



**Hewlett Packard
Enterprise**

Reshaping Normandy's future with AI-powered research

**CRIANN fuels scientific discovery
through high-performance computing
and advanced applications**



Normandy-based CRIANN is driving research breakthroughs. By expanding AI capabilities and upgrading its supercomputing infrastructure, this French computing center is accelerating research processes and supporting impactful results. These include uncovering potential health treatments, improving aircraft engine efficiency, and deepening the understanding of climate change and its effects.

Driving scientific breakthroughs

Centre Régional Informatique et d'Applications Numériques de Normandie (CRIANN) is at the forefront of research and innovation in Normandy, France. As a regional public supercomputing institute, it plays a pivotal role in powering sophisticated applications to advance environmental research, climate modeling, new drug development, and other discoveries. This is helping to address key challenges in Normandy and beyond.

One of CRIANN's emerging contributions is research on the impacts of climate change. By providing essential computational resources that support high-resolution climate modeling and simulations, CRIANN helps researchers understand trends such as flood risk, changing weather patterns, and coastal erosion. Its findings inform local authorities' decisions on disaster preparedness and environmental conservation, contributing to resilience and sustainability.

According to Marie-Sophie Cabot, head of high-performance computing at CRIANN, "Normandy is highly exposed to the impacts of climate change due to its large coastal areas. If the sea levels rise, it will directly affect the region. Because of this, several research projects focus on understanding and addressing the impacts of climate change, while others aim to reduce greenhouse gases or develop wind or water turbines."



Industry: Research
Country: France

Vision

Facilitate research breakthroughs to help address real-world challenges

Strategy

Advance computing resources and diversify applications for AI-driven research and insights

Outcomes

- Accelerates drug development and enhances understanding of climate change's impact in Normandy
- Promotes aviation sustainability through cleaner combustion research
- Facilitates scientific discoveries by integrating AI capabilities into research

Meeting evolving research demands

As researchers' needs have evolved in recent years, CRIANN realized it had to expand its computing capacity to accommodate diverse applications and meet the increased demands of burgeoning artificial intelligence (AI) workloads. It also wanted to enhance the speed of simulations and scientific applications.

"Since 2017, when we began collaborating with AI experts, we've noticed a steady increase in demand for resources," says Cabot. "Even labs traditionally focused on fields like CFD¹ are now using TensorFlow™ routines in their workloads. That's why we wanted to provide an environment that facilitates the use of AI."

To support these growing research requirements, CRIANN decided to upgrade its infrastructure in collaboration with Hewlett Packard Enterprise. Priorities included expanding the number of computing nodes, increasing GPU capacity, and adopting the latest technology to boost performance across workloads. As Cabot explains, "We wanted to run research across multiple distributed nodes because scaling beyond single-node GPU usage was getting too complex."

Accelerating results through AI

Today, researchers supported by CRIANN, who are mostly from academic and public institutions, are using the upgraded facilities to train machine learning models in a way that expands their research scope. These upgrades have enabled new applications, such as recognizing audio scenes,

understanding complex digitized documents, and automating the analysis of medical images. In the transportation and mobility sector, the modernized facilities are supporting the development of new models to help autonomous vehicles avoid obstacles within a range of environments, even in adverse weather conditions.

According to Cabot, AI integration is expected to streamline research processes and lead to faster results. "The new infrastructure is more flexible and accommodates diverse research requirements. It also eliminates the need for special hardware setups, which makes it easier for researchers to access and use our resources."

While researchers have yet to fully harness AI's capabilities, many already benefit from enhanced GPU capacity with HPE Apollo 6500 featuring NVIDIA® A100 Tensor Core GPUs. This results in increased efficiency and more impactful outcomes, including in drug development.

For instance, the University of Caen Normandy's Centre d'Études et de Recherche sur le Médicament de Normandie undertook an ambitious computational project that tested 620 million molecules to see how they interacted with three proteins linked to COVID-19. This resulted in promising drug candidates being identified to tackle the virus.

"Using CRIANN's facilities to process 120 terabytes of data helped accelerate the hunt for potential COVID-19 treatments," says Cabot.

