The high performance computing solution from Cray and ANSYS is a key enabler of high-fidelity simulations, providing a combined solution that facilitates large and detailed aeroelastic simulations.

Aeroelasticity is essential to aircraft design. Today, aeroelasticity helps control and withstand flutter- and gust-type phenomena. Tomorrow, aircraft design will open up a revolutionary new field by leveraging aeroelastic behavior as a design feature, creating more efficient and better aerodynamics with wings and structures that change shape in response to their environment.

Cray and ANSYS are advancing engineering simulation for aerospace applications by assessing state-of-the-art computational aeroelasticity (CAe) methods as practical tools for the prediction of static and dynamic aeroelastic phenomena and responses on relevant geometries. With comprehensive aeroelastic benchmarking validation against existing wind tunnel data, Cray and ANSYS have produced a joint solution that delivers the resources required for large and detailed aeroelastic simulations.

ANSYS Fluent®:
ANSYS Fluent is a computational fluid dynamics (CFD) software solution used to predict flow, turbulence, heat transfer and reactions for industrial applications. Those applications address almost any problem – from air flow over an aircraft wing to combustion in a furnace, from bubble columns to oil platforms, from blood flow to semiconductor manufacturing, and from clean room design to wastewater treatment plants. Advanced solver technology provides fast, accurate CFD results, flexible moving and deforming meshes, and superior parallel scalability. Additionally, Fluent has a record of outstanding parallel scalability up to thousands of processors, enabling high-fidelity results in the shortest possible time.

This aeroelastic application is both CPU and memory intensive, making CPU speed, memory speed and memory bandwidth paramount when selecting a processor. Faster memory improves Fluent performance. Also, the system interconnect is a critical factor when leveraging scalability to improve the application’s performance. With a high performance interconnect, ANSYS Fluent can scale to thousands of cores.

Cray XE6™ Products
The Cray XE6 product line provides a wide range of configurations with a focus on sustained performance, scalability and reliability – accelerating the impact of innovation and breaking the boundaries of technical competitive advantage.

It Features:
- High bandwidth, low latency Gemini interconnect
- Node specialization allowing compute nodes to specialize in computation
- Proprietary MPI library – highly optimized and tightly coupled with Gemini interconnect
- Cray Linux Environment (CLE) – Linux-based OS optimizing launch and execution of applications at large scale
Cray XE6 + ANSYS Fluent

ANSYS Fluent scales efficiently to large numbers of MPI ranks on the Cray XE6 architecture. Together the solution enables users to:

- Perform complex simulations involving the interaction of multiple physics efficiently
- Simulate bigger, more detailed models and more complex physics
- Deliver more innovation, more features and more reliability in less time
- Deliver higher productivity, better product quality and faster time-to-market

ANSYS Fluent and the Cray XE6 System in Action

The Benchmark Supercritical Wing test case was developed as a part of the Benchmark Models Program at NASA Langley Research Center. This program facilitated the development and validation of aeroelastic CFD codes by providing steady and unsteady flutter experimental data. The wing has a rectangular platform with a supercritical airfoil shape cross section.

For this case, researchers obtained both unsteady experimental and computational data by using forced oscillation at a specified frequency of 10 Hz. They created hexahedral mesh with three different mesh refinements using ANSYS ICEM CFD meshing software (i.e., 1.45 million, 4.94 million and 13.7 million cells) and performed both steady and dynamic case simulations using ANSYS Fluent 14.0. Finally, the researchers studied the scalability of the ANSYS Fluent solver using the Cray XE6 supercomputer for the steady case using the finest mesh (13.7 million cells) with scaling up to 3,072 cores and 96 nodes.

For ANSYS Fluent, the Cray XE6 system offers impressive parallel scaling performance, with scaling out to thousands of cores for this 13.7 million cell simulation.

Cray and ANSYS are committed to delivering HPC performance and capability to bring aerospace applications to new heights of simulation fidelity in the shortest amount of time.