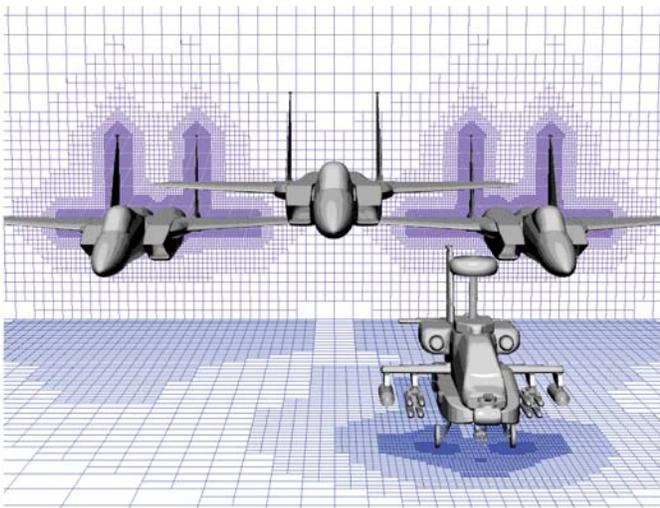




**technology opportunity**

## Cart3D

A High-fidelity Inviscid Analysis Package for Conceptual and Preliminary Aerodynamic Design



Cart3D automates the grid layouts for aircraft and spacecraft design analysis.



Cart3D is a high-fidelity inviscid analysis package for conceptual and preliminary aerodynamic design. It allows users to perform automated CFD analysis on complex geometry. The package includes utilities for geometry import, surface modeling and intersection, mesh generation, flow simulation and post-processing of results. The main simulation code, flowCart, runs in parallel both in shared memory (OpenMP) and distributed memory (mpi) with excellent scalability. The package is highly automated so that geometry acquisition and mesh generation can usually be performed within a few minutes on most current desktop computers. Geometry enters into Cart3D in the form of surface triangulations. These may be generated from within CAD packages, from legacy surface triangulations or from structured surface grids. Cart3D uses adaptively refined Cartesian grids to discretize the space surrounding a geometry and cuts the geometry out of the set of “cut-cells” which actually intersect the surface triangulation. The flow solver is parallel and can take full advantage of multi-core and multi-cpu hardware.

## Benefits

- Easy reconfiguration that simplifies parametric studies
- High quality mesh generation at low PC memory requirements
- Excellent Scalability
- Reduces simulation time requirements significantly

## Applications

- Air and spacecraft design
- Aerodynamic and fluid flow simulations in automotive, turbomachinery, electronics, and process industries
- Military vehicles
- Helicopters design

## Technology in Detail

### Mesh Generation

Cubes is an automated mesh generation tool which produces Cartesian meshes around arbitrarily complex, watertight geometry. The mesh is adaptively refined based on the local curvature of the geometry. Geometry is input as surface triangulations of individual components. This component-based approach permits easy reconfiguration, greatly simplifying parametric studies. The time to generate a mesh is insensitive to the complexity of the geometry. The highly optimized code generates meshes at over four million cells-per-minute on typical desktop computers and memory requirements are below one gigabyte per million cells.

### Flow Solver

FlowCart is a scalable, multilevel, linearly-exact upwind solver which uses on-the-fly domain-decomposition to achieve excellent scalability on modern multi-core computers. It is among the most scalable, accurate and robust codes in the industry. On most modern desktop machines it can converge well over 2 million cells-per-hour-per-core, and is targeted directly at multi-core CPUs. FlowCart is tightly integrated into Cart3D with a suite of automation tools built around it. Since it is a multilevel code, it converges very quickly and includes the latest technical developments on low-dissipation numerics, solid wall boundaries, mesh interfaces and limiters. Both the parallelization and multigrid are completely transparent to the user and can be adjusted at runtime without pre-processing or a special domain partitioning step.

### Patents

This technology has been patented (U.S. Patent 6,445,390).

### Licensing and Partnering Opportunities

This technology is part of NASA's Innovative Partnerships Program, which seeks to transfer technology into and out of NASA to benefit the space program and U.S. industry. NASA invites companies to inquire about licensing possibilities for this technology for commercial applications.

## For More Information

**If you would like more information about this technology, please contact:**

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