Next-Gen AI-Enabled Solutions for the Real World: Autonomous Navigation/ Drones, Surveillance and Robotics

Featuring Aerora and Lantronix

Aerora LANTRONIX®

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Executive Summary

Advanced Technologies Accelerate AI-Powered Visual Navigation in Drones, Robotics and Surveillance Applications

OEMs of drones, robotics and surveillance solutions face increasing pressure to shorten development timelines while maintaining high standards for imaging and control systems. In addition, there may be additional compliance needs from NDAA (North American Defense Authorization Act), DIU (Defense Innovation Unit) Blue status, and/or AUVSI's (Autonomous Uncrewed Vehicles Systems International) Green cyber secure.

This white paper will examine the challenges, technology breakthroughs, advantages, benefits and opportunities for OEM development of Unmanned Aerial Vehicles (drones) and robotic solutions for use in a variety of industries as based on the OEM solution developed by Aerora, with supporting technologies from Lantronix products that are based on Qualcomm Technologies' chip and Teledyne FLIR.

Technical Challenges

- Sensor quality and reliability (including cameras and GPS systems)
- Navigational precision
- Environmental factors (such as wind, rain, snow, etc.)
- Meeting qualifications for required certifications – design control, country of origin, Green, Blue, NDAA
- Integration with other products or systems
- Battery life and insurance
- Payload capacity

Economic Challenges

- High initial cost for development
- Time-to-market constraints
- Finding trusted and affordable developers
- Supply chain and manufacturing scale – large and small

Aerora's Integrated Camera + Gimbal Solution for OEMs

Aerora's fully integrated camera + gimbal system and SDK's help eliminate engineering overhead and shorten time-to-market while ensuring NDAA compliance.

It provides the flexibility to develop advanced thermal image processing (ISP) and AI capabilities to edge devices such as drones, robots and surveillance equipment.

This system utilizes key technologies:

- Lantronix's Open-Q™ 8250 System-on-Module (SoM), which is based on the Qualcomm® Dragonwing™ QCS8250 processor. Designed to deliver Edge AI capabilities, it is NDAA and TAA compliant.
- Teledyne FLIR's industry-leading thermal and visual camera, the Hadron™ 640 series, provides a lightweight, low-module integrated camera that helps reduce development time. It is also NDAA compliant.

Breakthrough Technology Innovations

Turnkey Integration: Camera + Gimbal as a Ready-to-Deploy Module
An all-in-one solution for OEMs that need a turnkey camera + gimbal module including:

- Full-stack solution: camera, gimbal, gimbal motors, housing, telemetry and interface, all pre-integrated.
- 4K video stream simultaneously with high-resolution thermal video (up to 640x512), including RGB up to 64MP, for example.
- Lantronix's Open-Q 8250 SoM that delivers unparalleled processing capabilities for AI-driven situational awareness, advanced computational imaging and real-time decision-making.

- Teledyne FLIR's integrated Hadron 640 module, providing support for advanced thermal/RGB imaging.

Smart AI-Optimized Interface Design for Seamless OEM Integration

With the embedded performance of the Lantronix Open-Q 8250 SoM, developers can quickly create high-performance, size, weight and power-optimized AI camera solutions.

Utilizing AI and smart design delivers a solution including:

- OEM adapter board architecture, allowing rapid drop-in integration into existing flight control systems.
- CAN BUS support that enables drone telemetry and gimbal control, which is designed to work out of the box.
- Software SDKs and interface protocols that are included, allowing additional integrations.
- Bespoke housing and vibration damping, which are designed to fit custom airframe constraints

Field Proven in Rugged Environments

- Designed for use in rugged environments, the compact form factor is optimized for size, weight, and power (SWaP) and field-proven for the ultimate performance and reliability.

Key Advantages

Engineering, Manufacturing & Supply Chain Support

- Aerora handles the full lifecycle from engineering and integration to volume production and aftermarket support.
- Teledyne FLIR's "easy-to-integrate" thermal camera provides an ideal dual sensor payload into an integrated camera + gimbal solution.
- Lantronix's Open-Q™ 8250 SoM, based on the Qualcomm® Dragonwing™ QCS8250 processor, delivers processing capabilities for AI-driven situational awareness.

