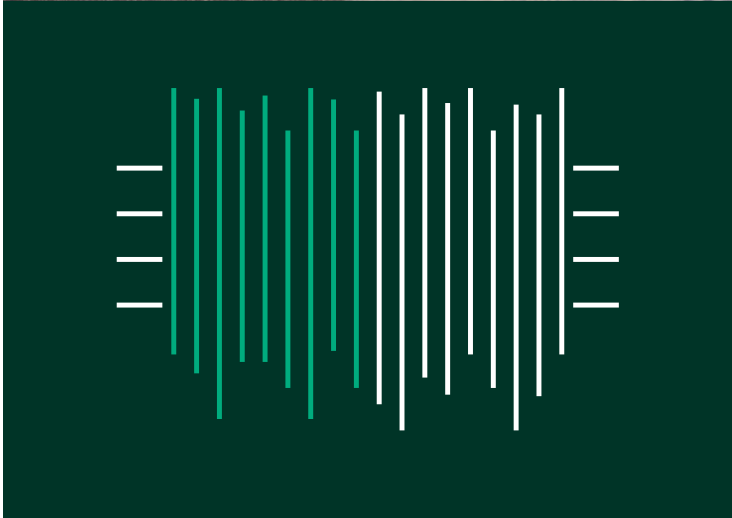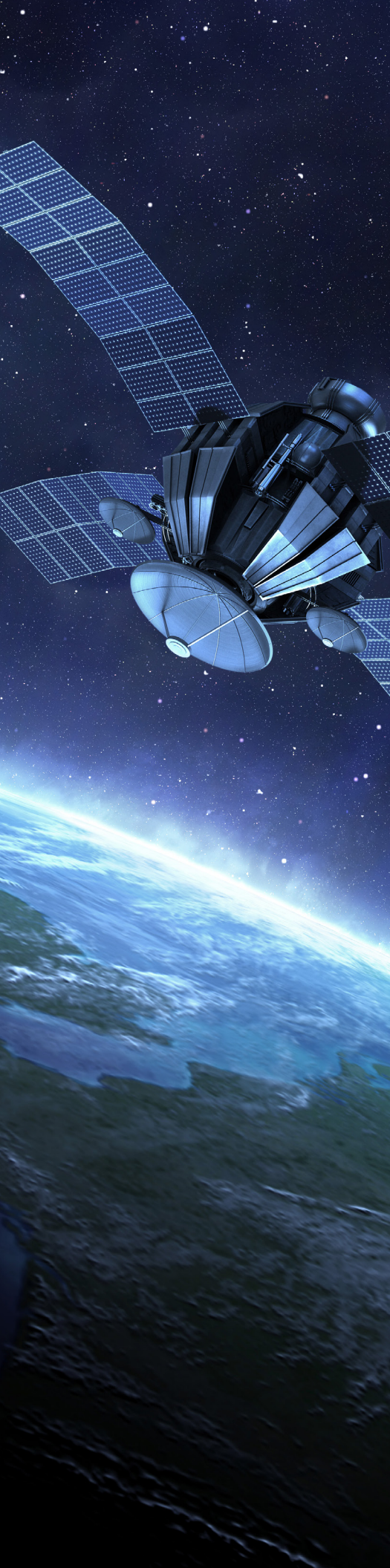Solution Brochure

EO/IR Focal Plane Array System Test

Explore NI's Solutions

Infrared imaging technology is a critical capability for intelligence, surveillance, and reconnaissance (ISR) missions, as well as weapons guidance and hypersonic weapon detection systems. Advances in focal plane array (FPA) semiconductor material technology have resulted in modern FPA imaging systems that are simultaneously highly sensitive, high frame rate, and high resolution.

Trends in Imaging Detector Technology

Modern FPA systems often leverage high-speed serial interfaces on the readout ICs (ROICs) to meet the data rate needs for resolution and rate. While there is a trend toward higher operating temperature imaging systems, the highest-performance FPA systems are integrated into a cryogenically cooled Dewar Cooler Assembly to maintain a constant low temperature for optimal sensitivity. Cryogenically cooled FPA systems require stable low noise power, which makes testing even harder.

