In This Issue

"Real-time recorders can capture wideband signals from radar and communications receivers ... These signals can yield vital information about which radars and radios are operational in the area, identify the type of enemy equipment, determine which countermeasure systems are operating, and decrypt encoded signals for content." ~ Rodger Hosking

SOSA™
Sensor Open Systems Architecture

Using Signal Recorder Technology in Unmanned Military Vehicles

Aerospace & Defense Technology interviews Rodger Hosking

A&DT: Why is real-time recording of wideband RF signals a critical part of radar, signal intelligence, and electronic warfare systems for unmanned vehicles?

Hosking: Many unmanned vehicles are deployed for gathering information about certain regions of interest. Real-time recorders can capture wideband signals from radar and communications receivers as raw, digitized data that must be analyzed after the mission. These signals can yield vital information about which radars and radios are operational in the area, identify the type of enemy equipment, determine which countermeasure systems are operating, and decrypt encoded signals for content.

A&DT: What does an FPGA in the UV electronics systems offer?

Hosking: Unmanned vehicles abound with different types of sensors, signals, interfaces, and protocols. FPGAs excel at implementing specialized I/O interfaces with real-time processing engines to extract information. These include configurable parallel and gigabit serial ports for data converters. ➤

Putting FPGAs to Work for Software Radio Handbook
by: Rodger H. Hosking

PENTEK
Setting the Standard for Digital Signal Processing

Click here to download.

FPGAs also accommodate digital down-converters for software radio, and the complex timing required for data acquisition and waveform generation for radar systems. FPGAs can also perform specialized digital signal processing operations that include decoding, decryption, beamforming, and demodulation, as well as image processing tasks like pattern recognition, motion detection, target identification, and classification.

A&DT: What is the best way to provide phase coherency across all channels of recording systems?

Hosking: Phase coherency requires that analog signals across all channels are digitized and captured at precisely the same sample clock edge. Usually, this is in response to a hardware trigger that starts the acquisition and recording. Provisions

for synchronization must be incorporated in the circuit design of the digitizer boards, not only for multiple A/Ds on each board, but also across multiple boards.

A&DT: Why is SWaP important?

Hosking: Size, weight, and power often present non-negotiable limits for equipment in unmanned vehicles. Size is an obvious factor, but shape can be just as important for fitting sub-systems into the vehicle like a puzzle. For UAVs, weight drives the required launch power and duration of flight time. Power is usually the most important limitation to mission duration, but it may also impact the effective range of sensors and communication systems.

QuickPac™ drive pack in a Pentek Talon® SFF recorder
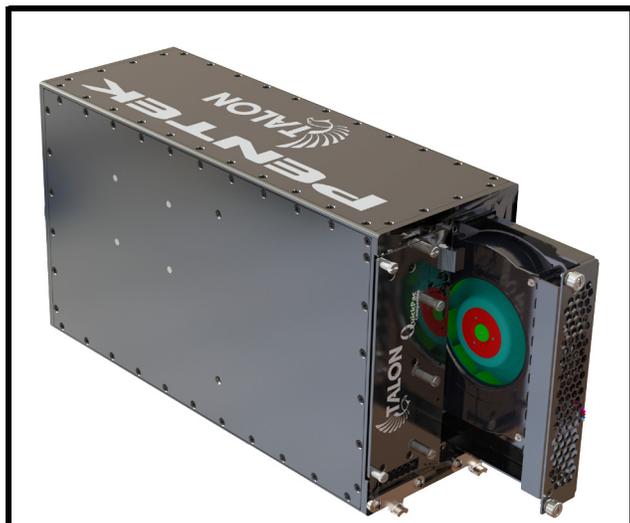
The Talon RTX SFF chassis seals the internal electronics from the outside environment by providing an inner plenum that is designed to extract heat from the internal electronics via conduction. The plenum is supplemented by a removable fan.

A&DT: What is the best way to achieve precision time stamping?

Hosking: Recorders equipped with GPS receivers can time stamp each recorded file with the precise time of the first sample. If the sample rate is locked to the GPS frequency reference, each sample in the recording is precisely defined in time. Additionally, Pentek recorders can log latitude, longitude, and elevation at programmable intervals of time.

A&DT: How are the best real-time recording rates achieved?

Hosking: Today, solid state drives (SSDs) provide the fastest read/write rates, now exceeding 500 MB/sec. RAID controllers aggregate both the speed and capacity of multiple SSDs to deliver rates to 8 GB/sec and higher. By judiciously assigning the PCIe ports of server class chip sets, and carefully controlling memory buffer structures and DMA block transfer sizes, overall system recording rates can be maximized.

A&DT: What are some thermal management techniques that allow for operation in harsh environments?

Hosking: In air-cooled environments, air must also be forced through the chassis across each of the heat-producing devices like FPGAs and CPUs. For very rugged environments, Pentek's 1/2ATR Small ➤

Form Factor (SFF) recorders feature a completely sealed system with an air channel and that pulls air through the center of the chassis to effectively remove heat from internal fins thermally connected to the components. In conduction-cooled systems, heat can be removed by forcing air across external fins, or by direct connection to a cold plate.

A&DT: What are some of the military specifications for UV equipment?

Hosking: Because most military unmanned vehicles must remain operational across a wide range of adverse environments, most must pass tests defined in MIL-STD-810. These tests include temperature limits, shock and vibration levels, various operational altitudes, acceleration, and resistance to fungus, humidity, fog, rain, and dust. Other tests defined in MIL-STD-410 expose the units to high levels of electrical and magnetic energy to validate unimpaired operation and strictly limits the allowed levels of radiated and conducted electromagnetic emissions.

A&DT: What are some best practice considerations for unmanned vehicle electronics?

