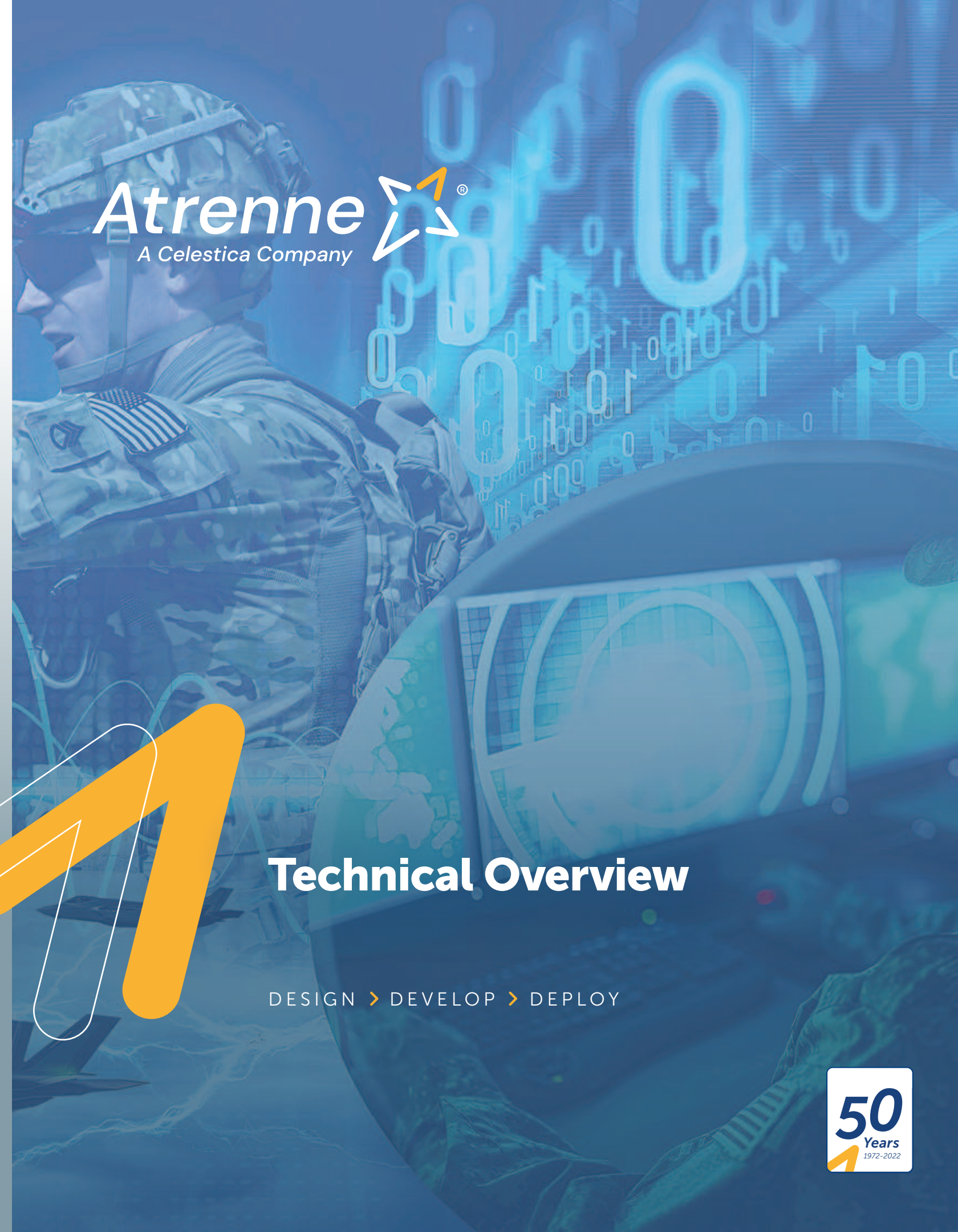



# Technical Overview

DESIGN › DEVELOP › DEPLOY

50 Years
1972-2022

ATRENNE COMPUTING SOLUTIONS HAS THE KNOWLEDGE AND EXPERTISE TO ADDRESS THE MOST CHALLENGING PACKAGING REQUIREMENTS.

