

AEROSPACE & DEFENSE™

TECHNOLOGY

The Engineer's Guide to Design & Manufacturing Advances

SAE
INTERNATIONAL®



Autonomous
"Wingman" Vehicles

The CAN Bus:
Driving the Future of
Autonomous Military Vehicles

Underwater
Drone Technology

SPECIAL ISSUE
Unmanned Vehicle &
Robotics Technology

INSIDE STORY

Pentek, Inc. designs embedded computer boards and recording systems for DSP, software radio and data acquisition for both COTS and rugged environments. In an interview with Aerospace & Defense Technology, Vice President Rodger Hosking explained how signal recorder technology is being implemented in military unmanned vehicles.

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. 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 subsystems 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.

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 sam-

ple. 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 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 limit 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.

To learn more about Pentek, Inc., read the full-length version of this interview at www.aerodefensetech.com/InsideStory0519.



Breakthrough Performance...

Weight No More!

Wideband RF Signal Recorders | Rugged ½ ATR | Built for SWaP

Designed for harsh environments and weighing only 22 pounds, the new Talon RTX SFF series captures real-time RF bandwidths of a gigahertz or more. Complete with a removable QuickPac™ drive pack holding terabytes of data, these units offer flexible I/O options and sustained real-time recording rates up to 4 GB/sec!

The RTX SFF series is the latest in our COTS Talon recording systems that deliver the industry's highest levels of performance in the harshest, space-constrained environments. You'll get high dynamic range, exceptional recording speeds and ample storage capacity for extended missions—all in this compact solution.

- **Sealed, rugged, ½ ATR chassis** for MIL-STD 810 and 461
- **Multi-channel recording**, A/Ds from 200 MS/s to 6.4 GS/s
- **Easily removable 61 TB SSD QuickPac** drive pack
- **Ideal for UAVs, military vehicles, aircraft pods** and more
- **Operating temperature** from -40°C to +60°C
- **sFPDP and Ethernet** models available

All this plus FREE lifetime applications support!



Model RTX 2589 with removable QuickPac drive



Download the FREE Development Tactics & Techniques for SFF Recorders White Paper

www.pentek.com/go/adsff

PENTEK
Setting the Standard for Digital Signal Processing

Pentek, Inc., One Park Way, Upper Saddle River, NJ 07458
Phone: 201-818-5900 • Fax: 201-818-5904 • email: info@pentek.com • www.pentek.com

Worldwide Distribution & Support, Copyright © 2019 Pentek, Inc. Pentek, Talon and QuickPac are trademarks of Pentek, Inc. Other trademarks are properties of their respective owners.

Free Info at <http://info.hotims.com/72993-753>