Hosking: Because the equipment must be easily controllable from the mission computer, Pentek products offer a high level application programming interface (API) using intuitive command functions and parameters that simplify operation of the equipment and interrogation of status and system health. For unmanned vehicles with onboard recorders, Pentek offers QuickPac drive packs that hold eight SSDs for quick removal and replacement, minimizing the down time between missions.

For more information

For more information about **Pentek's Talon recording systems, click here.**

You also can email us at **sales@pentek.com**, contact **your local representative**, or contact Pentek directly [+1 (201) 818-5900]. ❑

Pentek Adds Digital I/O Capability to Talon Extreme Rugged 1/2 ATR Recorder Family

Pentek recently added a new model to the Talon RTX small form factor (SFF) series of high-speed, high-performance, rugged recording systems: Model RTX 2596, which is capable of recording and playing back four Serial Front Panel Data Port (sFPDP) data streams.

The **Talon RTX 2596** is fully-deployable and ideal for capturing digitized sensor data from radar systems and RF downconverters that use the lightweight VITA 17.1 sFPDP protocol. It supports baud rates to 4.25 GBaud and has options for multi-mode or single-mode optical interfaces. The VITA 17.1 specification is fully implemented, providing standard sFPDP features such as Flow Control, Copy/Loop Mode and CRC error checking. The Talon RTX 2596 also provides playback capabilities, allowing users to operate the system as either a receiver or a transmitter.

The Talon RTX 2596 SFF recorder weighs just 18 pounds and is designed for extreme operating environments. Optimized for SWaP (size, weight and power), the rugged sealed ½ ATR recorder is available with up to 61 TB of removable SSD storage.

"The Talon RTX SFF recorders have undergone extensive independent laboratory testing to assure they can operate in some of the toughest environments," said Chris Tojeira, Recording Systems Director, Pentek. He added, *"We've tested to a wide array of military standards in the MIL-STD 810 and 461 specifications to assure that whether in a UAV, an aircraft pod, or shipboard, our recorders will perform at the highest level."*

Extremely Rugged, Sealed Design

Not only are RTX SFF recorders engineered to operate in the toughest environments with high levels of shock and vibration, the chassis also keeps all electronics sealed from the external environment. The ½ ATR chassis uses military standard circular I/O connectors to control RF emissions while protecting the recorder's electronics from humidity, water, dust, sand, and salt fog.

The Talon RTX SFF chassis seals the internal electronics from the outside environment by extracting heat through conduction to an air-cooled inner ➤

Click to download this FREE resource!

This white paper discusses the engineering considerations and design techniques used to develop a small form factor (SFF) rugged recorder that can handle the extremely high data rates associated with very wide bandwidth RF signal recording. **Click** to download it.

Development Tactics & Techniques for SFF RF Signal Recorders

FRONT PANEL   **REAR PANEL**

MODEL RTX 2596

Diagram labels:
- REMOVABLE QUICKPAC DATA DRIVE PACK
- REMOVABLE OS DRIVE
- REMOVABLE FAN
- INTERNAL COMPUTER PERIPHERALS
- RAID CONTROLLER
- INTEL PROCESSOR
- DDR4 SYSTEM MEMORY
- Serial FPDP (×4)
- OPTIONAL GPS
- +12V to +28V DC PSU
- Ethernet
- USB 3.0
- RS232 (optional)
- HDMI
- Channel 1 In / Out
- Channel 2 In / Out
- Channel 3 In / Out
- Channel 4 In / Out
- GPS (Optional)
- DC POWER IN

plenum. A thermostat-controlled, **removable fan** pulls air into the front of the chassis, through the plenum and then out the back of the chassis. Only the fan is exposed to the outside environment, assuring all system electronics are protected in the sealed chassis. The inner plenum can be replaced to provide other cooling options, such as liquid or conduction cooling.

Designed to operate from -40ºC to +60ºC, these recorders can handle most thermal environments, making them ideal for UAVs, aircraft pods, tight equipment bays, military vehicles, and most outdoor environments.

High–Speed Data Storage and Security

Pentek's **QuickPac drive pack** is easily removed from the recorder via a set of captive thumb screws on the front panel. Fully sealed with environmental gasketing, an

empty QuickPac drive pack can replace a full one for short down times and extended missions. A companion offload system for the QuickPac drive pack is available so the recorder can be redeployed while the recorded data is transported and reviewed via the offload system at a ground facility. The QuickPac drive pack holds up to 61 TB of SSD data storage and supports RAID levels 0, 5 or 6.

For secure applications, a separate operating system drive can be removed, allowing users to extract all non-volatile memory from the system in just a few seconds.

Mission Computer Capable

Talon RTX SFF recorders with the Intel Core i7 7700K, 7th Generation Quad Core 4.2 GHz processor and 8 GB DDR4 DRAM, are expandable to 16 or 32 GB with enough processing power to act as the primary mission computer when needed,

delivering state-of-the-art processing for mission applications and control, with minimal impact on the overall power budget of the system.

Ease of Operation

Pentek's System-Flow® software interface is integrated into every Talon recorder. The software includes the graphical user interface (GUI) that is used to control the recorder with point-and-click configuration management, using a client/server communication interface. An NTFS file system ensures immediate access to recorded files, and an application programming interface (API) supports custom user applications and control. The system can be controlled remotely via the Gigabit Ethernet interface available on one of the MIL-STD circular connectors. Signal analysis tools include a virtual oscilloscope, spectrum analyzer, and spectrogram to monitor signals before, during and after data collection.

Available Options

The Talon SFF recorders offer an optional GPS receiver for precise time and position stamping. Additional QuickPac drive packs with 3.8 to 61 TB are available. Computer I/O on all models includes Gigabit Ethernet, USB 3.0, RS-232 and HDMI.