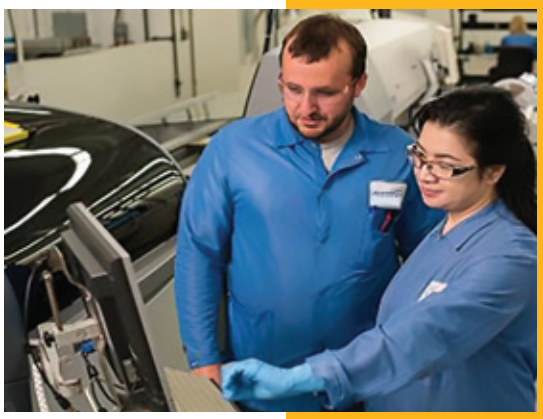
## Chassis and Backplane Solutions for High Performance Applications

The effectiveness of any system based on commercial off-the-shelf (COTS) technologies, components, and solutions is determined by how well those elements work together and with other systems. Single Board Computers (SBCs), digital signal processing (DSP) boards, graphics systems, radar processing boards, signal acquisition systems and more must all connect to advanced backplanes that are optimized to support the latest networking standards, and they must be packaged in chassis and enclosures engineered for rugged, high performance application requirements.

Because so much depends on this critical step in the development and deployment process, you can't afford second best solutions. You need proven and reliable backplane and packaging options that are engineered to the highest standards and guarantee to work with your highly engineered system.

With more than 50 years of experience delivering advanced backplane, chassis and packaging solutions for rugged, high performance applications worldwide, the Atrenne Computing Solutions team has the knowledge and expertise to address the most challenging packaging requirements. Whether your challenges are thermal management, high speed backplane signal integrity, mechanical considerations, shock and vibration concerns, size, weight and power (SWaP) constraints, or standards, our team can develop and engineer a solution that lowers development and non-recurring expenditure (NRE) costs, reduces program

## Optimized for Component and System Packaging



Atrenne Computing Solutions offers a one-stop-shop, end-to-end service approach to component and system packaging.

All our packaging solutions are based on unsurpassed expertise designing and manufacturing rugged backplanes, sub-racks and powered enclosures for defense and aerospace applications. Our standard and custom chassis platforms provide best-in-class thermal performance and are specifically engineered to support today's computing intensive applications.

### Designed for Maximum Flexibility

Our wide range of standards-based OpenVPX™ (VITA 65/68), SOSA™, MOSA, CMOSS and custom products are engineered to meet the most stringent design criteria and provide flexible, innovative solutions to your packaging challenges. Plus, we provide development platforms for new technologies, which leverage our leading role in developing industry standards and enable you to optimize the packaging of your system.

### Structured for End-to-End Quality

In addition to our complete in-house engineering services, we offer world class manufacturing for small quantity prototypes to large volume production orders. Our services include in-house Environmental Stress Screening (ESS) designed to ensure all our rugged backplanes and enclosures are optimized to withstand the extremes of temperature, shock, vibration, and environmental hazards.

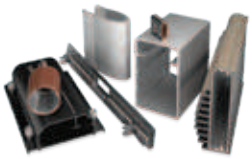
From development, design and engineering, to manufacturing and testing, all our processes are built on industry quality standards and our own company-wide quality metrics. This means, you can always rest assured that you are getting a packaging solution you can trust in any situation. Enabled for any OpenVPX requirement.

