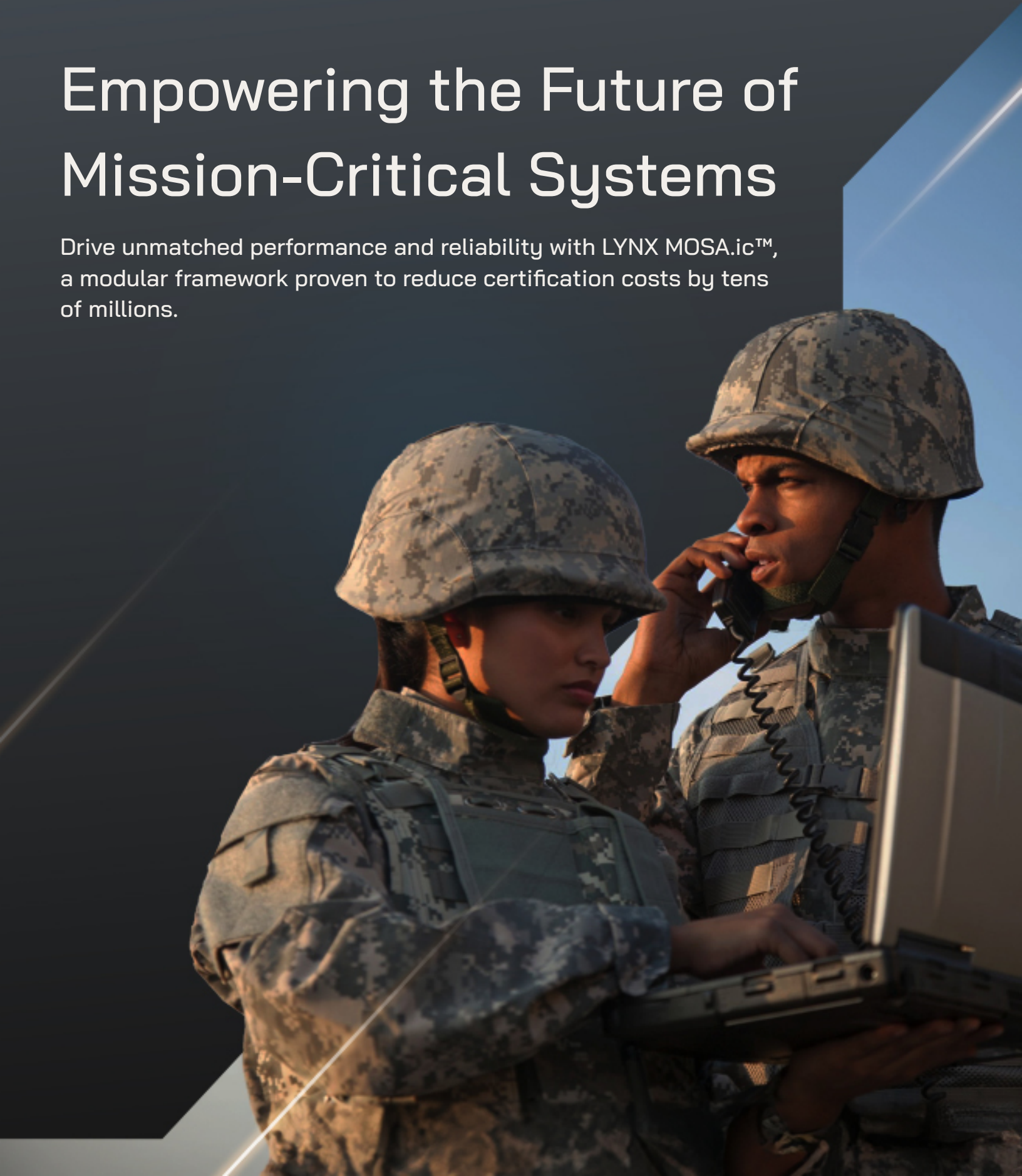
LYNX

Empowering the Future of Mission-Critical Systems

Drive unmatched performance and reliability with LYNX MOSA.ic™, a modular framework proven to reduce certification costs by tens of millions.