For more information about **Model RTX 2596, click here**. You also can email us at **sales@pentek.com**, contact **your local representative**, or contact Pentek directly [+1 (201) 818-5900]. ❏

Pentek Introduces a New Sentinel Recorder for Military Signal Intelligence Applications

■ **Automatically tune, detect, and record signals of interest**

■ **Scan and search from 800 MHz to 26.5 GHz**

■ **Capture instantaneous RF signal bandwidths up to 500 MHz**

■ **4U chassis with front panel hot-swappable SSDs**

■ **Storage capacities to 245 TB**

Pentek has announced a major addition to its popular family of Talon® signal recording and playback systems, the **RTR 2654 26.5 GHz RF Sentinel™ Intelligent Signal Scanning rackmount recorder**. The RTR 2654 combines the power of a Pentek Talon Recording System with a 25.6 GHz RF tuner and Pentek's Sentinel intelligent signal scanning software. The RTR 2654 automatically scans the RF spectrum from 800 MHz to 26.5 GHz for signals of interest and monitor or record

SENTINEL

bandwidths up to 500 MHz wide, making it very suitable for military, security, and government intelligence (SIGINT, COMINT, and ELINT) applications.

A Pentek **Model 78141** Jade® transceiver module serves as the data acquisition engine of the Talon RTR 2654. One of its dual 3.2 GS/sec 12-bit A/D converters is operated at a sample rate of 2.8 GS/sec. The Model 78141 is coupled to the 500 MHz bandwidth IF output signal of a 6 GHz RF tuner front end with excellent dynamic range across its entire spectrum. A digital downconverter (DDC) in the Model 78141 provides frequency zooming for signal bandwidth steps of 500, 280, or 140 MHz.

"The RTR 2654 Sentinel recorder greatly expands the scanning spectrum over previous Pentek products to 26.5 GHz, covering the vast majority of

popular RF signal bands," said Rodger Hosking, Vice President of Pentek.

Sentinel Intelligent Signal Scanning

The Sentinel recorder provides automated signal monitoring and detection. The user specifies a start and stop frequency for the scan, covering any range between 800 MHz and 26.5 GHz. The RF tuner and DDC step across the scan range in consecutive bands, each programmable up to 500 MHz in width. Threshold RF energy in each band can be detected to trigger creation of a waterfall spectrum display over the entire scan.

Any band can be selected for continuous real-time monitoring and/or recording. In addition to manual band selection, a recording can be automatically started during a scan by configuring signal strength threshold levels to trigger a recording of the detected band. Once a ➢

