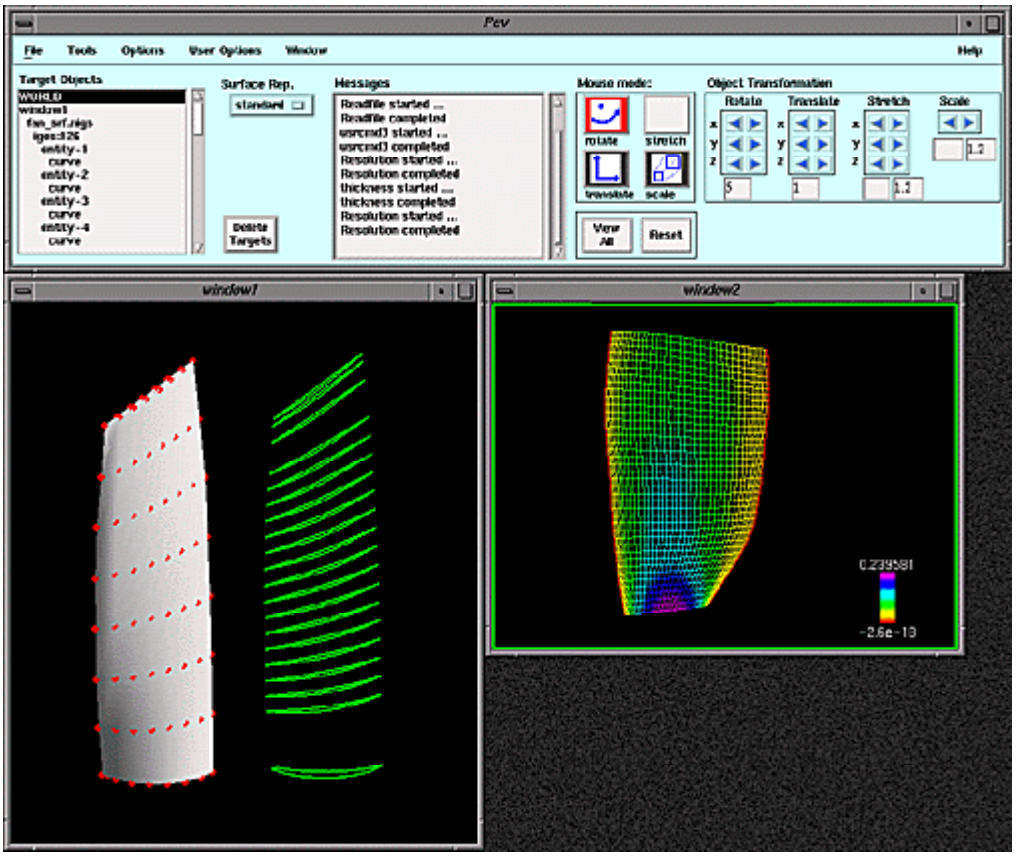
Portable Extensible Viewer



Typical Portable Extensible Viewer (PEV) screen.

The use of NURBS (Nonuniform Rational B-Splines) to represent geometry and data offers a standard way to facilitate the multidisciplinary analysis and design of aeropropulsion products. Using standard geometry defined by NURBS throughout design, analysis, part definition, manufacture, and test processes saves money and time. The Portable Extensible Viewer (PEV) offers engineers of different disciplines a means to view and manipulate NURBS geometry and associated data. Under the guidance of a team of Lewis, Boeing Company, and Navy personnel, PEV was developed by NASA Lewis Research Center's Computer Services Division for Lewis' Interdisciplinary Technology Office. The aeropropulsion industry provided input to the design requirements.

PEV software is designed to read, write, evaluate, display, manipulate, and analyze NURBS data. NURBS data can be stored in several predefined file formats (including the Initial Graphics Exchange Standard (IGES)) or in a file format that can be read in by a user-defined function. The data can be multidimensional, including not only geometry information, but also such data as temperature defined over multiple time steps and at various conditions.

A graphical user interface provides an easy, intuitive, and extensible interactive interface for users to perform geometric transformations (such as scaling, translating, stretching,

and rotating objects), modify display attributes (such as the color, shading, visibility, and style), evaluate surfaces, annotate with text, create multiple view windows, save interactions in a journal file, invoke command scripts, and perform many other functions. PEV is extensible, allowing users to develop custom application codes with functions from the PEV library of routines.

The PEV architecture was designed so that the graphical user interface remains active and responsive to users at all times, even when the application is busy processing requests or performing calculations. To achieve this goal, PEV runs as three distinct processes and communication is conducted through bidirectional interprocess communication channels. These channels allow commands of higher priority to interrupt the processing of lower priority commands.

PEV is written mostly in the ANSI C language, with a few Fortran routines. It has been compiled and run under the following operating systems: HP 9000/755, HPUX 9.05, SGI IRIX 5.3, SUN Sparc Solaris 2.4, and IBM RS6000 AIX 3.2. PEV requires the X-Window System, Motif, the DT_NURBS library, and the HOOPS library. The DT_NURBS library provides the mathematical tool kit to manipulate the NURBS-based representation of the data and geometry. HOOPS is the graphics library that provides three-dimensional capabilities for PEV to display and graphically manipulate NURBS.

In the example shown here (see the figure), a NASA IGES file was read in and the curves and surface were displayed. The surface was moved so that rather than being superimposed on the curves, it was placed next to them. The resolution of the surface was changed, and the appearance of the objects was modified. A second window was then created, and a four-dimensional NURBS object was read in. A script was executed that defined the variables used for the geometry as well as a variable assigned to the thickness of the geometry. Color coding of the thickness of the geometry was used to enhance understanding.

Lewis contact: Gregory J. Follen, (216) 433-5193, gfollen@grc.nasa.gov
Author: Dr. Jay G. Horowitz
Headquarters program office: OA (HPCCO)