 6G/3G/ HD-SDI SerDes inputs & outputs; 4K-capable digital frame grabber w/ conversion + transmit; MCOTS interface options	<ul style="list-style-type: none"> • PCIe Gen3 x4 Additional GPIO, I2C, and UART connections	High-data-rate 4K video capture/transmit front-end for machine vision, synthetic vision, and rugged video processing where SWaP is tight. Designed to pair with NVIDIA compute for low-latency peer-to-peer processing.

IMAGE 1. WOLF'S N4XP BOARD



IMAGE 2. WOLF'S N180 BOARD



IMAGE 3. EXAMPLES OF THE DIVERSITY OF CHASSIS THE COYOTES DESIGN AND BUILD



RUGGEDIZATION METHODOLOGIES

To maximize lifespan and performance in harsh operating environments, the Coyotes apply rigorous ruggedization practices throughout system development, with primary emphasis on thermal and mechanical resilience.

Small-form-factor systems are engineered to withstand shock, vibration, and extreme temperature cycling through robust mechanical design, rugged conduction-cooled architectures, and careful materials selection. These designs are validated through testing aligned with recognized standards such as MIL-STD-810H, ensuring reliable operation in demanding aerospace and defense environments.

Thermal management is a core competency of the Coyotes team. Advanced cooling strategies—ranging from passive conduction to mission-specific active approaches—enable stable operation across wide temperature ranges (−40 °C to +85 °C), even in tightly constrained SWaP envelopes. For space-oriented concepts, the team applies thermal-electrical co-design techniques to support vacuum operation and long-duration missions.

For emerging aerospace and space-oriented use cases, the Coyotes focus on building adaptable system architectures that prioritize reliability, flexibility, and long-term supportability. High-performance COTS compute is integrated within rugged mechanical and thermal designs, allowing platforms to be evaluated and evolved as mission requirements mature. This provides customers with a practical foundation for future deployments without over-constraining performance or design options.

In short, Coyotes systems are built to survive extreme environments—and to keep performing once deployed.

KEY INNOVATIONS

The Coyotes combine high-efficiency thermal engineering, rugged mechanical design, and modular open architectures to deliver new capabilities quickly and reliably:

- Rugged small-form-factor chassis optimized for thermal efficiency and mechanical resilience
- Modular VNX+ architectures supporting high-performance AI and video workloads
- Advanced power-supply conditioning for wide thermal and electrical operating ranges
- High-bandwidth sensor and video I/O integration for autonomous and ISR platforms
- FPGA-based frame-grabber solutions for low-latency sensor throughput

A representative example is the WOLF-N4XP, a compact VNX+ compute module designed for deployments where VPX form factors are impractical. It integrates an NVIDIA Jetson Orin NX 16GB SOM with an embedded Ampere GPU to support AI inference, machine vision, audio processing, and video encode/decode at the edge. PCIe Gen 4 connectivity, secure networking, and NVMe SED storage enable protected, high-rate data processing in rugged environments.

Across the portfolio, the objective remains consistent: maximize edge performance while minimizing SWaP, without compromising reliability.

APPLICATIONS

Coyotes systems are designed for mission-critical applications where mechanical stress, thermal extremes, and operational constraints challenge conventional hardware. Typical deployment scenarios include:

- Rugged AI processing units for defense and ISR operations
- High-bandwidth video and sensor processing for ground vehicles and aircraft
- Distributed edge computing nodes for aerospace platforms
- Satellite, lunar, and deep-space concept platforms and future missions, where SWaP, thermal control, and reliability are paramount

As WOLF continues to expand testing and qualification efforts, these platforms provide a foundation for evaluating and supporting future ground, air, and space-oriented applications.

CUSTOMER BENEFITS

Adopters of Coyotes systems gain:

- Reduced SWaP: compact, lightweight designs for space- and platform-constrained environments
- Mechanical and thermal robustness: systems engineered to withstand shock, vibration, and extreme temperatures
- Adaptability: modular architectures and custom configurations tailored to mission needs
- Rapid deployment: accelerated development and integration through open standards
- Future readiness: architectures designed to support evolving requirements and long lifecycle programs
- The result is faster fielding, reduced integration risk, and greater confidence in long-term system performance.

ROADMAP AND FUTURE DEVELOPMENT

As WOLF's engine for next-generation embedded compute, the Coyotes continue to advance capabilities through R&D, rapid prototyping, and structured qualification efforts. Near-term focus areas include:

- Expanded small form factor offerings and developed new modules
- Expanded environmental and radiation screening programs
- Continued advancement of thermal-electrical co-design techniques
- Modular sensor and video I/O architectures for autonomous platforms
- Strategic collaborations with agencies and defense partners to support future aerospace and space missions

These efforts position WOLF to support increasingly demanding mission profiles as requirements evolve.

CONCLUSION

The Coyotes embody WOLF's commitment to delivering rugged, high-performance embedded systems engineered for mission-critical environments where reliability, efficiency, and adaptability are paramount. With deep expertise in small-form-factor architectures, advanced thermal management, mechanical ruggedization, and open standards, the Coyotes design platforms that continue to perform under extreme shock, vibration, and temperature conditions—without exceeding strict SWaP constraints. These capabilities form the foundation for dependable operation across today's most demanding aerospace and defense deployments.

Beyond current fielded applications, the Coyotes serve as WOLF's center of gravity for next-generation system development. Through disciplined R&D, rapid prototyping, and structured environmental screening, the team enables customers to explore new operational envelopes, including future space-oriented missions, with clarity and confidence. By evaluating high-performance COTS technologies within ruggedized system architectures, WOLF helps bridge the gap between cutting-edge compute capability and the realities of harsh operational environments.

As mission requirements continue to evolve toward greater autonomy, higher data rates, and increased edge intelligence, the Coyotes ensure WOLF remains positioned to respond—quickly and credibly. Their focus on modularity, interoperability, and long-term adaptability allows customers to field capability faster today while preparing for tomorrow's challenges. In an environment defined by uncertainty and constraint, the Coyotes deliver engineering discipline, technical depth, and a clear path forward for rugged embedded compute.

The Coyotes — united in instinct, unrivaled in innovation.

To learn more about WOLF's cutting-edge solutions, visit wolf-at.com or contact our team at sales@wolf-at.com.