Model RTR 2654

RF In → 26 GHz RF Downconverter → 6.4 GHz 12-bit A/D → Digital Downconverter Decimation: 4, 8 or 16 ↔ Host Processor Running SystemFlow (Intel Processor, System Drive, DDR SDRAM) → Gigabit Ethernet, USB, Keyboard, Mouse, Video Output, GPS Antenna (optional); RAID Data Storage (System Drive ×4)
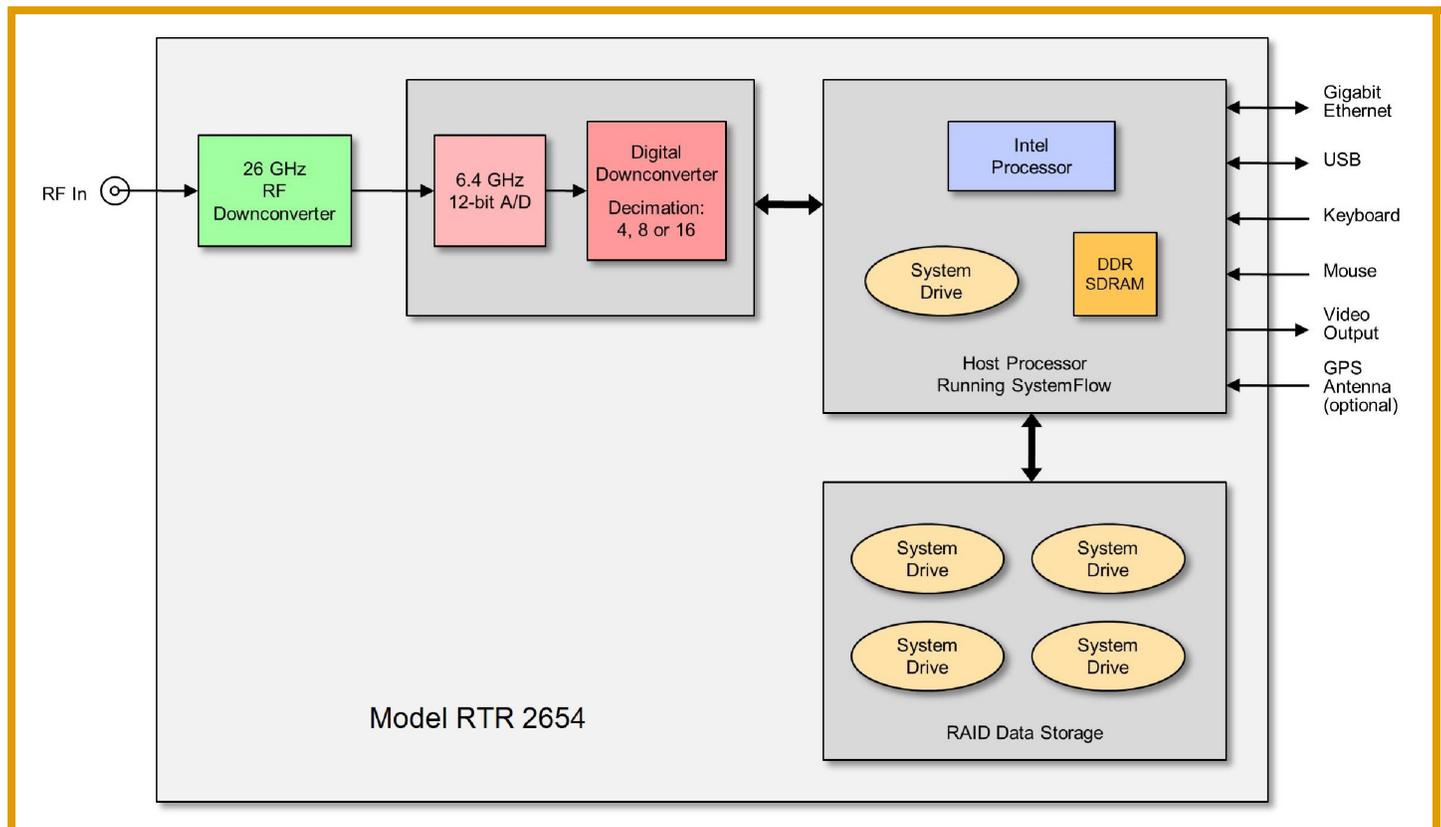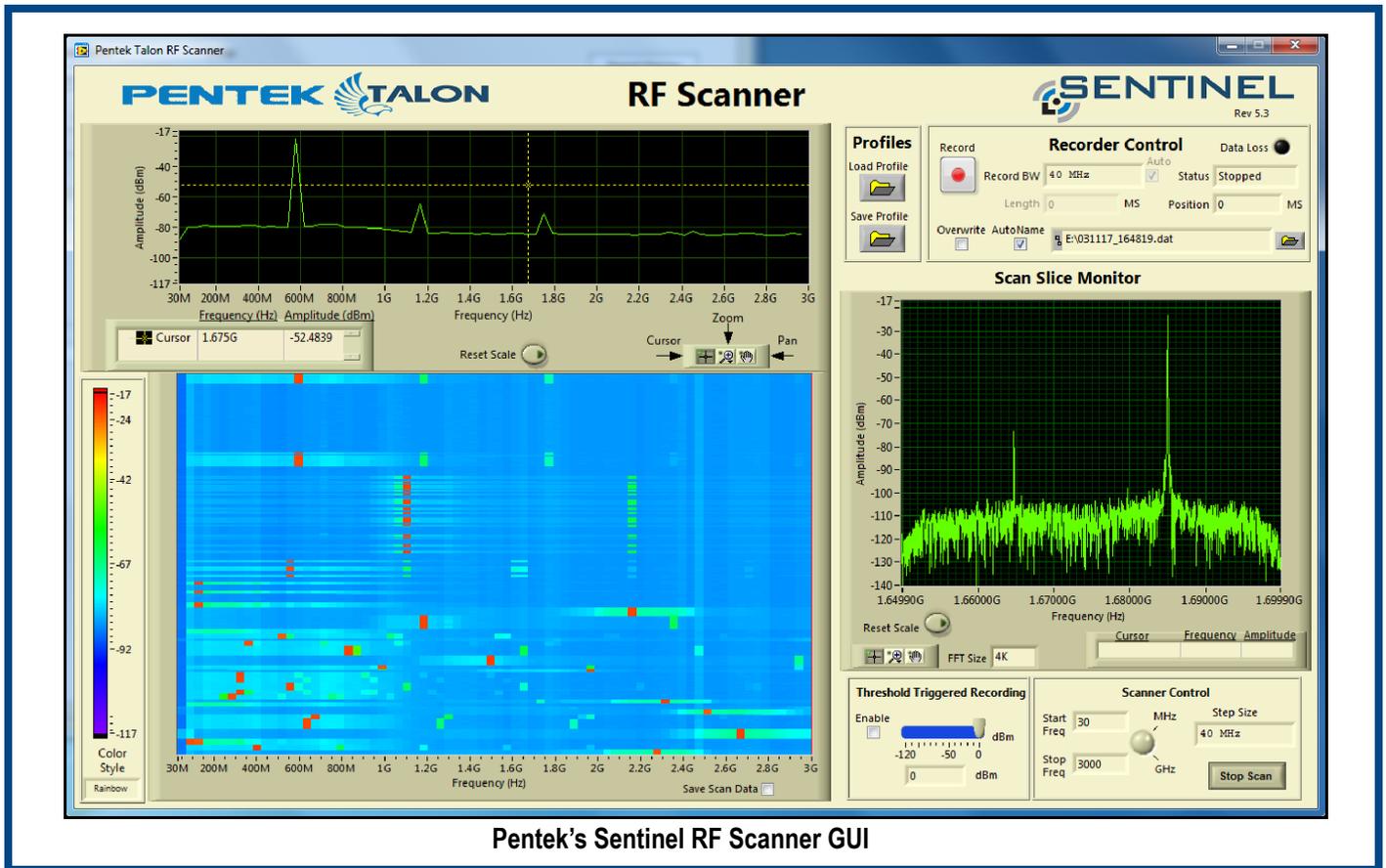
Pentek's Sentinel RF Scanner GUI

signal of interest is detected, the real-time recorder can capture and store hundreds of terabytes of data to disk, allowing users to store data spanning multiple days.

Ease of Operation

Sentinel recorders are built on a Windows® workstation with an Intel Core i7 processor and provide both a GUI (graphical user interface) and API (Application Programmer's Interface) to control the system. Systems are fully supported with Pentek's SystemFlow® software for system control and turn-key operation. The SystemFlow software has been enhanced to include intelligent scanning and integrated control of the RF tuner and optional RF upconverter. The software provides a GUI with point-and-click configuration management and can store custom configurations for single-click setup. It also includes a virtual oscilloscope, spectrum analyzer, and spectrogram to monitor signals before, during, and after data collection.