Revolutionizing System Design for Aerospace & Defense

At Lynx, we understand the complexities of creating safe, secure, and certifiable platforms in an era defined by rapid technological advancement. LYNX MOSA.ic™ reimagines modular system design, empowering you to overcome legacy challenges, streamline integration, and Seize the Edge in every mission-critical endeavor.

Research shows 31% of cost overruns stem from insufficient systems analysis and underestimating complexity during early planning stages. By addressing these challenges upfront, LYNX MOSA.ic helps reduce costs, accelerate timelines, and deliver mission-critical solutions you can trust.

Traditional multicore architectures often bundle diverse system functions—hardware control, real-time scheduling, security, and multimedia—into monolithic stacks. This approach increases complexity, limits scalability, and creates hurdles in meeting rigorous safety and certification standards.

LYNX MOSA.ic revolutionizes this paradigm by enabling system architects to create smaller, independent stacks tailored to each application's needs. Acting as an Integration Center—highlighted by the ".ic" in its name—LYNX MOSA.ic unifies tools and frameworks to simplify software component management and integration. These capabilities reduce development cycles and enable faster certification and deployment of secure, mission-critical platforms.

With its modular design and unified toolsets, LYNX MOSA.ic empowers developers to build comprehensible systems that meet the highest standards of safety, scalability, and efficiency, even in the most complex multicore environments.

> "At Lockheed Martin, we are committed to providing our customers with cutting-edge solutions that promote interoperability, reusability and cost savings. By working closely with Lynx Software Technologies and leveraging the LYNX MOSA.ic platform, we are helping our customers achieve its MOSA vision of creating more agile and capable systems built on open standards."

-Steve Donlin, Lockheed Martin Avionics and Aircraft Modernization Director.

The Challenge: Complexity in Multicore Environments

Traditional multicore architectures create challenges that extend beyond technology—they complicate timelines and increase costs. By eliminating these architectural barriers, LYNX MOSA.ic ensures you spend less time navigating legacy issues and more time driving innovation.

Customer Adoption: Partnering for Real-World Impact with LYNX MOSA.ic

We understand the challenges you face in delivering safety-critical platforms that demand reliability, performance, and scalability. That's why we've designed LYNX MOSA.ic to be your foundation for mission success. Customers have reported experiencing transformative outcomes, from eliminating hundreds of thousands of lines of code to reducing certification costs by tens of millions of dollars.

Together with our customers, we've accomplished remarkable outcomes:

The following are publicly disclosed programs that leverage LYNX MOSA.ic.

Lockheed Martin F-35
In partnership with Lockheed Martin, LYNX MOSA.ic powers the Panoramic Cockpit Display (PCD) and Integrated Core Processor (ICP) avionics platforms. By streamlining software migration from Linux to the LynxOS-178™ real-time operating system, we helped achieve F-35 SEAL Level 1 certification—equivalent to DO-178C DAL A standards.

Collins Aerospace Perigon Mission Computer
LynxSecure™, the foundational separation kernel in LYNX MOSA.ic, enabled Collins Aerosace to enhance safety and scalability by supporting bare-metal applications across three processor architectures. Together, we've delivered unmatched flexibility for mission-critical systems.

General Atomics Gray Eagle Extended Range UAS
LYNX MOSA.ic transformed a mixed-criticality system (Linux and LynxOS-178™) from a monolithic stack into a streamlined, scalable architecture. Collaborating with General Atomics, we leveraged our modular approach to achieve significant improvements in performance and integration for their Arm-based (Xilinx MPSoC) system.

Why Organizations Choose LYNX MOSA.ic

With its modular design and robust capabilities, LYNX MOSA.ic empowers you and your teams to overcome complexity, reduce development costs, and accelerate certification timelines. We work alongside you to deliver measurable results that drive mission success and enable you to Seize the Edge across critical platforms—because at Lynx, your goals are our goals.