**WE OFFER WORLD CLASS MANUFACTURING FOR SMALL QUANTITY PROTOTYPES TO LARGE VOLUME PRODUCTION ORDERS**

### Enabled for Any OpenVPX and SOSA Requirement

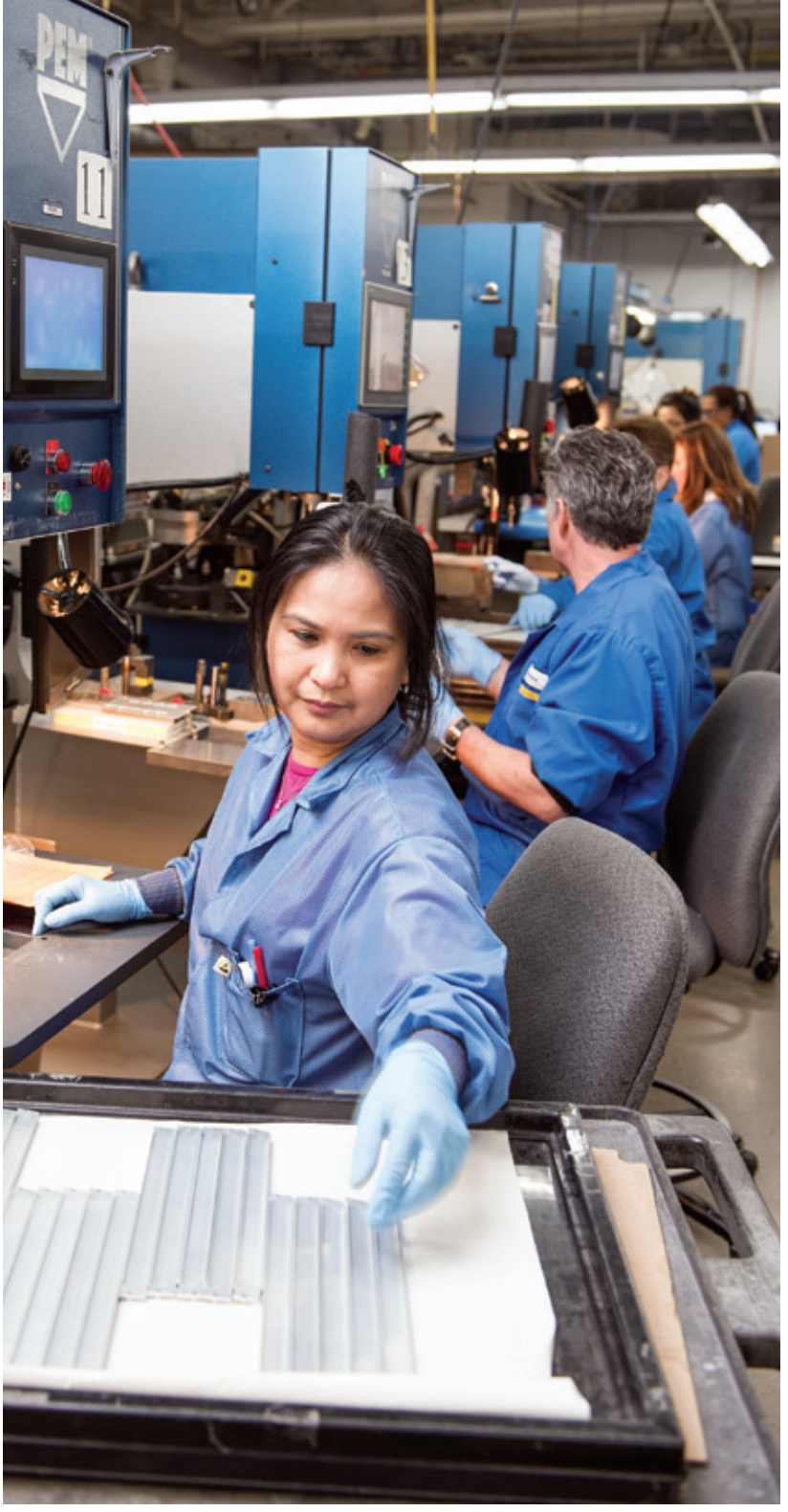
Backplanes

Enclosures/Chassis



Accessories

Quick Start Development Kits




### Development Systems

When you're ready to move to development, we have the air-cooled, conduction-cooled or liquid-cooled development system to meet your needs.

Our high performance, tower and rack mount enclosures are designed for high quality ruggedized construction and a variety of payloads. They support a wide range of backplane profiles, including OpenVPX, SOSA and they enable rapid prototyping with short lead times and low up-front costs.