Lastly, engineers building modern EO/IR systems are increasingly being pushed to deliver systems on an accelerated timetable as delivery expectations compress. The combination of these requirements has influenced many top EO/IR FPA manufacturers to move away from fully custom in-house built test solutions with FPGA evaluation boards. They are increasingly looking to standardize on modular COTS-based systems that can adapt to the unique requirements of FPA systems test, thus reducing development time and eliminating many issues with long-term obsolescence.

Common FPA Systems Architecture

Modern focal plane arrays are often customized to meet the unique requirements of a specific application; however, most systems share a common overall system architecture, as shown in Figure 1. Data from the ROIC is moved over a high-speed link to an FPA electronics subsystem where image data is corrected and processed for use in the mission processing subsystem. Each subsystem has unique power and control requirements; however, many interfaces are of a common type—enabling test systems to standardize on a superset of interfaces to test each subsystem pre- and post-integration.
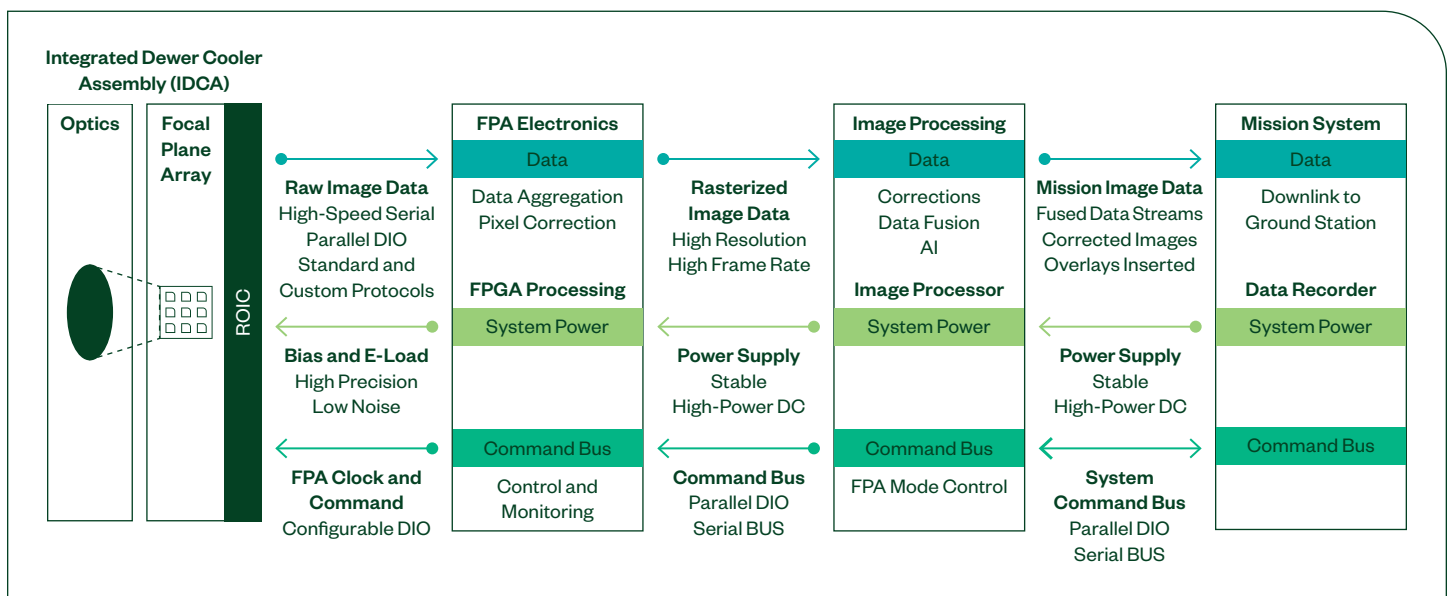

FIGURE 01

Common Architecture for Imaging Detector FPA Systems

Focal Plane Array System Test Solution

Scalable Test Solutions for FPA System Test

The higher-level integration of today's FPA devices make test expensive, custom, and complex. The NI approach to FPA systems test is to provide a modular platform of customizable instruments, giving you a common test solution whether you are doing semiconductor device test or a full systems-level validation with custom communication protocols. Often, FPA test engineers leverage stand-alone instruments and customizable FPGA evaluation boards to meet interface requirements; this non-integrated strategy leads to fragile and hard-to-maintain test systems, with little or no future-proofing.

