NASA Aeronautics Parallel Software

http://www.aero.hq.nasa.gov/hpcc/cdrom/content/reports/annrpt96/cas96/cas96.htm

NASA Codes

- **OVERFLOW**
  - Reynolds Averaged Navier-Stokes Equations
  - Overset grid topology
  - Beam-Warming Implicit Algorithm
  - Coarse grained parallelism using PVM
  - 7 SP2 processors ~ 1 C90
  - 30 workstations ~ 1 C90

NASA Codes

- **ENSAERO**
  - RANS (Overflow) + Aeroelasticity
  - Rayleigh-Ritz for elasticity
  - decomposed by discipline; 1 node for elasticity other nodes used for fluids

NASA Codes

- **CFL3D**
  - RANS (60,000 lines)
  - Implicit in time, upwind diffence, multigrid
  - multiblock & overset grids, embedded grids
  - serial & parallel executables from same code
  - 10.5 SP2 processors ~ 1 C90

NASA Codes

- **CFL3D**

No. of SP2 processors	time/(time Cray YMP)
2	1.92
4	1.00
8	.56
16	.27

NASA Codes

- **FUN3D**
  - Incompressible Euler
  - 2nd-order Roe Scheme, unstructured grid
  - Parallelized using PETSc (Keyes, Kaushik, Smith)
  - Newton-Krylov-Schwarz with block ILU(0) on subdomains

NASA Codes

- **FUN3D** tetrahedral grid with 22677 gridpoints (90708 unknowns)

SP2 Procs	iterations	exec time	speedup	efficiency
1	25	1745.4s	-	-
2	29	914.3s	1.91	.95
4	31	469.1s	3.72	.93
8	34	238.7s	7.31	.91
16	37	127.7s	13.66	.85
24	40	92.6s	18.85	.79
32	43	77.0s	22.66	.71
40	42	65.1s	26.81	.67

Speedup=(exec time on 1 proc)/(exec time on n procs)
Efficiency=speedup/(# of procs)