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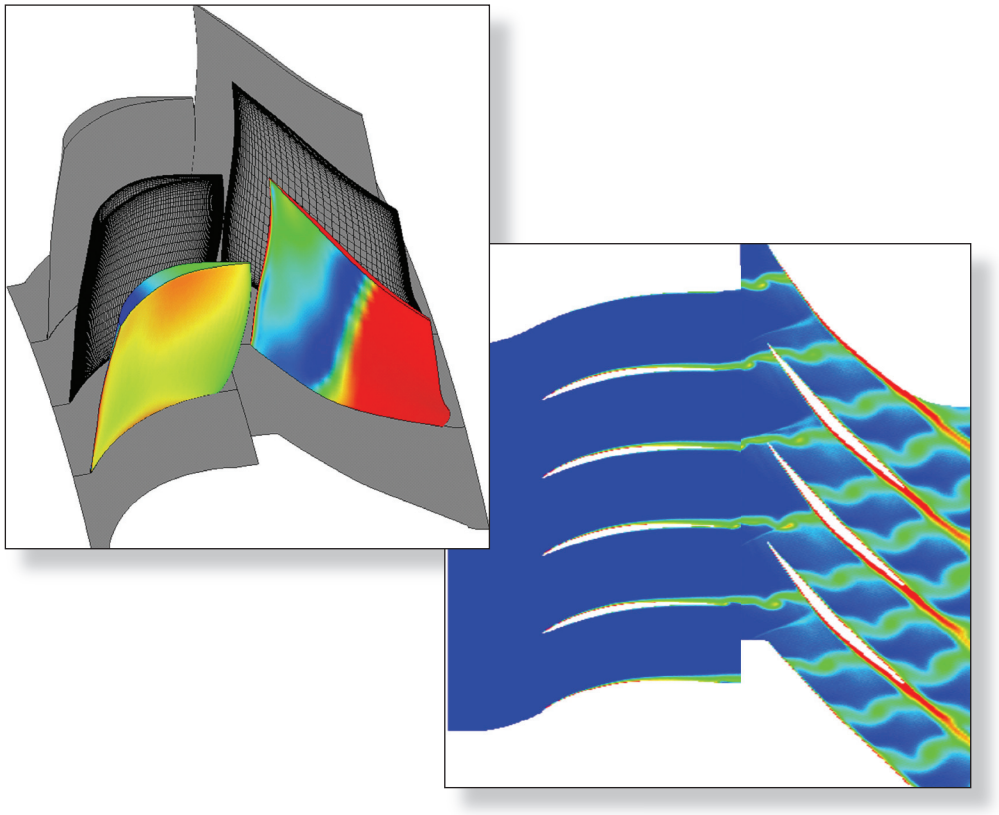
Science and Technology for Tomorrow's Air and Space Force

Success Story

PROPULSION DIRECTORATE DEMONSTRATES M&S APPLICATION IN TURBINE ENGINE DEVELOPMENT



Propulsion Directorate scientists use high performance computing (HPC) and modeling and simulation (M&S) capabilities to analyze components under development and to impact turbine engine design and manufacturing decisions in a short time frame. The M&S application will reduce the number of engine design iterations required and provide predictions of component performance, thus reducing the need for expensive and time-consuming system testing.

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Accomplishment

Directorate scientists teamed with the Aeronautical Systems Center (ASC) Major Shared Resource Center (MSRC) and General Electric Aircraft Engine (GEAE) Company and successfully demonstrated the use of a time-accurate computational fluid dynamics (CFD) code that analyzed advanced compression systems. Simulations on four cases, each having a different boundary condition, were accomplished. Nine blade passages were modeled in three dimensions, requiring a total of 22 million-grid points.

The data provides the capability to analyze and understand unsteady airflow phenomena so that intelligent design choices can be made to improve efficiency in new-development jet engine compressors, combustors, and turbines. This effort demonstrated the utility of HPC resources to allow critical technologies to be discovered and applied to advanced turbine engine development programs at a much faster pace.

Background

The use of M&S is a key directorate approach to address the affordability of advanced turbine engines. ASC MSRC provided the computation resources and the software, and TURBO was the CFD code used. TURBO's principal architect is J.P. Chen from Mississippi State University and the National Aeronautics and Space Administration (NASA) Glenn Research Center, and GEAE provided the program funding and upgrades.

Researchers conducted the demonstration in support of the Versatile Affordable Advanced Turbine Engines (VAATE) program. VAATE is a joint Department of Defense, NASA, Department of Energy, and industry effort seeking to achieve a tenfold improvement in turbine engine affordability by 2017. VAATE will also transition advancing turbine engine technologies to legacy and pipeline systems.

Propulsion
Emerging Technologies

Additional information

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