Post processing and analysis software tools like Matlab can be installed on the Talon RTR 2654 platform. Data files are recorded to the Windows native NTFS file system, which allows operators immediate access to recordings without the need for any file format conversion.

Configuration Options

The Talon RTR 2654 is packaged in a 4U 19-inch rackmountable chassis, with front panel removable and hot-swappable Solid State Drives (SSDs), front panel USB ports, and I/O connectors on the rear panel. The SSDs are available in 7.6 to 245.7 TB configurations, supporting RAID levels 0, 5, or 6. Options include GPS time and position stamping and 10GbE or 40GbE offload facilities.

For more information about **Talon Model RTR 2654, click here**. You also can email us at **sales@pentek.com**, contact **your local representative**, or contact Pentek directly [+1 (201) 818-5900]. ❏

Click to download this FREE resource!
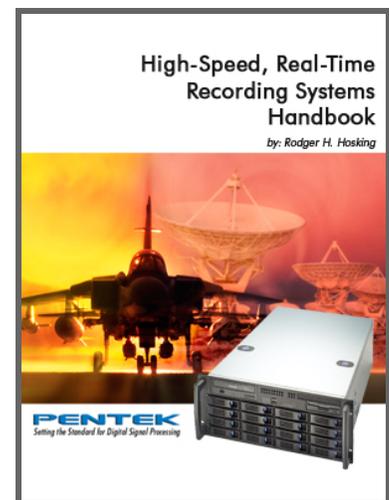
In today's world of high-speed A/D converters, real-time signal recording has become a challenging task that requires specialized hardware and intelligent application software. Click **here** to download this useful technical reference.

SOSA Consortium Members Pentek, Herrick Technology Laboratories and Kontron Teamed Up to Deliver C4ISR Demonstrator System

Pentek Inc., Herrick Technology Laboratories, Inc., and Kontron, have developed products aligned with the Sensor Open Systems Architecture (SOSA) Technical Standards that are used in a new 3U VPX demonstrator system designed to illustrate the capabilities of open systems architectures. This 3U VPX system is ideal for electronic warfare (EW), SIGINT, radar, and communications applications. The flight-qualified chassis utilizes open architecture modules, from multiple suppliers, for a complete functional demonstration system.

"Herrick Technology Laboratories, Inc. of Germantown, MD, and another major U.S. system integrator have received shipments of the Kontron

Sensor Open Systems Architecture

VX305C-40G SOSA aligned SBC for U.S. defense community applications," said Mark Littlefield, Kontron's vertical product manager for Defense and SOSA standard contributor. He added, *"Herrick has integrated this SBC with a Model 71813 XMC board from Pentek which provides customizable I/O signal status and control for their new SOSA C4ISR demonstrator system for the U.S. Army."*

The **SOSA Consortium** is chartered with creating a common framework for transitioning sensor systems to an open systems architecture, based on key interfaces and open standards established by industry-government consensus. The benefits of this architecture include improved interoperability, as well as reduced development time, deployment, and costs.

The SOSA approach establishes guidelines for Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) systems. The objective is to allow flexibility in the selection and acquisition of sensors and subsystems that provide sensor data collection, processing, exploitation, communication and related functions over the full life cycle of the C4ISR system. ➤

C4ISR Demonstrator System Aligned to SOSA Technical Standard

Pentek Model 71813 LVDS with Optical I/O Kintex UltraScale FPGA XMC

Kontron VX305C-40G

VITA 62 650/800 Watt Power

HTLv-1: Four channel Tx/Rx
Range: 2 MHz to 6 GHz
IBW: 80 MHz

HTLv-2: Two channel Tx/Rx
Range: 20 MHz to 20 GHz
IBW: 80 MHz

HTLv UWB Rx/Tx Roadmap:
Range: 20 MHz to 20 GHz
IBW: 2000 MHz

PNTRv:
Position, Navigation, Timing Card
1 PPS, 100 MHz Ref, NTP, PTP, CSAC, SAASM
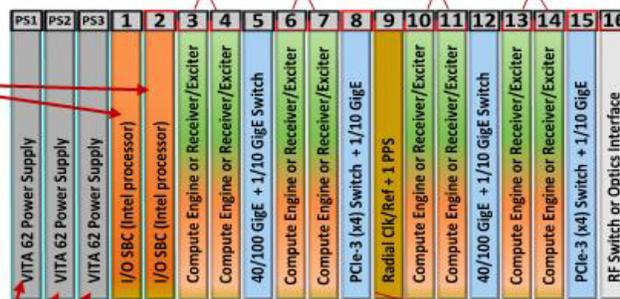
- 16 payload slots
- 8 RF payload slots provide 32 Tx/Rx channels
- 3 Power supply slots (>1950 Watts)
- 100+ W/slot power and thermal
- Chassis Manager with IPMI
- SOSA aligned system interfaces
- VITA 48.2 REDI

kontron S&T Group

PENTEK

HERRICK TECH LABS

The

The C4ISR demonstrator system, in an HTLv-C-19 chassis, with 16 payload slots and three power supply slots, includes:

- **Two slots with Kontron VX305C-40G SBC utilizing 12-core Intel® Xeon® D processors and Pentek Model 71813 digital I/O XMC modules with Xilinx Kintex® Ultrascale® FPGAs.**

- **Eight RF/payload slots with multiple Herrick Technology Laboratories HTLv-1 and HTLv-2 dual and quad channel HF/VHF/UHF transceiver modules.**

- **One slot with an HTL PNTRv Precision Navigation and Timing Reference module providing a radial clock with position, navigation and timing.**

- **Two slots with 40/100 Gigabit Ethernet switches.**

- **Two slots with PCIe Gen 4 and 1/10 Gigabit Ethernet switches.**

- **Three power supply slots providing 100+W of power per slot.**

The system-level interfaces are also aligned with the SOSA Technical Standard to maximize the chassis-level interoperability. The backplane is designed to support 100 Gigabit Ethernet (GigE) Data Plane, PCIe-Gen 4 Expansion Plane, and 10 GigE Control Plane. The HTLv-C-19 chassis uses the SOSA-aligned front panel I/O connector definitions. It is also designed to the VITA 48.2 VPX REDI conduction cooling standard for rugged environments.