> "With Lantronix's Open-Q SoMs, developers can confidently build AI-powered solutions knowing they are backed by industry-leading embedded compute technologies that deliver longevity, reliability and continuous innovation."
>
> – *Mathi Gurusamy*
> *Chief Strategy Officer*
> *Lantronix*

NDAA Compliant

This solution meets internal and external compliance requirements as the NDAA-compliant solution is manufactured in Vietnam. All companies are headquartered in the Western U.S. and serve clients globally.

Use Case #1: Rapid Integration and Manufacturing for EO/IR Camera Systems

An OEM required rapid integration and manufacturing of a dual optical and thermal (EO/IR) camera solution into its drone system. Aerora leveraged its engineering and NDAA-compliant manufacturing capabilities to fulfill this need. Collaborating, the advanced FLIR Hadron camera, featuring 640x512 thermal and 64MP optical resolutions to ensure superior imaging performance, was selected. Utilizing Lantronix's system-on-module (SOM) solutions and engineering support along with Qualcomm's advanced processing technologies, Aerora integrated these components onto a precision-engineered 3-axis gimbal. This approach significantly reduced the OEM's development timeline and resource allocation, enabling a quicker approach to market.

Use Case #2: Scalable Integration for Future Specialized Sensor Applications

Expanding on its proven EO/IR camera integration expertise, Aerora can adapt to a broader range of sensor types and applications. Aerora's flexible integration

model, utilizing Lantronix and Qualcomm SOM technologies as foundational building block, enables rapid adaptation and deployment. This can now include the integration of specialized sensors, such as multi-spectral cameras for agricultural monitoring and optical gas imaging (OGI) sensors for methane detection. Aerora's NDAA-compliant manufacturing and end-to-end supply chain management then allows the OEM to deploy highly stable and reliable camera-gimbal solutions onto drones and ground robots, supporting critical missions such as methane leak detection and crop health assessments as needed.

Benefits of Drones and Unmanned Aerial Vehicles

- **Efficiency and speed,** making tasks like surveying, mapping and surveillance faster and easier
- **Cost effectiveness,** compared to manned aircraft or ground-based inspections
- **Safety,** as drones can perform dangerous tasks, such as inspecting high-voltage and hazardous areas without risking human lives
- **Data collection,** including capture of high-resolution images, videos and other data
- **Real-time data** from live video feeds and data, enabling real-time monitoring and decision-making
- **Accessibility** to remote and difficult-to-reach areas
- **Versatility** for use in a variety of tasks and industries, ranging from security and infrastructure protection to agriculture and construction
- **Precision** when equipped with advanced technology and sensors to aid in gathering accurate assessments and data
- **Enhanced site security** when used to monitor perimeters, detecting unauthorized access and for investigations

> "Our collaboration with Lantronix adds flexibility for integrators developing thermal-enabled AI-based platforms. Our SWaP-optimized IR camera modules and ultra-low embedded software processing power simplify thermal management and extend battery life for autonomy applications."
>
> – *Michael Walters*
> *Vice President of Product Management*
> *Teledyne FLIR OEM*

Bringing Edge AI to the Real World: Success Factors

- **Advanced Development Capabilities**
  - OEMs have the flexibility to develop advanced thermal image processing (ISP) and AI capabilities to edge devices.
- **Accelerated Time to Market**
  - Aerora's white-label production delivers faster development cycles by ensuring that OEMs stay focused on their core, not on sensor integration or manufacturing.
- **Worry-Free Production and Integration**
  - Based on the tight collaboration between Aerora and Teledyne FLIR technology, backed by Lantronix System on Modules and Qualcomm processor technology, OEMs gain the confidence that this solution will work as designed.
- **Lower Engineering Costs**
  - Designed with the integrated solution in mind, this solution saves OEMs thousands of dollars in development time and effort, helping to ensure faster time to market.
    - Integrated payloads and cameras
    - Simultaneous video and thermal SOM

Advanced AI and Thermal Processing

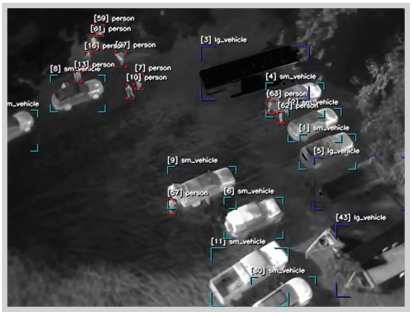
Lantronix's integration of Teledyne FLIR Prism™ into the Qualcomm Dragonwing™ QRB5165 and QCS8250 platforms brings advanced thermal image signal processing (ISP) and AI capabilities to edge devices.