¹ Computational fluid dynamics



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– Marie-Sophie Cabot, Head of High-Performance Computing, CRIANN



Advancing aviation's sustainability through fuel research

CRIANN's supercomputing resources have also been instrumental in CFD research initiatives conducted by scientists from Complexe de Recherche Interprofessionnel en Aérothermochimie (CORIA), a research unit affiliated with the University of Rouen Normandy. The team's work to reduce emissions from burning fuels on land and in the air has advanced understanding of cleaner combustion processes.

By conducting simulations and in-depth analysis of an aircraft engine fuel injection system, CORIA scientists have contributed to sustainable aviation and improved engine performance. Their high-fidelity simulations of gas turbine combustion chambers realistically reproduce observed flame shapes, with one resembling a "V" and the other a tulip. These simulations highlight the importance of effectively blending fuel and air to achieve optimal combustion in engines.

These findings have the potential to stimulate the development of more fuel-efficient and environmentally friendly engines in the aviation industry. "They can also have applications beyond aviation and be valuable to industries looking to refine combustion processes and improve energy efficiency," says Cabot.



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– Marie-Sophie Cabot, Head of High-Performance Computing, CRIANN

Transforming aircraft engine efficiency

In another promising project, scientists from CORIA are investigating hydrogen's potential role in achieving cleaner combustion and reducing emissions.

Aircraft gas turbine manufacturers aim to cut nitrogen emissions by lowering combustion chamber temperatures, a process known as lean premixed combustion. However, this method results in less stable flames, which are essential for consistent and safe combustion within gas turbine engines. To address this challenge, CORIA researchers have been conducting specialized simulations, now powered by CRIANN's HPE Cray supercomputer. Their work involves creating databases and validating different combustion models.

Building on this research, the scientists are now running advanced simulations to improve aircraft engine design and reduce its environmental footprint. The simulations precisely replicate real flames, consider heat loss from surrounding surfaces, and streamline the computational process while maintaining accurate results.

As Cabot notes, "These research projects are paving the way for cleaner, more efficient aircraft engines, which are vital for the aviation industry's sustainable future."

Expanding research capabilities

CRIANN's new supercomputing setup includes HPE Apollo 6500 Gen10 Plus System, equipped with NVIDIA A100 Tensor Core GPUs for AI and molecular dynamics workloads, and HPE Cray XD2000 with AMD EPYC Genoa 9654 for a range of tasks, including CFD, chemistry, and material science. CRIANN also expects to utilize HPE Superdome Flex 280 Server in research projects that will benefit from the large shared memory capabilities of the platform, such as studying the mechanical behavior of complex materials.

Completing this setup is the HPE Machine Learning Development Environment Software, designed to power advanced machine learning and AI research.

According to Cabot, "Not only did HPE provide the supercomputer but also the infrastructure surrounding it. Various teams — including HPC, infrastructure specialists, and HPE Services, worked together to make it happen, which showed their depth of expertise in delivering a complete solution."

She adds that compared to its previous infrastructure, CRIANN has significantly increased its computing capabilities. This includes a 10x boost in GPU capacity and a 3.5x improvement in CPU performance.

"Our overall memory capacity has also nearly doubled," says Cabot.



Supporting diverse scientific communities

As AI tools become increasingly integrated into research workloads, CRIANN is primed to expand support for physics researchers using these advanced capabilities.

“We’ve welcomed new scientific communities in HPC, including biologists, geographers, and economists,” says Cabot. “And we expect to see a rise of projects related to experimental techniques as labs refine their methods and some plan to include AI in their workflows, potentially leading to more research breakthroughs and discoveries.”

With a growing number of research laboratories relying on CRIANN, Cabot anticipates supporting an even broader range of scientific applications in the future. “Our HPE infrastructure ensures we meet this rising demand.”



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– **Marie-Sophie Cabot**, Head of High-Performance Computing, CRIANN

Solution

Hardware

- HPE Cray XD2000 with AMD EPYC Genoa 9654
- HPE Apollo 6500 Gen10 Plus System with NVIDIA A100 Tensor Core GPUs
- Cray ClusterStor E1000 Storage System
- HPE Superdome Flex 280
- HPE Slingshot Interconnect

Software

- HPE Machine Learning Development Environment Software
- HPE Performance Cluster Manager

HPE Services

Key partners

- Module-IT

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