"The Pentek Jade Model 71813 directly addresses I/O needs called out in the emerging SOSA standards," said Paul Mesibov, Pentek's chief technical officer and active member of the SOSA standard Hardware Working Group. *"Pentek is working with other SOSA members and is committed to lending our experience in meeting open system architecture challenges."*

"Herrick's SOSA demonstrator project is an important, fast-paced

effort to demonstrate the value of Open Systems Architectures for defense sensor platforms," said Acie Vickers, CEO and President of Herrick Technology Laboratories, Inc. *"By providing key components for this design, Kontron and Pentek are helping to deliver on the OSA promise of faster and simplified technology updates for defense sensor platforms."*

Open Architecture Modules

All of the following modules are designed to support the open systems architecture of the SOSA approach.

- The **Herrick Technology Laboratories** HTLv-1 and HTLv-2 are 3U OpenVPX quad and dual channel HF/VHF/UHF software-defined radio transceiver modules designed to support various missions. The PNTRv is also a 3U VPX module that provides position, navigation, and timing information to the chassis via GPS and Chip-Scale Atomic Clock.

- The **Kontron** VX305C-40G 3U VPX SBC utilizing a 12-core Intel® Xeon® D processor, with 40 Gigabit Ethernet Data Plane (40GBASE-KR4), a 4-lane PCI Express 3.0 expansion plane, dual 10 Gigabit Ethernet Control Plane (10GBASE-KR), and a rich assortment of user I/O including SAT III, USB (2 and 3), serial links, video (HDMI, with DisplayPort available in 2019), GPIO, and an XMC site with backplane user mapping.

- Based on the Xilinx Kintex UltraScale FPGA, **Pentek's Model 71813** features 28 pairs of LVDS digital I/O to meet the requirements of emerging standards from The Open Group SOSA Consortium of which Pentek is a member.

For more information about **Pentek Model 71813, click here.** You also can email us at **sales@pentek.com**, contact **your local representative**, or contact Pentek directly [+1 (201) 818-5900]. ❑

Pentek's Vice President of Engineering, Paul Mesibov, Participated in the SOSA Roundtable Panel at the AOC International Symposium & Convention

At the 56th Annual AOC International Symposium and Convention on October 28 - 30, Paul Mesibov was part of the **SOSA Industry Roundtable Panel**. This event was recorded and you can view the video by clicking **here**.

AOC INTERNATIONAL SYMPOSIUM & CONVENTION

Pentek Adds 3U VPX Software Radio Board
with Backplane Optical & RF I/O to Jade FPGA Family

- **Three 200 MHz 16-bit A/Ds with three programmable multiband DDCs**

- **OpenVPX Compliant Optical and RF I/O to VPX Backplane**

- **Jade® Architecture with Xilinx Kintex Ultrascale FPGA offers price, power and processing performance advantages**

- **Navigator Design Suite expedites development and custom IP integration**

Pentek recently introduced a new member of the Jade family of high-performance 3U VPX boards. The **Model 54821** is based on the Xilinx Kintex® UltraScale™ FPGA and features three 200 MHz 16-bit A/Ds with three programmable multiband digital downconverters (DDCs) and one digital upconverter (DUC) with two 800 MHz 16-bit D/As. The 54821 is the latest addition to the Pentek 3U VPX architecture with the advanced wideband I/O options afforded by OpenVPX.

"Our customers are eagerly adopting the new optical and RF I/O standards for VPX," said Robert Sgandurra, director of Product Management. "*Over half of new product orders require optical or RF I/O per these standards for high-performance*

I/O that perfectly match our product capabilities." The Model 54821 takes advantage of these VPX I/O options for RF and optical interconnects through the VPX backplane:

- **Option -109:** Optical connections based on VITA 66.5 (draft), containing blind-mate MT optical connectors with fixed contacts on the plug-in module and floating displacement on the backplane.

- **Option -111:** RF connections based on ANSI/VITA 67.2, containing multi-position blind-mate analog connectors with SMPM contacts.

- **Option -112:** RF connections based on ANSI/VITA 67.3 type C, containing multi-position blind mate analog connectors with SMPM contacts, spring-loaded on the backplane allowing more movement and larger diameter cables for better performance.
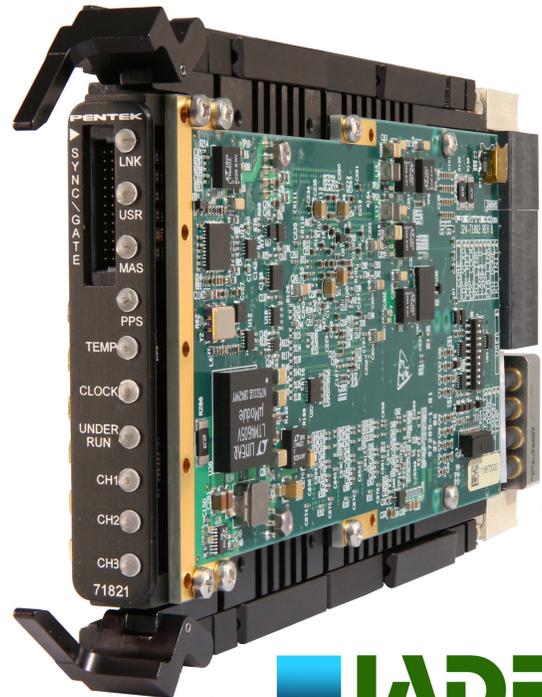
This new 3U VPX architecture further expands the options for custom I/O by offering 20 pairs of LVDS connectivity and one 8X gigabit link for serial protocols. Future options for higher density optical and RF connectors are planned as the supporting standards become available.