The NI modular and integrated test approach, when paired with powerful automation software, will lower the cost and time burden of test as well as improve test coverage—ultimately delivering a higher quality system to the end user. Further, the modularity minimizes the effort on accommodation of future product versions and test equipment tech refreshes.

- Perform functional and parametric test on the FPA interface with modular instruments from analog to digital
- Easily incorporate your custom high-speed serial protocols with a fully user programmable, FPGA-based digital capability
- Programmable power supplies to measure and control power delivered and bias sources

The AEDIS instrument, available from Viewpoint Systems, is an excellent example of the NI modular approach that offers a complete software and hardware solution for FPA testing.

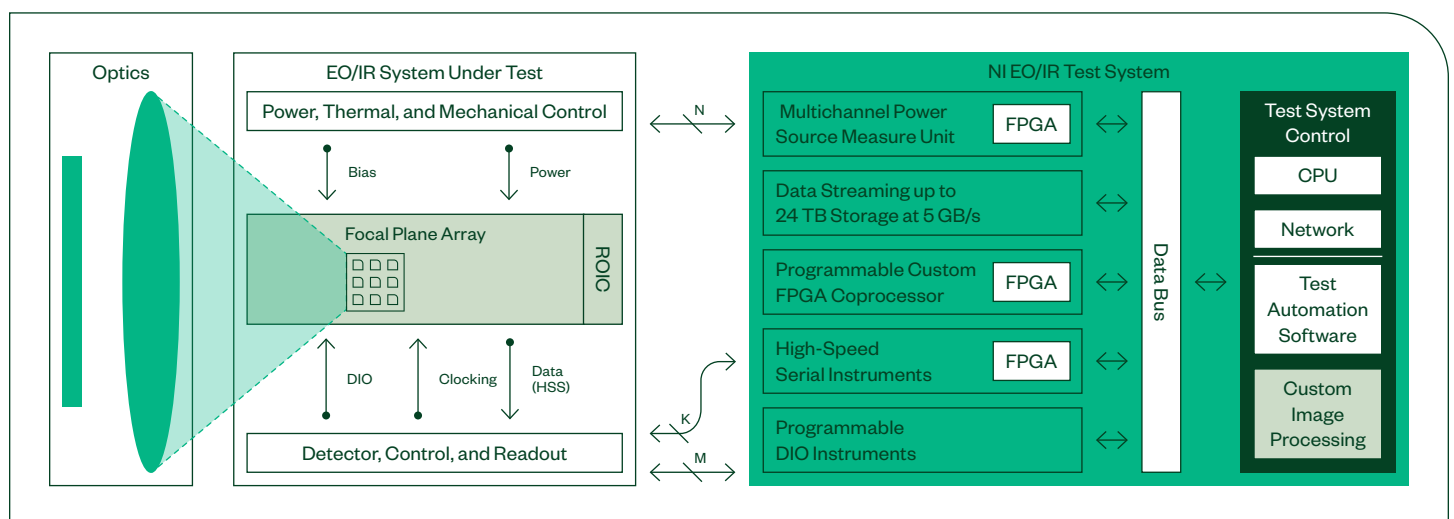## NI Solution: Modular COTS Platform

FIGURE 02
Focal Plane Array Test System Using Customized Control and Processing IP

Solution Hardware Details

The NI solution for EO/IR FPA systems test is built on the modular PXIe platform. PXIe is a standardized, highly flexible, high-performance, ultra-compact COTS test solution for high IO mix test stations.

- Scale your system to meet the channel count, IO types, and signal processing needs.

- Integrate third-party or in-house image processing analytics libraries.

- Future-proof your system with the ability to add newer IO modules, address higher speed data interfaces, and add new IP on demand.

- Remove fragile evaluation boards for custom IP integration.

- Integrate image system record and playback with up to 24 TB of in-system RAID storage.

KEY SPECIFICATIONS	
Max DC Power per Channel	20 W (500 W Pulse)
Best Current Sensitivity	0.01 pA
DC Power Channel Count per Card	24
Maximum High-Speed Serial Rate	28 Gbps per lane of QSFP+
Ultrasonics	Through vehicle bus

TABLE 01
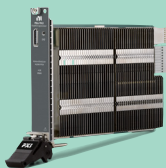NI Products Commonly Used for FPA Test
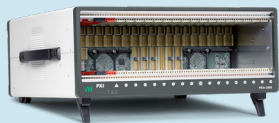
PXI Platform

Modular infrastructure for customized EO/IR test systems. Up to 24 GB/s data transfer.