Overcome Complexity

Reduce development costs

Accelerate certification timelines

Learn more customer benefits enabled by LYNX MOSA.ic on the next page.

Customer Benefits	Capability Enabled by LYNX MOSA.ic
Enhanced Safety & Security	• LYNX MOSA.ic delivers systems purpose-built for safety and security, ensuring robust, multi-core platforms designed to meet the highest certification standards. This enables the development of highly reliable, high-performance systems critical to aerospace, defense, and automotive industries.
Optimized Multi-Core Performance	• By leveraging an architecture natively designed for multi-core environments, LYNX MOSA.ic reduces overhead by 25%, enabling unmatched efficiency and scalability.1 Customers benefit from streamlined development processes, improved performance, and the flexibility to scale operations more effectively while avoiding the limitations of retrofitted single-core systems.
Lower Certification Costs	• The modular, multi-core architecture of LYNX MOSA.ic reduces code complexity by 30%, allowing faster adaptation of legacy designs to modern systems. This streamlines certification, accelerates time-to-market, and ensures compliance with regulatory requirements.

Technical Overview: Simplifying Multicore System Integration

LYNX MOSA.ic transforms complex multicore environments into streamlined, mission-ready platforms by introducing modular, application-specific stacks. Its innovative runtime architecture, powered by LynxSecure™, delivers unmatched scalability, portability, and certification readiness for mission-critical systems.

Runtime Architecture: Control & Data Plane Integration

The runtime architecture of LYNX MOSA.ic exemplifies flexibility and precision, leveraging two core platform technologies:

- **Control Plane -** Provides robust hardware time and space separation, managed by the LynxSecure™ hypervisor. This ensures deterministic performance while enabling hardware-enforced software architectures tailored to specific system configurations.
- **Data Plane** - Delivers real-time POSIX and ARINC applications within VMs, offering a rich development environment for mission-critical workloads.

Illustrative Use Cases

- **Aerospace Avionics** - Securely isolate critical flight data processing while enabling real-time multimedia applications.
- **Defense Systems -** Ensure isolated processing for classified operations while running mission applications seamlessly

Key Capabilities of LYNX MOSA.ic Runtime Architecture	Capability Enabled by LYNX MOSA.ic
Flexible Multicore Support	• Dynamically allocates CPU cores to virtual machines, maximizing performance.
Tickless Scheduling	• Reduces context switching and enhances real-time efficiency.
Virtual Device Emulation	• Enables inter-VM communication and streamlines hardware resource sharing.

Hypervisor Capabilities: A Foundation for Security, Portability, and Scalability

At the heart of LYNX MOSA.ic is the LynxSecure™ hypervisor, a lightweight separation kernel developed according to DO-178C DAL A standards and compliant with ARINC 653 architecture requirements. LynxSecure™ addresses complexity challenges in multicore systems by:

- **Hardware-Enforced Partitioning**
  Securely isolates system resources to support mixed-criticality applications.
- **Enhanced Portability and Robustness**
  Provides superior platform robustness and application portability compared to conventional RTOS designs.
- **Advanced Scheduling Flexibility**
  Supports multiple scheduling configurations, including static cyclic, adaptive cyclic, and priority-preemptive, tailored to specific mission needs.
- **Aperiodic Reservation**
  Guarantees execution time for sporadic workloads, maintaining operational stability.

LynxSecure™ operates as a hardware control plane, handling resource allocation and policy enforcement without providing application or data services. All resource allocation and policy enforcement capabilities provided by the hypervisor apply to the definition of virtual machines and their assigned resource and access control permissions. This approach creates a hardware-enforced software architecture for a given system configuration.

This focus ensures seamless integration across multicore systems, enabling developers to meet the highest certification standards while optimizing performance.

Key Capabilities of LYNX MOSA.ic

Optimized Multi-Core Support

The LynxSecure™ hypervisor enables the flexible allocation of CPU cores to virtual machine environments, allowing diverse execution configurations to run simultaneously. This flexibility ensures optimal performance and resource utilization in mission-critical systems.