The VITA 66.5 draft standard calls out blind mate optical connectors with fixed contacts on the plug-in module and floating displacement for the MT ferrule on the backplane. The 3U VPX module uses a single assembly that includes an electro-optical transceiver, a fixed MT ferrule blind mating connector, and the mechanical housing. This eliminates the need for internal optical cables on the plug-in module to ease assembly and save space.

The Model 54821 can be populated with a range of Kintex UltraScale FPGAs to match specific requirements of the processing task, spanning from the entry-level KU035 (with 1,700 DSP slices) to the high-performance KU115 (with 5,520 DSP slices). The KU115 is ideal for ➤

OpenVPX Profile

SLT3-PAY-2F2U1E-14.6.10-n

Key	
SE P0/J0	
Utility Plane	
S E / **Diff** / **Diff**	Data Plane – 2 Fat Pipes
User Defined	**P1/J1** — Expansion Plane – 8 Pairs
Utility Plane	Control Plane* – 2 Ultra-Thin Pipes
User Defined	**S E*** / **Diff P2A/J2A** — User Defined
	P2B/J2B — VITA 65 Aperture E (VITA 66.5)
Key	

* not connected on board
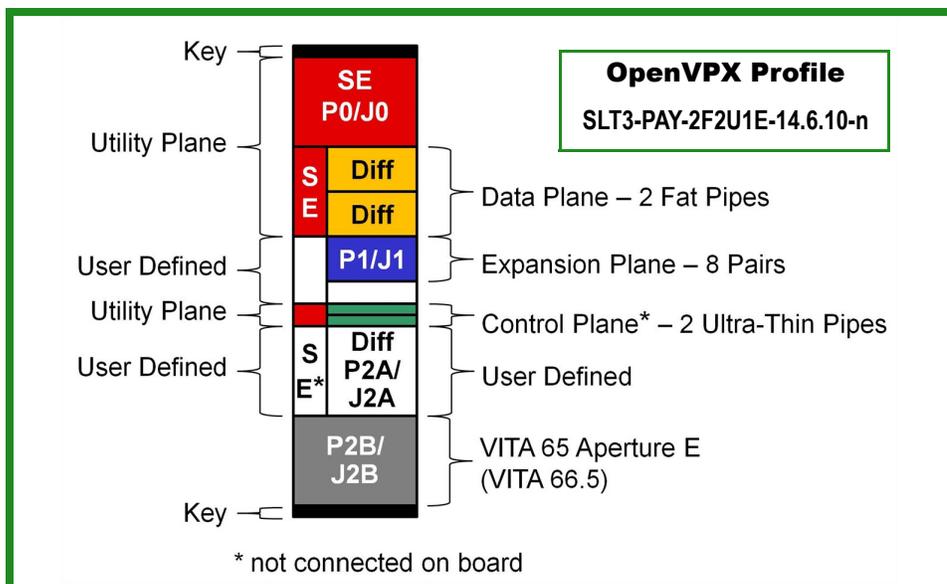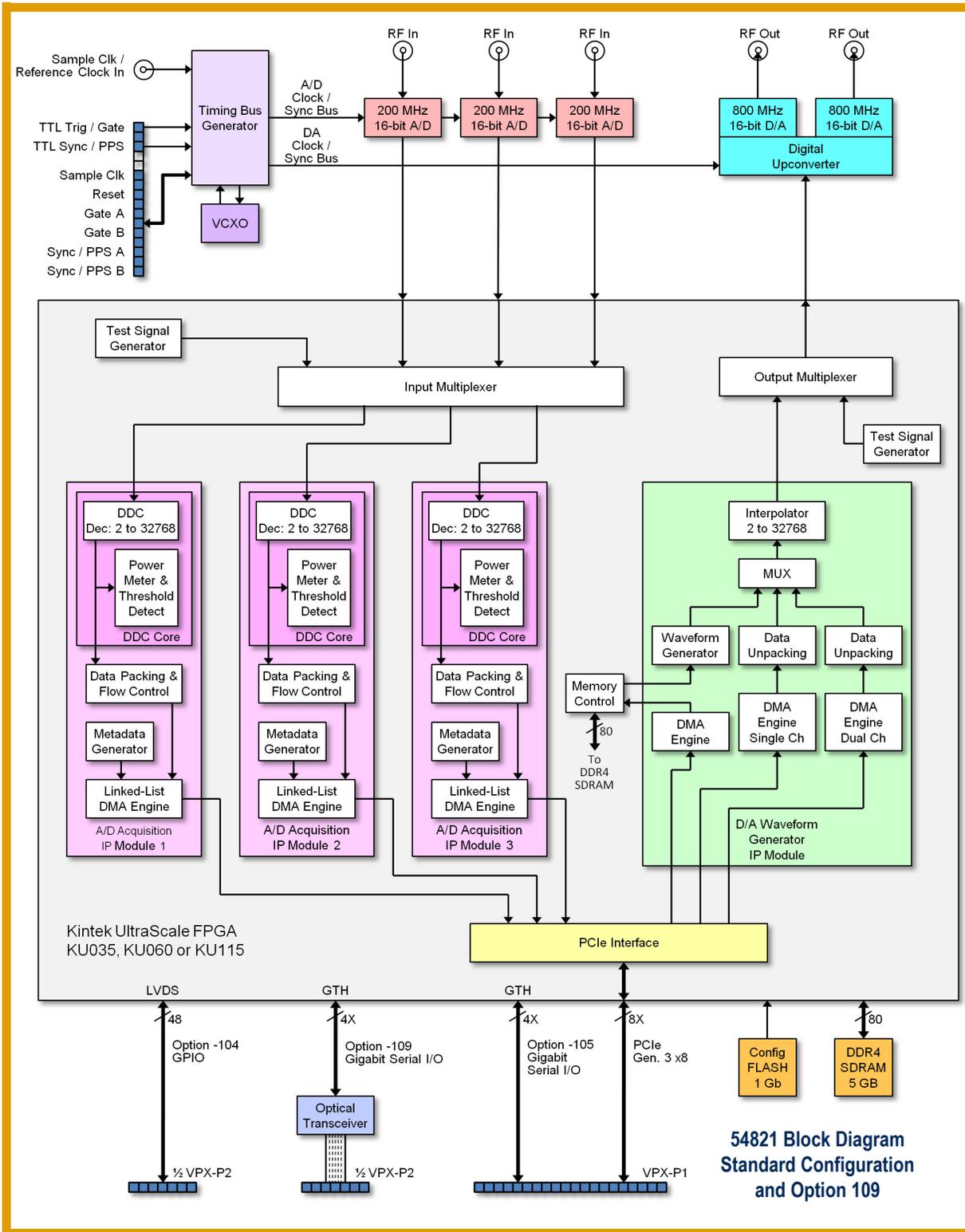
54821 Block Diagram
Standard Configuration
and Option 109