Source Measure Units

From high power to high accuracy to high channel count, the NI SMU portfolio is sure to meet the stringent requirements for EO/IR test systems.

FPGA Coprocessors

Xilinx Kintex Ultrascale+ FPGAs are programmable with LabVIEW or Vivado, with high performance peer-to-peer streaming over PCIe gen 3 X8.

High-Speed Serial

Leverage the FlexRIO architecture to integrate your customer serial protocol. Ready to connect to Aurora, JESD204C, 100 GBE, 25 G CPRI, and more.
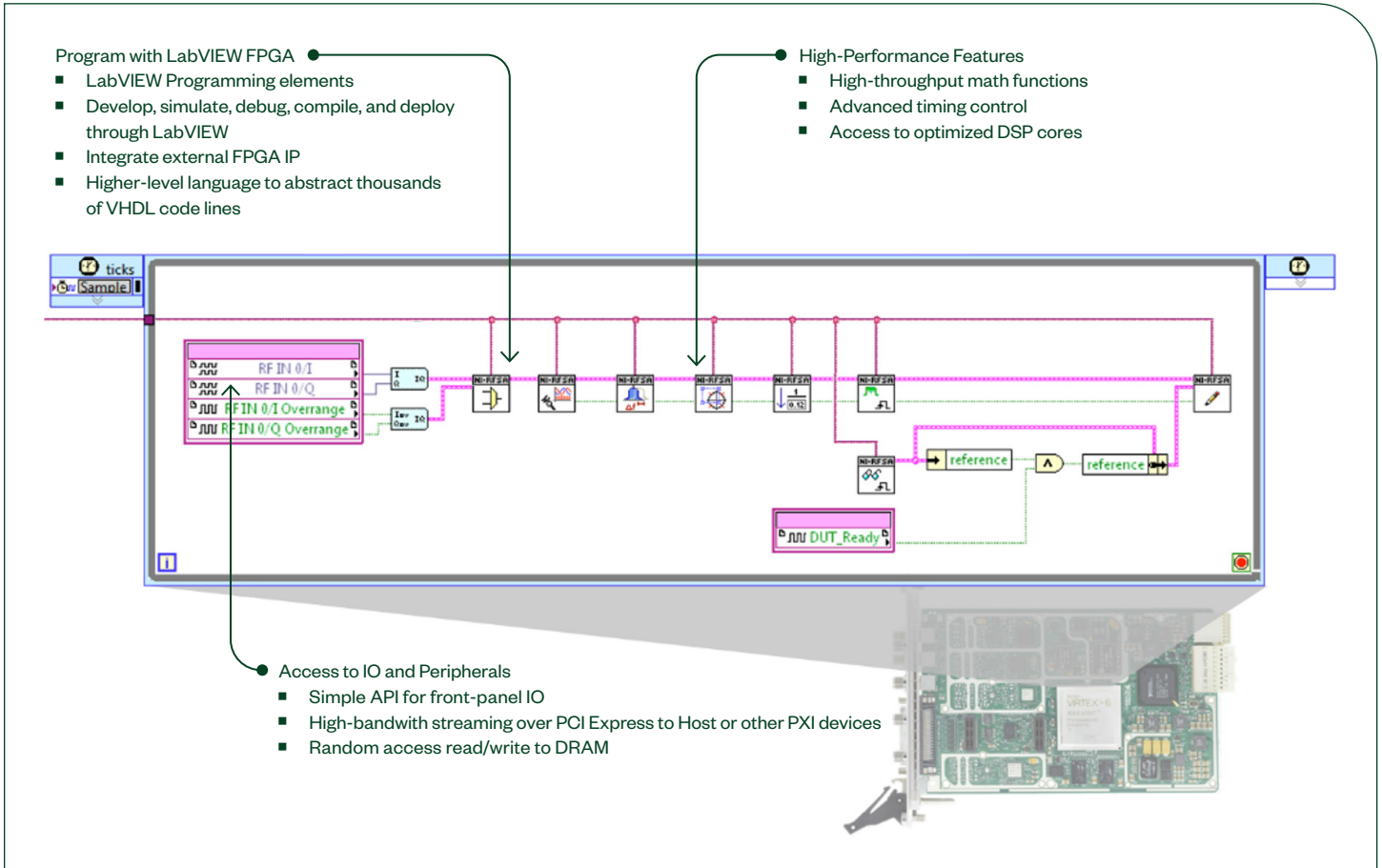

