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A THREE-DIMENSIONAL APPLICATION WITH THE NUMERICAL GRID GENERATION CODE - EAGLE (UTILIZING AN EXTERNALLY GENERATED SURFACE)

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ABSTRACT

Program EAGLE (Eglin Arbitrary Geometry ImpLicit Euler) is a multiblock grid generation and steady-state flow solver system. This system combines (A), a boundary conforming surface generation scheme, (B) a composite block structure grid generation scheme, and (C) a multiblock, implicit Euler flow solver algorithm. The three codes are intended to be used sequentially from the definition of the configuration under study to the flow solution about the configuration. EAGLE has been specifically designed to aid in the analysis of both freestream and interference flow field configurations.

These configurations can be comprised of single or multiple bodies ranging from simple axisymmetric airframes to complex aircraft shapes with external weapons. Each body can be arbitrarily shaped with or without multiple lifting surfaces.

Program EAGLE is written to compile and execute efficiently on any CRAY machine with or without Solid State Disk (SSD) devices. Also, the code uses namelist inputs which are supported by all CRAY machines using the FORTRAN Compiler CFT77. The use of namelist inputs makes it easier for the user to understand the inputs and to operate Program EAGLE. Recently, the Code has been modified to operate on other computers, especially the SUN Spare4 Workstation.

Program EAGLE was jointly developed by the Air Force Armament Laboratory's (AFATL) Aerodynamic Branch (FXA) at Eglin Air Force Base, FL, and Mississippi State University (MSU), Department of Aerospace Engineering.

Several two-dimensional grid configurations have been completely and successfully developed at NASA LaRC in ACD/CAB, using EAGLE. Currently, the grid generation group in CAB is beginning to utilize EAGLE for three-dimension grid applications. The activities of this project involved developing with EAGLE a three-dimensional grid configuration (the volume grid) around a surface (the PLS Vehicle) that had not been developed by EAGLE.

DISCUSSION

The summer activities involved required preliminary pre-research preparation activities and the research itself. The following major tasks consisted of the pre-research preparation while working through two-dimensional applications of EAGLE:

A. Becoming more proficient with UNIX and the editors on LaRC's Super-computing Network Subsystem (SNS) consisting of a four-processor CRAY-2S computer (named Voyager, two virtual memory CONVEX 210 computers (named Eagle and Mustang), and MASSTOR, a high-capacity storage device;

B. Becoming proficient with the use of the IRIS Workstation and the graphic package PLOT3D (used to display the surface and grid configurations);

C. Learning to operate other local computer systems for making hard copy black and white grid plots from postscript files, and,

D. Understanding in details, the three volumes of documentation describing the Numerical Grid Generation Code--EAGLE.

THREE-DIMENSIONAL APPLICATION WITH EAGLE

The primary three-dimensional application initially involved accepting a surface grid, the PLS Vehicle (one- half), formatted and in PLOT3D form. First, a FORTRAN program had to be written to convert the surface to be unformatted and in EAGLE form. Additionally, the program interchanged the roles of the I's and the K's, changing a 81 x 1 x 125 surface to a 125 x 1 x 81 surface. Another step involved getting EAGLE to read the surface, store it, and print it out in a PLOT3D form, so that it could be inspected for proper orientation. The major tasks were those of developing the boundary Generation Run Stream (PLSV3d.b), executed by Surf and the Volume Grid Generation Run Stream (PLVS3d.g), executed by Grid. The former involved strategically and appropriately identifying six points, generating three-line segments, two conic sections, and properly rotating them to meet in order to form the outer boundary. The latter run stream generated the volume grid. The final product was a volume grid generated about the PLS Vehicle surface.

A second three-dimensional demonstration application was made operational using Program EAGLE.