

PUMA: ADVINT's Rugged Portable PXI-Based Platform for Factory to Field Support

Background

The Department of Defense (DoD) and its prime contractors experience weapon system downtime, high transportation costs, and extended delays on missions relying on rack-and-stack test systems located back at the factory. The necessity for field deployable automated test systems that provide acceptance test capability to support field maintenance activities is critical to minimize deployment risks. This requires robust software capability hosted on rugged hardware that's easily transportable and suitable for operation in various field environments.



ADVINT, a leading provider of automated test systems for aerospace/defense applications, offers customized versions of its flagship Portable Universal Multi-Channel Asset (PUMA) test platform to support these missions.

Mission Goal

Provide a modular, scalable, flexible, transportable test capability tailored for a wide variety of weapons system needs. Offer field test capability to achieve heightened sustainability to enhance mission critical weapon system uptime.

Mission Objectives

Deployed military systems demand test systems meet several unique performance, integration, and usability objectives:

- **Weapon System Support:** Adaptation for specific stimulus, measurement, sensors and data interfaces used in military systems, avionics, and electronics.
- **Transportability:** Compact footprint that is vibration/shock resistant to allow mobile operations without compromising test precision or performance.
- **Repeatability & Accuracy:** The ability to reproduce diagnostic results across multiple system variants and environments.
- **Ruggedization:** Hardware capable of operating in intense field conditions with minimal maintenance.
- **Reliability:** Proven reliability in harsh test environments, including military-grade applications.
- **Scalability:** Easy expansion through modular PXI extensions for Instrumentation (PXI) slots and software-configurable channels.
- **Compatibility:** Integration with legacy components and support for future system upgrades.
- **Environmentally Rated:** System to withstand storage, transport, and operation in real-world environmental conditions:
 - Temperature
 - Humidity
 - Altitude
 - Vibration
 - Shock
 - Transit Drop
 - Bench Handling
 - Salt Exposure
 - Solar Radiation
 - Dust Resistance
 - Acoustic Noise
 - EMC
 - Etc.

Solution Overview

ADVINT leverages the inherent modularity of its PUMA platform, built around National Instruments (NI) hardware and software ecosystems, to address the challenge. Working closely with the client's engineering team, ADVINT delivers solutions that balanced hardware standardization with program-specific flexibility while supporting system longevity via future upgrade/enhancement path.

Design Customizations

- **Form Factor Adjustments:** Design chassis and enclosure to meet transport, storage, and deployment requirements including rugged casings shock-mounting systems, and various MIL-STD-810 scenarios.
- **Signal Adaptation:** Unique interfaces/test capabilities are supported via custom NI-based signal conditioning modules or custom Tester Replaceable Units (TRUs) designed and manufactured by ADVINT.
- **Mass Interconnect:** Systems include MIL-STD-38999 interconnect and/or MAC Panel Scout receiver using Direct Access Kit (DAK) circuit board direct connect to PXI instrumentation assets. In addition, PUMA also offers PCB based Interface Test Adapters (ITAs) for heightened signal density/integrity.



Figure 1: 6U 30"D PUMA with MIL 38999 Connectors

- **Automated Self-Test & Calibration:** Embedded routines using NI LabVIEW®, LabWindows™/CVI, and TestStand® enable system self-test and calibration via automated field verification and fault diagnostics which greatly reduce logistics pipeline.
- **Test Coverage Expansion:** The system supports analog, digital, video, switching, and RF/EW interfaces across multiple weapon system generations enabling comprehensive cross-platform test capability.

NI Technology Integration

NI's PXI platform is integral to the modular solution. ADVINT utilized:

- **NI PXI Chassis:** Leverages high performance embedded controller for multifunction analog modules, DMM, digital I/O, RF VSTs, and switching cards.
- **LabVIEW RT and FPGA Modules:** Real-time data acquisition and deterministic control in emulated threat scenarios.
- **LabWindows/CVI:** ANSI C integrated programming environment.
- **TestStand Automation Framework:** Implement reusable test sequences, create reports, and manage configuration settings across various avionic subsystems.