Embedded Controllers

Feature the latest high-performance Intel chipset for high throughput with PCIe gen 3 interfaces.
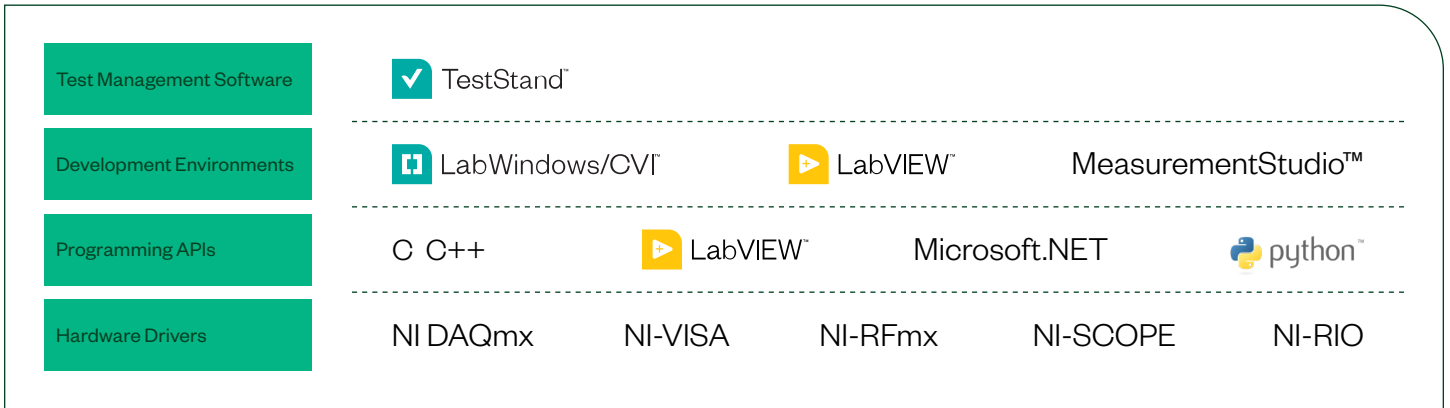
Test Software Solutions

Customized IP Integration with LabVIEW FPGA

Program with LabVIEW FPGA
- LabVIEW Programming elements
- Develop, simulate, debug, compile, and deploy through LabVIEW
- Integrate external FPGA IP
- Higher-level language to abstract thousands of VHDL code lines

High-Performance Features
- High-throughput math functions
- Advanced timing control
- Access to optimized DSP cores

Access to IO and Peripherals
- Simple API for front-panel IO
- High-bandwith streaming over PCI Express to Host or other PXI devices
- Random access read/write to DRAM

TestStand

Develop, Automate, Deploy Standardized Test Infrastructure

TestStand is test management software that helps you develop, debug, and deploy test systems and provides full visibility into testing process and results.

Test Management Software	✔ TestStand™			
Development Environments	▯ LabWindows/CVI™	▶ LabVIEW™	MeasurementStudio™	
Programming APIs	C C++	▶ LabVIEW™	Microsoft.NET	🐍 python™
Hardware Drivers	NI DAQmx	NI-VISA	NI-RFmx	NI-SCOPE NI-RIO