Advanced Scheduling Support

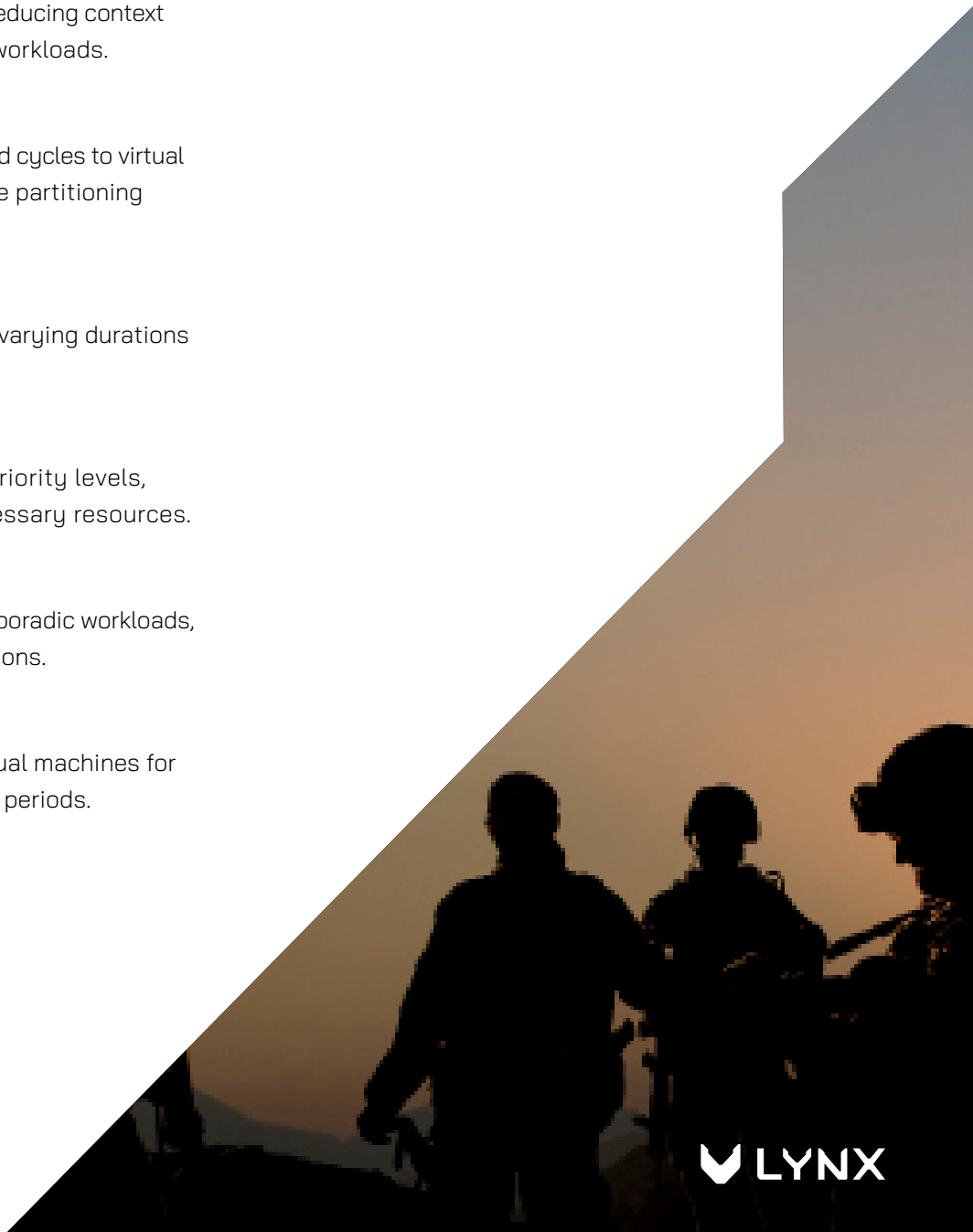
With a variety of configurable scheduling options, LYNX MOSA.ic empowers developers to meet the unique demands of complex workloads:

