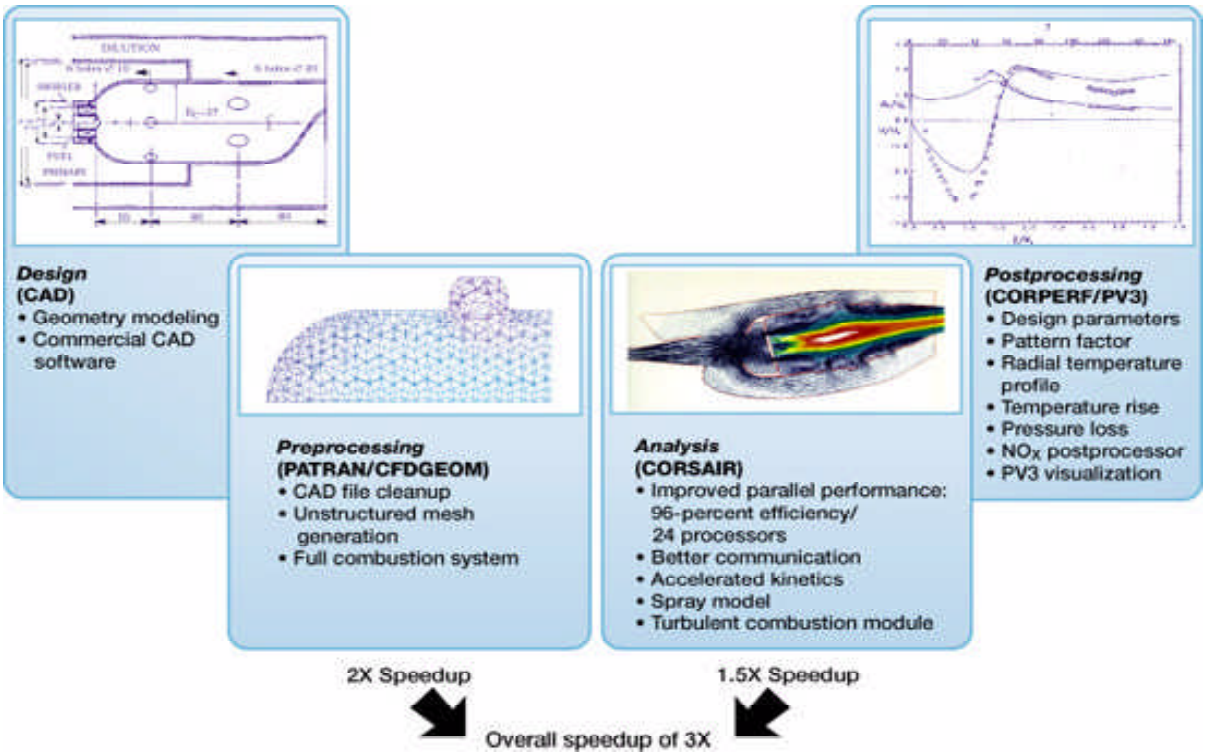
National Combustion Code, a Multidisciplinary Combustor Design System, Will Be Transferred to the Commercial Sector

The NASA Lewis Research Center and Flow Parametrics will enter into an agreement to commercialize the National Combustion Code (NCC). This multidisciplinary combustor design system utilizes computer-aided design (CAD) tools for geometry creation, advanced mesh generators for creating solid model representations, a common framework for fluid flow and structural analyses, modern postprocessing tools, and parallel processing. This integrated system can facilitate and enhance various phases of the design and analysis process.

The National Combustion Code was developed under a NASA/Department of Defense/Department of Energy/U.S. industry partnership. Recent efforts have been focused on developing a computational combustion dynamics capability that will meet combustor designer requirements for model accuracy and analysis turnaround time, incorporating both short and long-term technology goals. As a first step, a baseline solver for turbulent combustion flows, CORSAIR-CCD, was developed under a joint modeling and code development effort between the aeronautics industry and NASA Lewis. CORSAIR-CCD is a Navier-Stokes flow solver based on an explicit four-stage Runge-Kutta scheme that uses unstructured meshes and runs on networked workstations. The solver can be linked to any computer-aided design system via the Patran file system. Turbulence closure is obtained via the standard k-ε model with a high Reynolds number wall function. The following combustion models have been implemented into the code: finite-rate chemical kinetics emulations for Jet-A and methane fuels, turbulence-chemistry interactions via an assumed probability density function for temperature fluctuations, and thermal emissions of nitrogen oxides. CORSAIR-CCD can switch between a parallel virtual machine (PVM) interface and a message-passing interface (MPI) by using compiler flags. Its parallel performance on several platforms has been analyzed; and on the basis of the results, several improvements have been made. Applications of the CORSAIR-CCD code to date include simulating swirling flow and simulating ignition-delay experiments; computing a generic swirling flow for a can-combustor and a multishear flow for a low-NO_x fuel nozzle; calculating a multiwalled production fuel nozzle and an IMFH/Cyclone "1-cup sector"; (which contains one cyclone and an integrated set of mixing and flame holder tubes); and providing computational support for tests of the NASA LDI-MVS sector rig combustor (which uses lean direct injection and a multiple venture swirler).



Typical results for the National Combustion Code (NCC), a combustor design and analysis system.

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