- Create, execute, and debug test sequences

- Extend the software to meet custom requirements

- Develop professional operator interfaces

- Generate reports and integrate with databases

- Reuse code developed in any programming language

- Increase throughput with parallel testing
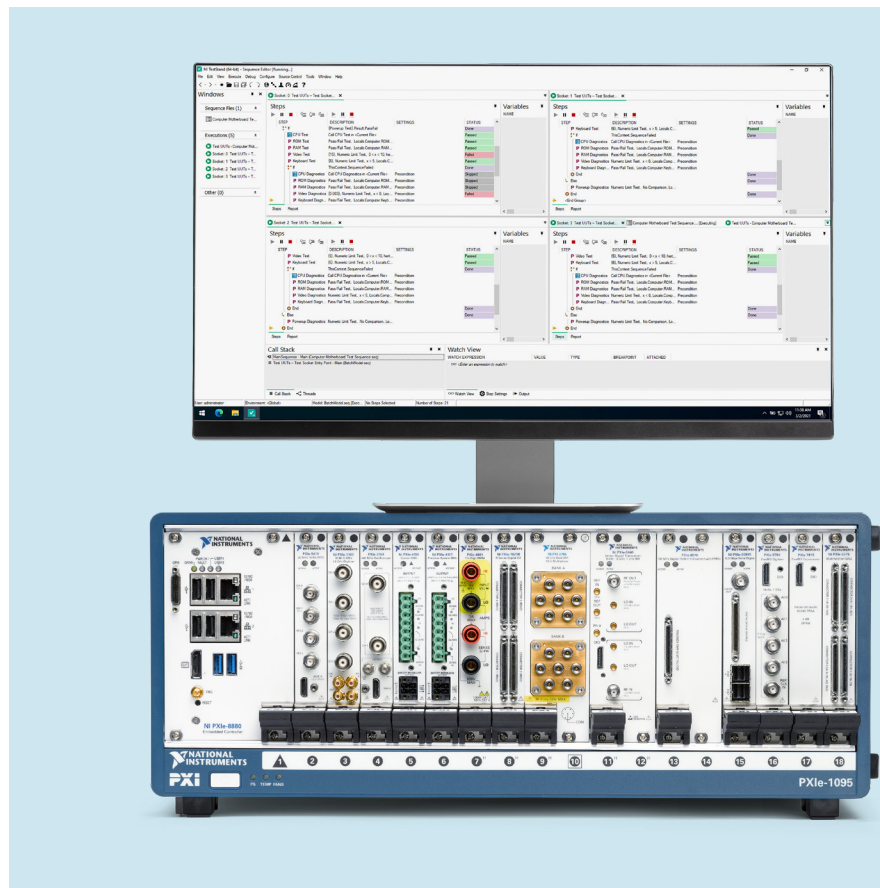
EO/IR Test Solution Partners

Turnkey FPA Emulation and Acquisition

Viewpoint Systems is a leading expert in EO/IR focal plane array systems test. Viewpoint Systems' AEDIS instrument is an FPA emulation and acquisition solution for testing high-bandwidth, high-channel count imaging subsystems. If a custom solution is needed, the 25+ years of NI technology experience allow Viewpoint Systems to help configure, customize, and develop your ideal FPA testing solution, including FPGA-based signal generation and acquisition, SMU control, custom FAMs with test points, and fault injection.

Core Competencies

- AEDIS instrument for complete FPA signal emulation and acquisition
- Full FPA test system customization and integration
- EO/IR manufacturing test systems

Contact Viewpoint Systems

High-Performance and Customizable FPGA IP Integration

New Wave Design & Verification has been an NI Partner since 2011 with extensive expertise in designing, building, testing, and delivering FPGA-based digital interfacing solutions for validation of modern focal plane array systems. New Wave DV brings advanced expertise in FPGA technology, digital protocols, and NI LabVIEW FPGA tools.

Core Competencies

- High-speed FPGA, interfacing with standard or customized protocols
- LabVIEW FPGA-based IP development
- FPA digital systems record and playback

Available Digital Protocols IP Cores

Serial Radio IO (sRIO), ARINC-818, HSDN, HSVN, 10 GE, 25 GE, 40 GE, 100 GE, sFPDP, Fibre Channel

Contact New Wave DV

System Integration on Your Terms

NI offers a variety of solution integration options customized to your application-specific requirements. You can use your own internal integration teams for full system control, or leverage the expertise of our worldwide network of NI Partners to obtain a turnkey system.

Contact your account manager or call or email us to learn more about how NI can help you increase UWB product quality and accelerate test timelines at (888) 280-7645 or info@ni.com.

NI Services and Support

Consulting and Integration

Global Support

Turnkey Solution Delivery and Support

Prototyping and Feasibility Analysis

Repair and Calibration

Training and Certification

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ni.com/aerospace