Key features include:

- **Prism™ ISP:** Super resolution, turbulence mitigation, atmospheric obscurant correction, de-noising, image fusion, electronic stabilization, and local contrast enhancement.
- **Prism™ AI:** Real-time object detection, motion target indication, and high-speed target tracking at video frame rates.

Lantronix's Open-Q™ SoMs fully support Teledyne FLIR Hadron™ dual visible-thermal and Boson® thermal camera modules, allowing for simultaneous color and infrared video capture across multiple MIPI-CSI camera interfaces. Key configurations include:

- Hadron Camera: Integrated with the Lantronix Open-Q 8250 SoM, featuring the Dragonwing™ QCS8250 processor running Android™.
- Boson Camera: Integrated with the Lantronix ultra-compact Open-Q 5165 SoM, leveraging the Dragonwing QRB5165 platform on Linux®.



Hadron 640 - High Performance, Dual Thermal and Visible OEM Camera Module

> **"By integrating with Teledyne FLIR's advanced thermal camera modules, Lantronix provides a turnkey embedded AI solution that maximizes performance while simplifying development and deployment."**
>
> *– Mathi Gurusamy*
> *Chief Strategy Officer*
> *Lantronix*

Next-Generation AI-Powered Camera Technology

The seamless integration of Lantronix's high-performance Open-Q™ SoM solutions, including hardware and software with Teledyne FLIR's thermal infrared (IR) camera modules and Prism™ embedded software, accelerates the development of next-generation AI-enabled camera solutions in autonomous navigation/drones, surveillance and robotics.

Powered by Lantronix's cutting-edge Open-Q SoMs, based on the Qualcomm® Dragonwing QRB5165 and QCS8250 processor platforms, this solution delivers unparalleled processing capabilities for AI-driven situational awareness, advanced computational imaging and real-time decision-making. Lantronix's seamless technology integration provides a competitive edge, enabling developers to create high-performance, size-, weight- and power-optimized (SWaP) AI camera solutions that push the boundaries of innovation.

Teledyne FLIR: Hadron and Boson Cameras Technical Specifications

Lantronix integrated Teledyne FLIR's Hadron and Boson cameras for use with Lantronix's family of Open-Q 865 family of SOMs. This work included integration with additional multi-vendor MIPI-CSI cameras, enabling simultaneous/concurrent color and infrared video capture. This support includes:

- Support for MIPI-CSI based Hadron/Boson as well as USB interfaced versions
- Support for CCI/I2C register protocol (custom for FLIR's serial stream interface)
- Integration of FLIR's Hadron camera with the Lantronix Open-Q 8250 SOM with Qualcomm's QCS8250 SOC running Android
- Integration of FLIR's Boson camera with the Lantronix Open-Q 5165RB SOM with Qualcomm's QRB5165 SOC running Linux

> “At Aerora, our core mission is delivering rapid integration, flexible sensor solutions, and fully NDAA-compliant manufacturing at scale. By collaborating closely with industry leaders Teledyne FLIR, Lantronix, and Qualcomm, we empower drone OEMs to significantly reduce development timelines, expand their operational capabilities, and confidently meet demanding market requirements.”
>
> – *Ghel Ghedh*
> *Chief Technology Officer*
> *Aerora*

- Implementation of many options for streaming camera preview off the SOM:
  - USB Video Camera (UVC) interface
  - Gstreamer interface
  - Networked streaming using RTSP
- Graphical Library utilities to compose FLIR thermal images together with Electro-Optical (EO) RGB imaging from OV64B
- High resolution imaging of the 64 Mp EO camera
- Latency improvements in end-to-end streaming

Summary

Aerora delivers solutions and manufacturing that works. Lantronix + Qualcomm NDAA compliance is hassle and worry free. Contact Aerora today for your drone sensor needs.

About the Advanced Components Supporting Aerora’s Solution

Teledyne FLIR’s Hadron 640

This high-performance, dual-thermal and visible OEM camera module is NDAA-compliant and ITAR-free. It pairs a 64 MP visible camera with a performance-leading 640x512 resolution radiometric Boson® thermal camera in a single, easy-to-integrate module.