Sample Clk / Reference Clock In

TTL Trig / Gate
TTL Sync / PPS

Sample Clk
Reset
Gate A
Gate B
Sync / PPS A
Sync / PPS B

Timing Bus Generator

VCXO

A/D Clock / Sync Bus
DA Clock / Sync Bus

RF In — 200 MHz 16-bit A/D
RF In — 200 MHz 16-bit A/D
RF In — 200 MHz 16-bit A/D
RF Out — 800 MHz 16-bit D/A
RF Out — 800 MHz 16-bit D/A

Digital Upconverter

Test Signal Generator

Input Multiplexer

Output Multiplexer

Test Signal Generator

DDC Dec: 2 to 32768 — Power Meter & Threshold Detect — DDC Core
Data Packing & Flow Control
Metadata Generator
Linked-List DMA Engine
A/D Acquisition IP Module 1

DDC Dec: 2 to 32768 — Power Meter & Threshold Detect — DDC Core
Data Packing & Flow Control
Metadata Generator
Linked-List DMA Engine
A/D Acquisition IP Module 2

DDC Dec: 2 to 32768 — Power Meter & Threshold Detect — DDC Core
Data Packing & Flow Control
Metadata Generator
Linked-List DMA Engine
A/D Acquisition IP Module 3

Interpolator 2 to 32768
MUX
Waveform Generator — Data Unpacking — Data Unpacking
DMA Engine — DMA Engine Single Ch — DMA Engine Dual Ch
D/A Waveform Generator IP Module

Memory Control
80
To DDR4 SDRAM

Kintek UltraScale FPGA
KU035, KU060 or KU115

PCIe Interface

LVDS — 48 — Option -104 GPIO — ½ VPX-P2
GTH — 4X — Option -109 Gigabit Serial I/O — Optical Transceiver — ½ VPX-P2
GTH — 4X — Option -105 Gigabit Serial I/O
8X — PCIe Gen. 3 x8 — VPX-P1
Config FLASH 1 Gb
DDR4 SDRAM 5 GB
80

supporting PCI Express Gen. 3 as a native interface, the Model 54821 includes optional high-bandwidth connections to the Kintex UltraScale FPGA for custom digital I/O.

With the Xilinx Kintex Ultrascale FPGA, data converters and optical or RF I/O, the Model 54821 becomes an excellent high performance interface to HF or IF ports of a communications or radar system.

The Jade Architecture

The Pentek Jade architecture is based on the Xilinx Kintex UltraScale FPGA, which raises the digital signal processing (DSP) performance by over 50% with equally impressive reductions in cost, power dissipation and weight. Its PCI Gen.3 interface allows access to control and status registers for controlling algorithms, state machines and data flow across the LVDS I/O front panel and carrier board interfaces. A 5 GB bank of DDR4 SDRAM is available for additional functions. The factory-installed DMA controller can sustain 6.4 GB/s data transfers across PCIe. ➤

demanding modulation/demodulation, encoding/decoding, encryption/decryption, and channelization of the signals between transmission and reception. For applications not requiring large DSP resources or logic, a lower-cost FPGA can be installed.

The Model 54821 also includes a complete multi-board clock and sync engine and a large DDR4 memory. In addition to

Navigator Design Suite

Pentek's **Navigator® Design Suite** was designed from the ground up to work with Pentek's Jade architecture and Xilinx's Vivado Design Suite®, providing an unparalleled plug-and-play solution to the complex task of IP and control software creation and compatibility. Graphical design entry for Xilinx and Pentek AXI4-compliant IP modules using the Xilinx IP Integrator greatly speeds development tasks.

The Navigator Design Suite consists of two components: **Navigator FDK (FPGA Design Kit)** for integrating custom IP into Pentek sourced designs and **Navigator BSP (Board Support Package)** for creating host applications.

Users can work efficiently at the API level for software development and with an intuitive graphical interface for IP design. The Navigator BSP is available for Windows and Linux operating systems.

For More Information

For more information about **Pentek's Model 54821, click here.**

You also can email us at sales@pentek.com, contact **your local representative,** or contact Pentek directly [+1 (201) 818-5900]. ❒

54821 Block Diagram
Options 111 and 112