### Chassis and Backplane Solutions

As the leading industry supplier of rugged COTS embedded computing modules, backplanes, and chassis, Atrenne Computing Solutions is uniquely positioned to optimize your element selection, while minimizing risk and delays to your development schedule. Atrenne Computing Solutions' broad product offering delivers a one stop solution for rugged embedded computing solutions.

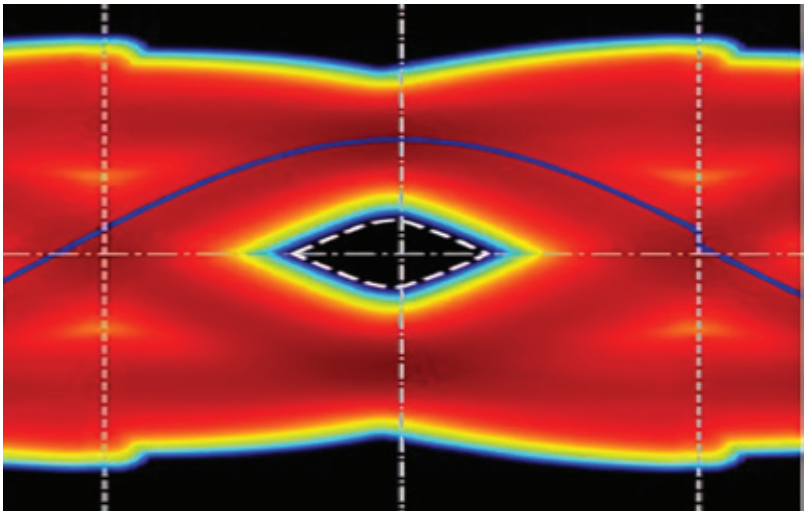
Atrenne Computing Solutions is positioned to assist with end-to-end expert guidance and support, whether you are building a development, demonstration, or deployable application, or you need air-cooled, air flow through, conduction-cooled, or liquid-cooled.

If you prefer an in-house development, we can help you with a backplane solution as well as rugged COTS embedded computing modules, including our industry-leading family of high speed backplanes.

## Signal Integrity

With the industry's leading signal integrity analysis tools and expertise, Atrenne Computing Solutions is the vendor of choice for high-speed backplane signaling. Atrenne has made significant investments in Gen-4/5 OpenVPX Signal Integrity analysis to identify and ensure a robust design that will deliver reliable Gen-4/5 performance.

Internal testing and research, has proven it is possible to achieve robust Gen-4/5 >16-25 Gbaud signaling in OpenVPX systems, but successful designs require both precision and excellence.

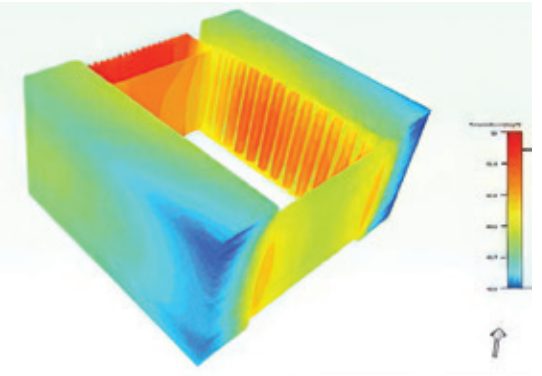


Module and backplane designs must be optimized to achieve robust Gen-4/5 >16-25 Gbaud signaling. The solution requires commitment of a high level signal integrity engineering, making it imperative that sufficient verification is conducted on both internal and external suppliers.

Atrenne's backplanes incorporates patent-pending optimizations to deliver the very best performance. It is important to ensure that Gen-4/5 modules and backplanes are designed accurately to mitigate the risks at Gen-4/5 speeds. Our backplanes utilize patent-pending optimizations are which are aimed at improving these "problem areas".

## Thermal Analysis - Chassis Solutions

Atrenne has extensive capabilities for advanced thermal/airflow modeling and simulation using industry standard CFD tools. Our capabilities range from detailed device package modeling to full system modeling for air-cooled, air flow cooled, conduction-cooled, or liquid-cooled applications.