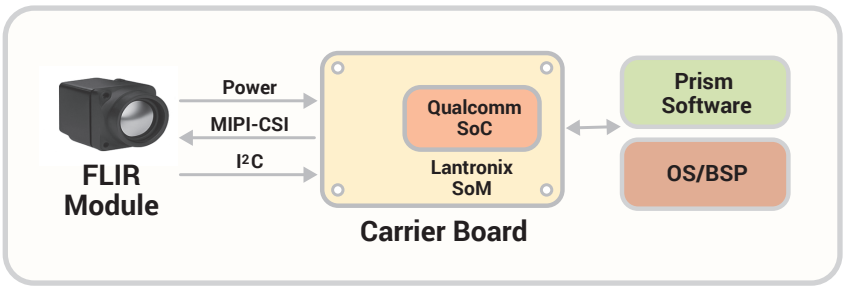
With a size, weight and power (SWaP) optimized design, it is an ideal dual sensor payload for integration into unmanned aircraft systems (UAS), unmanned ground vehicles (UGV) robotic platforms and emerging AI applications using Teledyne FLIR Prism™ software.

Lantronix’s Open-Q™ 8250CS System on Module

Lantronix’s Open-Q™ 8250CS production-ready computing SOM, delivered with Android™ 13, provides a power platform for edge computing and can be utilized to:

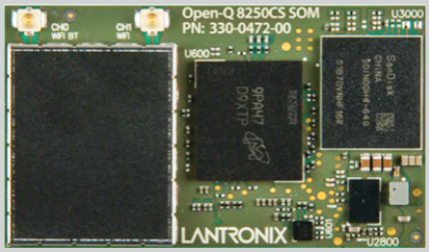
- **Collect** – significant communications and video capture and processing capabilities
- **Connect** – integrated WiFi 6 & BLE 5.1 in chipset
- **Compute** – powerful CPU and GPU engines
- **Comprehend** – neural, computer vision and DSPs
- **Control** – many I/O interfaces to external systems to provide intelligent feedback

The OpenQ 8250 development software package supports multiple concurrent decode+encode sessions, 2A sync for two cameras, UVC/UAC source mode for video collaboration bars to function as a USB class device, low-latency MS codecs, MS Teams video extensions and other exciting camera and video features.



About the Companies

Lantronix



Lantronix Open-Q 8250CS SOM

Lantronix Inc. is a global leader of compute and connectivity IoT solutions that target high-growth markets, including Smart Cities, Enterprise and Transportation. Lantronix's products and services empower companies to succeed in the growing IoT markets by delivering customizable solutions that enable AI Edge Intelligence. Its advanced solutions include Intelligent Substations infrastructure, Infotainment systems and Video Surveillance, supplemented with advanced Out-of-Band Management (OOB) for Cloud and Edge Computing. Lantronix is based in Irvine, California.

Aerora

Aerora™ accelerates drone and robotics innovation by offering fully integrated, NDAA-compliant propulsion, ground control, and precision AI payload systems. Managing the entire supply chain and overseeing all manufacturing processes—both onshore and offshore—we empower manufacturers to effortlessly scale, streamline operations, and faster time to market without compromising quality or compliance. Aerora™ is based in Santa Clara, California.

Conclusion:

Situation:

- OEMs of drones, robotics and surveillance solutions face increasing pressure to shorten development timelines while maintaining high standards for imaging and control systems.

Technical Challenges:

- Sensor quality and reliability, navigation precision, weather factors, certification requirements, integration with other products and systems; battery life and insurance; and payload capacity.

Economic Challenges:

- High initial development cost; time-to-market constraints; finding trusted and affordable developers; ad supply chain and manufacturing scale.

Solution:

- **Aerora's fully integrated camera + gimbal system** utilizes AI to eliminate engineering overhead and shorten time-to-market while ensuring NDAA compliance.

Benefits:

- It provides the flexibility to develop advanced thermal image processing (ISP) and AI capabilities to edge devices such as drones, robots and surveillance equipment.

Key Advantages:

- Engineering, manufacturing and supply chain support
- NDAA complaint

Integrated Technologies:

- Lantronix's Open-Q™ 8250 System-on-Module (SoM) which is based on the Qualcomm® Technologies Dragonwing™ chip. Designed to deliver Edge AI capabilities, it is NDAA and TAA compliant.
- Teledyne FLIR's industry-leading thermal and visual camera, the Hadron™ 640 series, provides a lightweight, low-module integrated camera that helps reduce development time. It is also NDAA compliant.

Call to Action:

For more information on Aerora's fully integrated camera + gimbal system, contact: https://www.aeroratech.com/contact-us

For more information on Lantronix's family of Open-Q System-on-Module and Development Kit solutions, contact: Sales@Lantronix.com

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