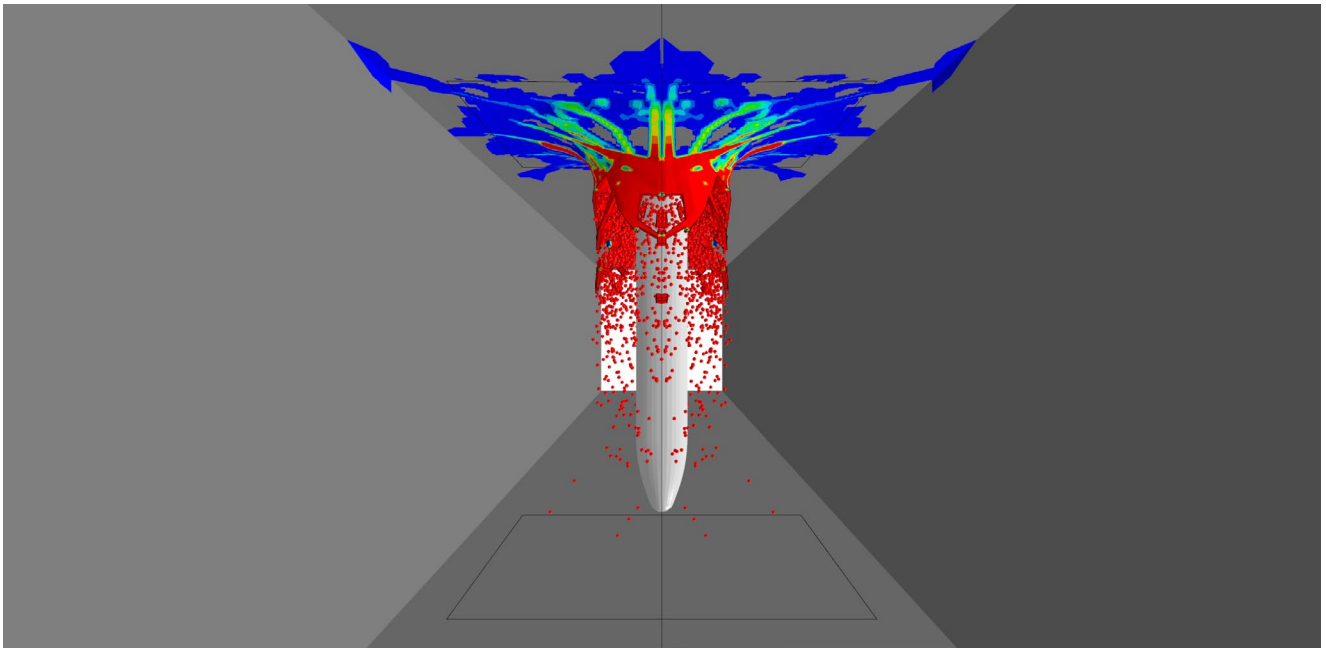# HPC APPLIANCE BOOSTS
SIMULATION PERFORMANCE

Applied Research Associates reduced IT support costs and increased
solver speeds by 20% with a managed HPC appliance from TotalCAE.

TotalCAE   ARA

High-performance computing (HPC) resources can provide a substantial boost to simulation, but an HPC cluster can be complex and difficult to manage. That is especially true for organizations where information technology (IT) resources are already stretched thin and operating with limited staff dedicated to supporting engineers.

Applied Research Associates (ARA), an employee-owned research and engineering firm, struggled with maintaining its legacy HPC cluster. IT staff had to dedicate several days per week to supporting the outdated hardware, and when there were failures, it could leave the engineering team idle while the IT staff would troubleshoot or find refurbished parts online. By deploying a managed HPC cluster appliance, the company was able to eliminate internal maintenance and support overhead, while improving productivity and reliability.

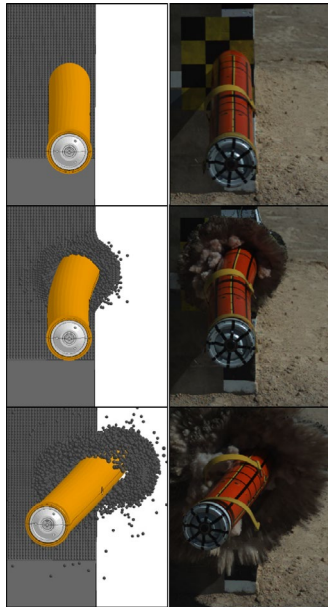*A warhead FEA model and test.*

HPC SUPPORT CHALLENGES

ARA has 1,300 employees across the U.S. in multiple divisions and supports a diverse client base that includes projects in robotics, computer design, weapons systems and infrastructure.

The company's team in Albuquerque, N.M. focuses on design analysis, prototyping and testing. "This branch is a concept development group, and our bread and butter is air-delivered weapons systems, says Drew Malechuk, lead engineer at ARA.

The office works with the U.S. Air Force and relies on LS-DYNA for the bulk of its simulation work. When the group first began to work on these airborne weapons systems, they used personal workstations to perform simulations using one or two cores. "The Air Force was interested in anything we could do to save time and money via simulation-based design," Malechuk says. "You can imagine how much a test of those systems in the field can cost. If we can get to the table with a 90% solution before they get to the testing stage, that provides significant savings."

However, this PC-based approach was not sufficient for the larger problems the group was asked to solve. "We didn't have much experience in that area, so we grabbed the first HPC cluster we could find," Malechuk says.

