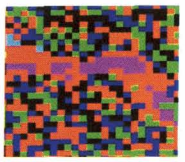
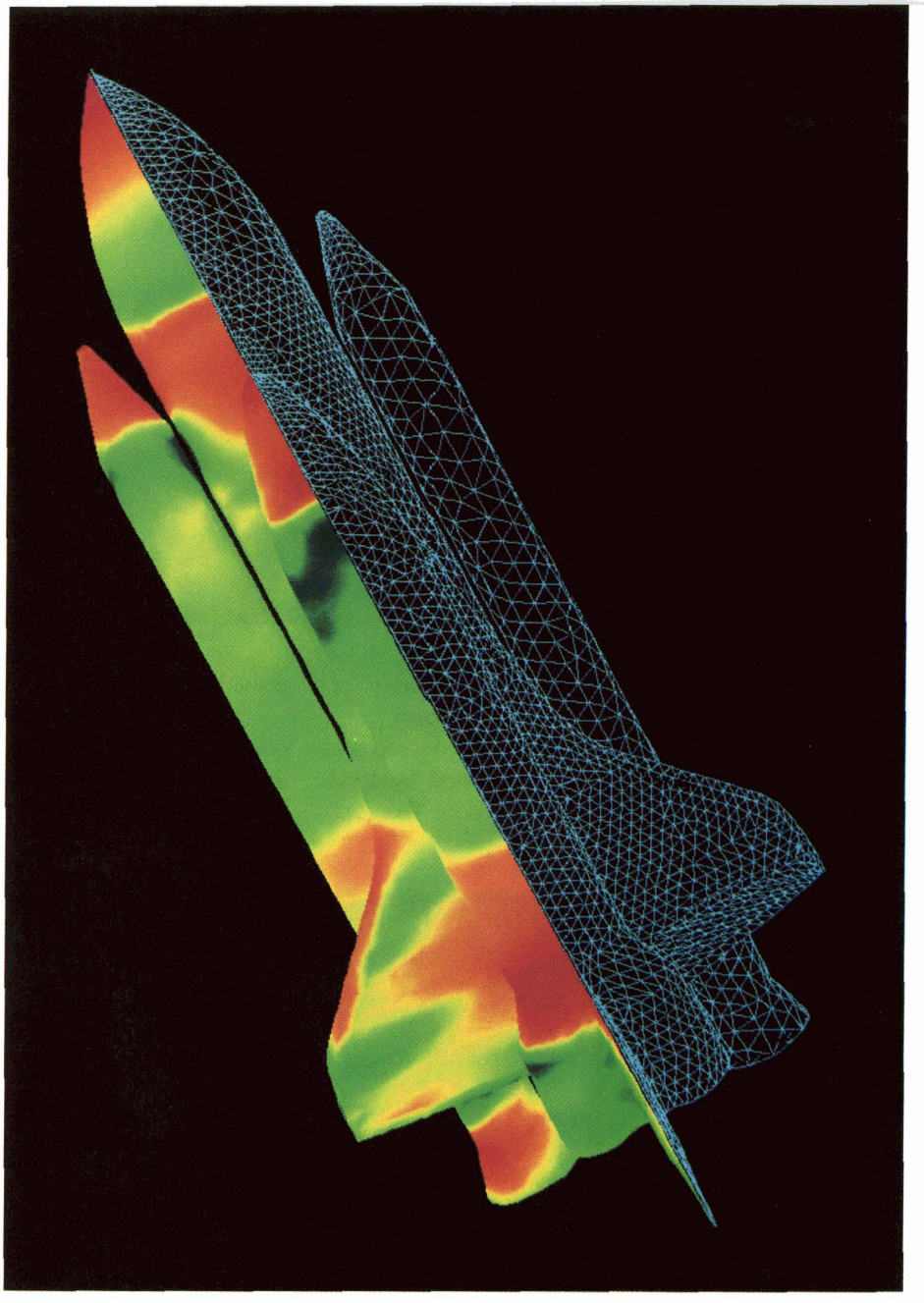




# Design Software

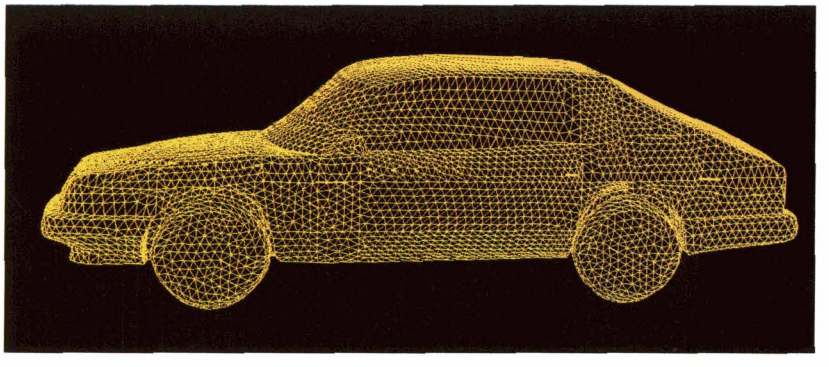


*Spinoff software products have found application in auto design, structural analysis and other non-aerospace applications*

