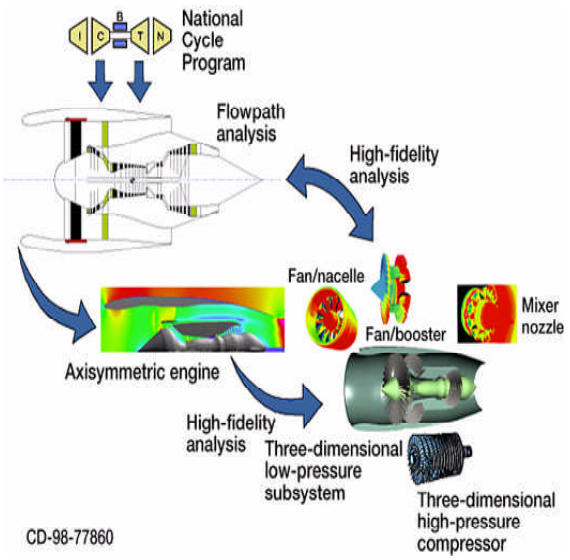
Common Analysis Tool Being Developed for Aeropropulsion: the National Cycle Program Within the Numerical Propulsion System Simulation Environment

The NASA Lewis Research Center is developing an environment for analyzing and designing aircraft engines-the Numerical Propulsion System Simulation (NPSS). NPSS will integrate multiple disciplines, such as aerodynamics, structure, and heat transfer, and will make use of numerical "zooming" on component codes. Zooming is the coupling of analyses at various levels of detail. NPSS uses the latest computing and communication technologies to capture complex physical processes in a timely, cost-effective manner. The vision of NPSS is to create a "numerical test cell" enabling full engine simulations overnight on cost-effective computing platforms.

Through the NASA/Industry Cooperative Effort agreement, NASA Lewis and industry partners are developing a new engine simulation called the National Cycle Program (NCP). NCP, which is the first step toward NPSS and is its initial framework, supports the aerothermodynamic system simulation process for the full life cycle of an engine. U.S. aircraft and airframe companies recognize NCP as the future industry standard common analysis tool for aeropropulsion system modeling. The estimated potential payoff for NCP is a $50 million/yr savings to industry through improved engineering productivity.

NCP is being developed to provide all the features that currently exist in cycle simulations as well as the framework needed to enable NPSS concepts of coupling multidisciplinary tools at various levels of detail in a collaborative distributed environment while preserving an overall engine system view. What NCP now allows is illustrated by the following illustration.



National Cycle Program makes it possible to zoom to a more detailed analysis.

The NPSS/NCP team consists of propulsion experts and software engineers from GE Aircraft Engines, Pratt & Whitney, the Boeing Company, AlliedSignal Engines, Allison, Williams International, Teledyne Ryan Aeronautical, Arnold Engineering Development Center, Wright Patterson Air Force Base, and NASA Lewis. Formal software development processes are followed to facilitate technology transfer.

In fiscal year 1998, the major accomplishment of the NCP team was the completion and distribution of NCP Version 1. New capabilities include transient analysis, test data reduction, a controls toolbox, and initial zooming. NCP applications to the NPSS architecture successfully demonstrated distributed simulations. Workshops were conducted throughout the year, training over 60 NCP users and component developers. NCP is being used as the modeling tool for in-house, High-Speed Research (HSR) at Lewis and GE Aircraft Engines.

In fiscal year 1999, the NCP team will complete the major pieces of the cycle system, including customer deck generation and dynamic solver capability, and will finish off the complete set of engine components. At the same time, NCP's development will shift to a major emphasis on zooming. As part of NPSS, the NCP is supported under the NASA High Performance Computing and Communications Program.

Bibliography

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