- **Tickless Scheduler**
  Enhances determinism, reliability, and efficiency by eliminating periodic timer ticks, reducing context switches, and adapting to varying workloads.
- **Static Cyclic Scheduling**
  Assigns fixed execution durations and cycles to virtual machines, following ARINC 653 time partitioning standards.
- **Adaptive Cyclic Scheduling**
  Allows multiple static policies with varying durations and periods for greater flexibility.
- **Priority Preemptive Scheduling**
  Allocates virtual CPUs based on priority levels, ensuring critical task receive necessary resources.
- **Aperiodic Reservation**
  Guarantees execution budgets for sporadic workloads, maintaining stability across operations.
- **Co-operative "Z-Scheduling"**
  Delegates context switching to virtual machines for conditional and bounded execution periods.

Virtual Device Emulation

LynxSecure supports the virtualization of peripheral interfaces, enabling:

- **Inter-VM Communication**
  Facilitates seamless communication between virtual machines.
- **Resource Multiplexing**
  Allows multiple VMs to share physical devices, enhancingsystem efficiency. This feature supports RTOS runtimes with advanced POSIX file system and networking capabilities.



Comprehensive Guest Software Support

LYNX MOSA.ic enables the development and deployment of diverse software types:

Guest Software Type	Key Features
Bare-Metal (LSA) Applications	• Minimal runtime complexity with 64-bit C libraries and GCC toolchain.
RTOS (LynxOS-178™)	• Safety-certified, preemptive hard real-time OS providing multi-threaded POSIX and ARINC runtime services.
Unikernels (LynxElement™)	• High-performance, consolidated environments with ARINC and POSIX libraries and a fully featured stack. This single-process, multi-threaded RTOS environment eliminates redundant architectural constructs, enabling lightweight, efficient deployments tailored to your needs. With a fully featured stack and standard ARINC and POSIX libraries, LynxElement™ ensures flexibility and scalability for mission-critical workloads.
Linux (Buildroot)	• A lightweight, embedded Linux toolchain that supports a broad range of peripherals with native Linux kernel.org images. Buildroot simplifies customization by allowing you to select kernel modules and application packages for deployment, ensuring your platform is optimized for specific use cases.

In addition, LYNX MOSA.ic supports third-party binary OS distributions, including Windows, Red Hat, and Ubuntu, offering unparalleled flexibility for customer-specific requirements.

Development Tools for Rapid Deployment

LYNX MOSA.ic accelerates the prototyping and deployment process with:

- **Lynx Software Development Kit (SDK) -** Comprehensive tools for building and integrating applications across bare-metal, RTOS, and Linux environments.
- **Virtual Integration Environment (VIE) -** Test and debug on virtual hardware, eliminating dependencies on physical board availability.
- **Embedded Board Farm (EBF) -** Remote access to physical hardware for continuous testing, debugging, and CI/CD pipeline integration.

Achieving Standards Compliance with FACE® Version 3.1

At Lynx, we understand the challenges of integrating advanced technologies into mission-critical systems. The Future Airborne Capability Environment (FACE®) Technical Standard addresses these challenges by enabling software reuse, accelerating warfighter capabilities, and fostering innovation in U.S. military aviation.

Streamlining Testing with Virtual and Physical Tools

Testing and debugging mission-critical systems can be complex and time-consuming, especially when access to physical hardware is limited. At Lynx, we simplify this process with the Virtual Integration Environment (VIE) and Embedded Board Farm (EBF), empowering you to test, validate, and refine your systems efficiently.

How We Help You Accelerate Development

- **Remote Access to Hardware**
  Manage tasks like power control, USB hot-plugging, and network management from anywhere, ensuring seamless integration into your workflows.

- **Virtual + Physical Testing**
  Combine the flexibility of virtual testing with the reliability of physical hardware access, enabling continuous integration and faster time-to-market.

- **Collaborative Debugging**
  Enable your teams to work together in real time, reducing delays and improving system reliability.

By integrating VIE with EBF, we provide a secure, scalable framework that adapts to your unique needs, helping you overcome testing challenges and deliver robust solutions with confidence.