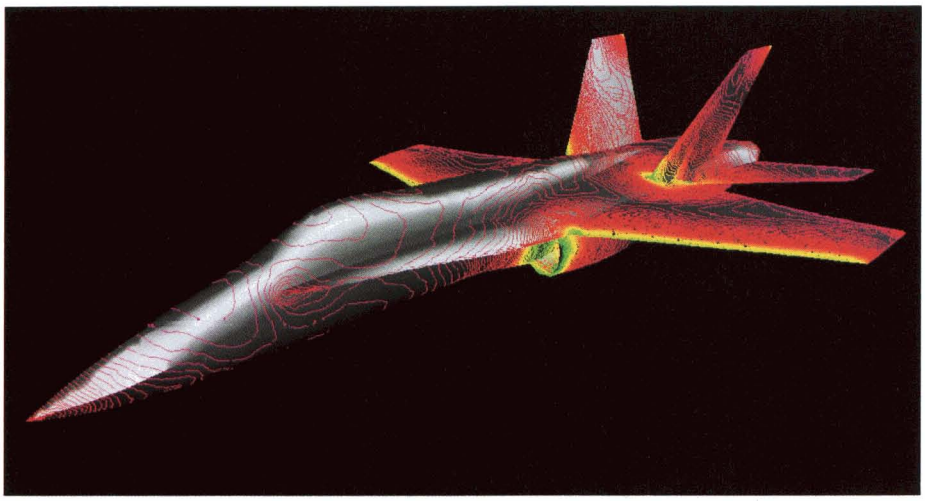
One of the objectives of the Small Business Administration's Small Business Innovation Research (SBIR) program is to encourage contractors to pursue research on innovative concepts and to seek commercialization of the end product.

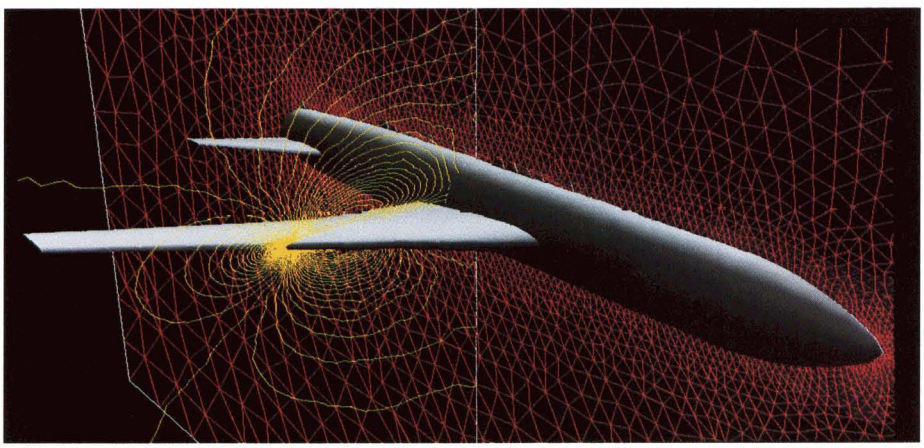
An example of a company that has successfully attained that end is ViGYAN Inc., Hampton, Virginia. ViGYAN is a small minority business firm providing aerospace, environmental and data processing services. Founded in 1979, the company received its first contract from NASA's Langley Research Center. Langley subsequently sponsored SBIR awards to ViGYAN for research and development of advanced software for computer simulation of flight vehicle configurations.

ViGYAN has converted the results of its NASA research into commercial software products known as VGRID3D and VPLOT3D. Both are employed in the aerospace design technique called computational fluid dynamics (CFD) and they have also found application in automobile design, structural analysis and other non-aerospace applications.



In aeronautical research, design engineers create mathematical models of flight vehicles and "fly" them by computer simulation. One of the disciplines extensively used is CFD, wherein the flow over a complex three-dimensional configuration is simulated using mathematical equations. The body of the configuration and the space surrounding it is represented by clusters of points, lines and surfaces; equations are numerically solved at these points. The set of lines and surfaces is called a





computational grid; the accuracy of the final result depends in great measure on the quality of the grid.

Since the early days of CFD, scientists have used "structured" grids — a structured set of lines in three coordinate directions. In recent years, availability of supercomputers has made it possible to calculate flow fields around very complex shapes in a matter of hours. However, grid generation, using the structured grid method, still takes a large part of the typical computational cycle.

An alternative grid generation technique — "unstructured" grids — has received a lot of research attention in recent years. In addition to an inherent ability to handle complex configurations with ease, unstructured grids are apt to efficiently incorporate adaptive refinement and moving boundaries and offer better control over the grid size and point clustering. It is in these areas that ViGYAN has been working for NASA and the company has created — with VGRID3D and VPLOT3D — what company officials term "an easier alternative to the use of conventional structured grids for fluid dynamic calculations."

VGRID3D is a robust, interactive program for generation of unstructured grids around complex 3D configurations. Examples of the types of grids it produces are shown **at far left** (a SAAB auto) and **left center** (a Space Shuttle study). VPLOT3D is an interactive, menu driven post-processing graphics program for manipulation and display of fluid dynamic data on unstructured grids. VPLOT3D examples are pictured in **the top photo** (which shows Mach number contours on an F-18 military aircraft) and **above** (a composite picture of a generic aircraft design).

*Availability of supercomputers has made it possible to calculate flow fields around very complex shapes in a matter of hours*