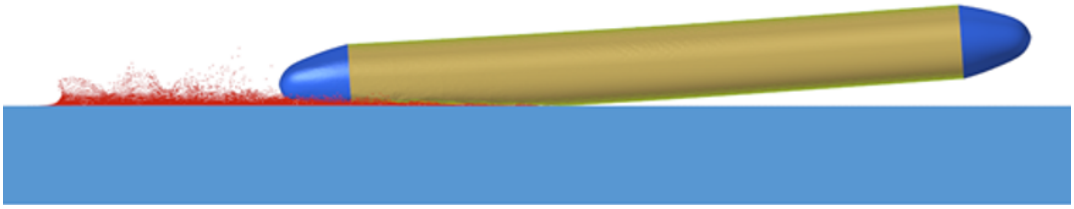
OUTSTANDING SCALABILITY AT NIAR

ADVANCED CRASH ANALYSIS SOLUTION TWICE AS FAST AS LEADING COMPETITOR

About the Customer

The Advanced Virtual Engineering and Testing Laboratories at the National Institute for Aviation Research (NIAR) conducts research to help manufacturers develop safer aircraft, faster and more efficiently. Based at Wichita State University in Kansas, this highly respected center of excellence employs more than 650 skilled and experienced staff, operating from one million square feet of lab space. NIAR offers the aviation industry a wide array of support services, including the development and validation of techniques that enable the use of virtual models to design and certify airframes. The organization's clients encompass a host of blue-chip manufacturers.

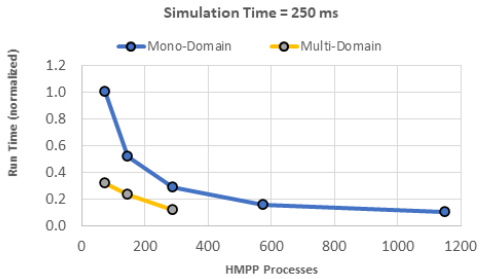
> "Radioss clearly represents an alternative crash analysis process with compelling benefits. It will help accelerate the research and development process at NIAR, and significantly shorten design cycle time in the aerospace industry. Radioss performs brilliantly on Oracle's high performance cloud infrastructure.
>
> Rafael Leite, Research Associate, NIAR

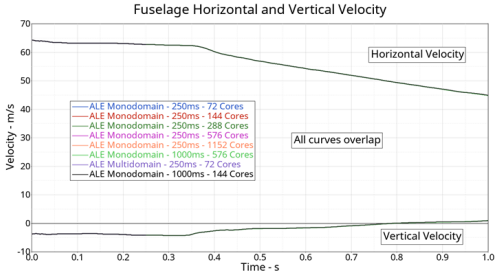


Their Challenge

Finite element method (FEM) is used throughout the aerospace industry to predict occupant protection during crash events. Simulation of these highly nonlinear dynamic events is intensive in terms of time and resources. As models grow in complexity and detail, simulation demands greater computing resources, making large-scale design exploration infeasible. Lower fidelity models speed the simulation at the expense of accuracy, leading to unreliable design decisions.

To support its goal of building safer aircrafts NIAR conducted a study to assess the scalability of Altair Radioss™. Could Radioss demonstrate significant reductions in runtime and enable large-scale reliable design exploration without compromising accuracy?





TOP: SPH Multi-Domain Ditching Simulation **LEFT:** Scalability of Radioss **RIGHT:** Repeatability of Results with Radioss

Our Solution

Radioss delivers industry-leading standards of scalability and speed via hybrid massively parallel processing, which enables tasks to be split into discrete parts that can be solved concurrently. Crucially, the efficiency with which additional cores are added determines the improvement in runtime. Radioss' multi-domain operation is used to further speed up simulations where different areas of the model require significantly different time steps. Multi-domain operation creates targeted sub-domains that are resolved discretely in their own timesteps.

The NIAR study was designed to measure these benefits and compare them with other existing solvers. Led by researcher Rafael Bini Leite, the study simulated the structural impact on an aircraft fuselage ditching in water. To ensure a thorough assessment, two formulations were used for the fluid domain (Arbitrary Lagrangian Eulerian mesh and smooth particle hydrodynamic). The scalability of the model was then tested in both mono- (up to 1152 cores) and multi-domain (72 to 288 cores) configurations.

Regular support from an Altair engineer ensured swift familiarization with Radioss. The study was performed on Oracle Cloud Infrastructure (OCI). OCI with its bare metal HPC shapes that use low latency RDMA interconnect provided highly scalable infrastructure-as-a-service (IAAS) for Radioss.

Results

The study confirms that Radioss supports the use of high-fidelity models within significantly faster development cycles. In every test, the scalability was outstanding. The value of multi-domain operation was also demonstrated, proving twice as fast as mono-domain on 72 cores. Running on 48 cores, Radioss completed simulations in less than half the time taken by other solvers on identical models and hardware. Repeatability was equally impressive, with Radioss consistently returning near identical results from all runs.

Going forward, Radioss will save time while ensuring the best use of computing resources as NIAR staff continue their vital work in aviation safety.

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