Figure 2: PUMA with Built-In Display



Figure 3 : PUMA with 18-Slot PXI Chassis, cDAQ/cRIO, MAC Panel Scout Mass Interconnect and PCB Based ITAs

Deployment & Results

Due to ADVINT's customization capabilities, the PUMA has been deployed across multiple weapon systems, military branches, and maintenance facilities. The platform enables clients to:

- **Speed Up Test Cycles:** Significant test time reduction improving throughput for urgent field deployments.
- **Increase Diagnostic Confidence:** Automated fault isolation improves accuracy in identifying system failures, reducing false positives facilitating field repairs.
- **Standardize Workflow:** The shared NI software interface allows technicians to operate across sites with minimal retraining.
- **Enable Remote Operations:** Built-in network protocols permit remote test execution and system health checks.
- **Accommodate Program Growth:** Modular architecture allows the incorporation of new Units Under Test (UUTs) and software updates without new hardware investments.

Lessons Learned

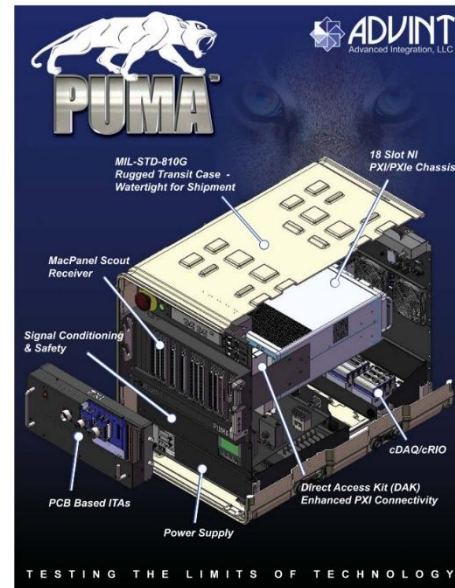
This mission underscored several critical design philosophies that future test platforms should embrace:

- **Modularity Enables Sustainability:** Leaning on NI's modular platforms, ADVINT delivers a long-lasting, configurable solution adaptable to a wide variety of military systems and future needs.
- **Software-Defined Testing Reduces Dependency:** LabVIEW, LabWindows/CVI and TestStand allows development of reusable code libraries and flexible test plans.
- **Ruggedization Shall Not Sacrifice Performance:** With proper enclosure design and shock mitigation strategies, high-fidelity diagnostics are maintainable in adverse field environments.
- **Cross-Platform Compatibility Matters:** Support for mixed-generation equipment is essential to avoid redundant tool sets and simplify lifecycle support.

Conclusion

ADVINT's customizable PUMA platform is the optimal solution to provide factory acceptance test capability that is field deployable to test a wide variety of military equipment. Integrating NI equipment into PUMA test platforms, ADVINT achieves a flexible, scalable, and future-ready test environment. NI's robust ecosystem empowers ADVINT to meet the demanding requirements of its clients while reducing system development time and lifecycle cost. This case reflects the power of modular engineering combined with collaborative design—where adaptable tools meet evolving operational requirements without compromise. ADVINT's PUMA platform enables scalable, repeatable, and precise diagnostics essential for mission readiness.

[Click Here to Learn More About PUMA](#)



About ADVINT

Located in Columbus, Ohio, ADVINT is an award-winning veteran-owned small business (VOSB). The company is a leader in the design and build of automatic test systems for military and commercial applications. As a full-service system integrator, we provide end-to-end hardware and software development, custom fabrication, and turnkey solutions for factory to field support in the most demanding environments without compromising precision or performance. Our multifaceted platforms integrate advanced data acquisition, control, and analysis capabilities, empowering clients to solve complex challenges in any industry (aerospace, defense, energy, life sciences, manufacturing, etc.). Whether you're seeking real-time field diagnostics, intuitive user interfaces, or scalable automation, ADVINT, known for unsurpassed customer responsiveness, supports everything from early-stage consultation to full system deployment and support.

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