**CFD Simulation of Forced Air Conduction ATR with High Power 6U OpenVPX 100-150W per slot**

Continuous market demands for increased speeds of operation have resulted in the advent of systems that exhibit dramatic increases in power dissipation compared to previous systems. For example, today's 6U Open VPX boards typically dissipate 2 to 4 times the power as compared to VME. This is a key reason for performing a thorough thermal design for modern electronic systems. Solving thermal management problems up front in the design phase can prevent expensive changes later on.

Atrenne has a long history of thermal innovations, and are currently developing exciting new technologies to improve thermal performance in demanding applications.

We offer thermal analysis services for our chassis solutions with power dissipation ranging to >200W per slot and chassis to >2000W. Cooling types include baseplate conduction, forced air conduction, liquid conduction, forced air-cooled, air flow through, air-air heat exchanger, and liquid-air heat exchanger.

OUR DEVELOPMENT TO DEPLOYMENT APPROACH REDUCES PROGRAM RISK, LOWERS PROGRAM DEVELOPMENT COSTS AND IMPROVES TIME-TO-MARKET.

# Everything You Need From Development to Deployment

Our development to deployment approach for packaging solutions reduces program risk, lowers program development costs, and improves time-to-market with deployable systems. It is specifically structured to enable you to develop a complete demonstration system that shows off the full capabilities of your design and allows you to transition from demonstration to deployment as quickly as possible.

## Engineering Design Services

From electrical engineering and mechanical engineering, to advanced 3D electromagnetic field modeling, signal integrity simulation, and thermal analysis we have the highly-skilled engineering teams you need to support your design objectives. Our electrical engineers deliver application- specific backplane solutions based on our extensive library of innovative standard and custom designs developed for deployment worldwide. And our mechanical design engineers provide robust, application specific designs based on extensive modeling analysis and system optimization and integration experience.

All our packaging solutions are engineered to deliver world class signal integrity. They are built based on in-depth signal integrity simulation studies we have performed that have served as the foundation for many of today's standards. And they are cross referenced with results of advanced 3D electromagnetic field modeling and analysis for vias, pads, and traces.

## Engineered Packaging Services

Whether it's for development, demonstration, or deployable application with an air-cooled, conduction-cooled, air flow through, or liquid-cooled design, we have the experience and expertise to support you every step of the way. Our team can recommend the right chassis to provide the thermal management needed for today's high power VME, VPX, SOSA, MOSA, and CMOSS requirements. It can assist with efforts to achieve the signal integrity you need for Gen-4/5 signaling. It can provide guidance for a smooth transition to OpenVPX modules, backplanes, chassis, and system solutions from older VME products. And it can make it easier to ensure there is compatibility and interoperability between your system's OpenVPX backplane and all the modules that connect to it.

## Meeting Today's Packaging Challenges

To truly compete in today's market you need more than superior packaging solutions. You need the attention to detail that will make your system stand out from competing offers. With the Atrenne Computing Solutions team you get project management services that lower program risk and ensure you get to market as quickly as possible with a high-quality, functional, rugged and affordable system.

### Integrated Program Management Services

As your development partner, we work as an active member of your Integrated Project Team and engage with you during the entire product development cycle. We work with you to analyze requirements and establish the ideal baseline architecture. We maintain two-way communication as the design matures and advances through a formal review cycle. And we control change to ensure there are no surprises at any stage of the process while supporting your critical program deliverables/SDRLs.

From the beginning, a program manager is assigned to your project along with a dedicated team of skilled and experienced engineers. A formal project plan is created and maintained to balance the competing project constraints of scope, quality, schedule, budget, resources, and risk. Weekly status reviews are conducted and world class systems engineering, earned value management, and lean project management techniques are applied.


A new class of COTS suppliers: COTS+

**OUR PROJECT MANAGEMENT SERVICES LOWER PROGRAM RISK AND ENSURE YOU GET TO MARKET AS QUICKLY AS POSSIBLE WITH A HIGH-QUALITY, FUNCTIONAL, RUGGED AND AFFORDABLE SYSTEM.**

Atrenne®
A Celestica Company

CONTACT INFORMATION
www.atrenne.com
sales@atrenne-cs.com
508.588.6110