LYNX MOSA.ic.SCA: Simplifying Cybersecurity and Compliance

Meeting cybersecurity requirements and achieving compliance in regulated industries like military and avionics can be daunting. That's why LYNX MOSA.ic includes a dynamic Software Composition Analysis (SCA) capability, designed to streamline your security processes and ensure transparency.

How We Empower Your Security Strategy

- **Full Component Transparency**
  Generate a Software Bill of Materials (SBOM) for each version of LYNX MOSA.ic, ensuring you have complete visibility into your software components.

- **Integrated Development Workflows**
  Seamlessly incorporate SCA tools into your CI/CD pipelines, reducing disruptions and enhancing efficiency.

- **Proactive Risk Mitigation**
  Track Common Vulnerabilities and Exposures (CVEs), prioritize risks, and manage patches effectively, so you stay ahead of threats.

- **Standards Compliance Made Simple**
  Compatible with CycloneDX and SPDX formats, LYNX MOSA.ic.SCA helps you comply with mandates such as the White House EO 14028, ensuring your systems meet industry and government requirements.

With Lynx as your trusted partner, you gain the tools and expertise needed to navigate complex security requirements and deploy resilient systems that inspire confidence.

Lynx Partners: Enhancing Innovation Through Collaboration

At Lynx, we believe that collaboration is key to solving the most complex challenges in mission-critical systems. That's why we partner with industry-leading technology providers to enhance the capabilities of LYNX MOSA.ic. By integrating best-in-class solutions, we ensure your systems are ready to meet the demands of tomorrow.

RunSafe Security: Advanced Threat Mitigation for Mission-Critical Systems

Cybersecurity threats continue to evolve, requiring proactive measures to safeguard critical systems. To strengthen protection, LYNX MOSA.ic integrates RunSafe Code, developed in partnership with RunSafe Security.

Key Benefits of RunSafe Code:

- **Minimized Attack Surfaces**
  Based on the Department of Defense-proven Runtime Application Self-Protection (RASP) approach, RunSafe Code addresses vulnerabilities left by traditional scanning and patching methods.

- **Advanced Memory Safety**
  Mitigates 70% of exploits, such as buffer and heap overflows, by rendering gathered information unusable during an attack.

- **Enhanced Security with Real-Time Performance**
  Implements fine-grained Address Space Layout Randomization (ASLR) while maintaining real-time performance guarantees for RTOS environments.

RunSafe Code is set to achieve certification under DO-330 TQL-1 for tools and DAL A for runtime, ensuring compliance with the highest security standards.

SpyKer-TZ Powered by Percepio®: Unmatched Observability and Debugging

To optimize system performance and ensure efficient resource usage, LYNX MOSA.ic integrates SpyKer-TZ, powered by Percepio Tracealyzer technology. This advanced trace analysis tool delivers:

- **Real-Time Observability**
  Enables non-intrusive event tracing for detailed insights into program execution.

- **Actionable Analysis Tools**
  Features trace views, CPU load graphs, and event logs to identify performance bottlenecks and optimize system behavior.

- **CI/CD Integration**
  Supports deployment into customer software pipelines, enhancing collaboration and efficiency in safety-critical applications.

With SpyKer-TZ, your teams gain the visibility needed to maintain operational excellence and streamline debugging in even the most demanding environment

Collaborative Partner Ecosystem

We work with a diverse network of partners to ensure LYNX MOSA.ic serves as the integration center for future systems. From system integrators to IP providers, hardware platforms to middleware solutions, our partner ecosystem spans the industry, enabling seamless collaboration and enhanced functionality for your mission-critical sytems..

Sources

- Lynx internal report.
- Defense Acquisition University, Mckinsey.
- Chromium Project. “Memory Safety.”
  Chromium Security : *https://www.chromium.org/Home/chromium-security/memory-safety/*

Ready to revolutionize your mission-critical systems?

Contact Lynx today to learn more about how LYNX MOSA.ic can empower your success and help you Seize the Edge in every mission-critical endeavor.

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