While the old cluster served its purpose, it came with no support—ARA's IT staff was solely responsible for upkeep during the six years it was in service. "They required us to do the configuration, and they had no clue how to use FEA software," Malechuk says. "Because of this, it became an added responsibility for the engineering staff to ensure the cluster and FEA software were up to date and running correctly."

The IT department, already overburdened, had difficulty supporting the legacy cluster. As the equipment aged and required more maintenance, the problem was compounded.

As time wore on, there were more frequent mechanical failures. As the cluster was out of warranty, ARA had little recourse but to scrounge for replacement parts on the aftermarket. "We lost a motherboard on a compute node, and it was very difficult to find," Malechuk says. "We had a node down for a week before we could identify the hardware to fix it. We lost the motherboard on the main node as well, and we had five engineers waiting to get their work done."

The old cluster was also Linux-based. As the ARA IT team's primary
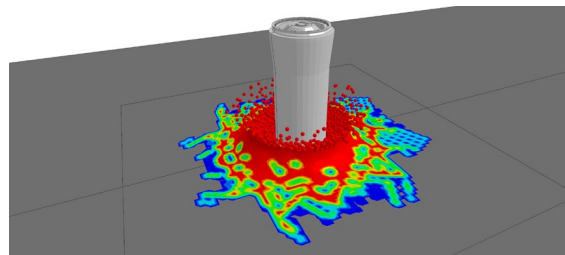
ARA can complete FEA analysis for its defense clients more efficiently thanks to the managed HPC cluster appliance.

responsibility is to maintain the multitude of MS Windows-based computers within the company, software updates were challenging, and ARA fell behind on standards and requirements. "We just kept falling behind on those requirements," Malechuk says. "We needed a team behind the team to get those things done, perform the maintenance and keep an eye on the cluster for us. That way our engineering team could focus on their jobs, knowing they had that support behind them."

A MANAGED APPROACH

ARA looked into accessing cloud-based HPC resources but felt that latency could be an issue. "We have to run quick and have everything at our fingertips, so having to download and upload things, and to be at the mercy of the remote HPC sites,

was not viable at this point," Malechuk says. "Due to the sensitivity of the work we do, finding the correct cloud system that met our requirements was just too complex," Malechuk says. "The HPC appliance made more sense because of the type of work we do."

The ARA team made a requirements list for a new computing solution that would include high reliability, white-glove service, and automatic updates and maintenance to help ensure the team was operating as efficiently as possible. ARA's contacts suggested they reach out to TotalCAE, a company that provides turnkey HPC appliances for simulation environments.

ARA explained their requirements to the TotalCAE team, and the appliance was installed in the data center in the summer of 2020. TotalCAE manages the appliance and our CAE applications so that we can focus on our engineering, and not IT issues.

"We started this as things began shutting down because of COVID-19," Malechuk says. "We thought that would be a problem, but it turned out to go very smoothly. TotalCAE went out of their way to understand what we wanted and how we wanted it configured. When the appliance showed up, we had it mounted and running jobs the next day."

FASTER SOLVES, NO HEADACHES
In just a few months, the TotalCAE HPC appliance delivered improvements in both reliability and productivity. "It has been

running reliably the entire time we have had it," Malechuk says. "It is faster than the previous cluster, and the large SSD allows us to run things a lot faster and to do larger runs."

ARA is seeing 20% speed-up improvements in job compute times on the same number of cores. "That is huge for us," Malechuk says.

The new system has also helped

HPC CLUSTER APPLIANCE INGREDIENTS

The TotalCAE HPC cluster appliance installed at ARA includes powerful hardware and software elements to ensure optimal performance. Components include:

- *1 Storage Node with 512TB of archival storage*
- *1 Visualization Node*
- *1 Management Node with 8TB of SSD working storage*
- *8 Compute Nodes powered by Intel Xeon Scalable 6226R Processors*
- *1 Mellanox EDR InfiniBand smart switch*
- *TotalCAE Platform and Managed Services*
- *Ansys software*

with visualization. Previously, ARA purchased two visualization nodes from their previous vendor but could never get them working correctly. With five high-end video cards in each node, it was an expensive lesson. "Nobody could help us get those working, so we were using straight visualization off the head node. Doing post processing and rotating a 3D model was a nightmare," Malechuk says.

Now, ARA has a high-end visualization node from TotalCAE that just works, and has helped improve post-processing. "We can interrogate 3D models

and make movies in almost real time," Malechuk says.

For the IT team, the change to use a managed service has been monumental. "As the old system reached the end of its life, there was one IT employee dedicated three days a week just to keep the cluster running," Malechuk says. "His to-do list was through the roof, so it has been invaluable to be able to pull him off that and give him time to work on other projects."

PLANNING FOR THE FUTURE
Malechuk says the appliance provides enough capacity to grow with the company's needs. "I have a level of confidence that we are not going to max out tomorrow," he says. "It can meet our needs today and over the next several years."

Malechuk says that TotalCAE will be adding new codes to the appliance for ARA.

"LS-DYNA is still our main solution, but the nature of the problems we are starting to solve will require different types of FEA codes," Malechuk says. "My goal is also get Ansys Fluent on the machine to come up with new ways to apply CFD and FEA to the models—not just using the codes as designed, but coming up with interesting ways to couple those with other codes and create scripts to go a step beyond what the code was intended to do."

With the fully managed HPC appliance, ARA will have both the computing and staffing resources available to create more innovative solutions for the company's clients.