## AePW Gridding guidelines

For consistency, all grids used for AePW calculations should conform to the following set of gridding guidelines listed in this section. These gridding guidelines for the Aeroelastic Prediction Workshop are adopted from the guidelines developed for the Drag Prediction Workshop and the High Lift Prediction Workshop. These guidelines have remained relatively unchanged over the course of these previous workshops and codify much of the collective experience of the applied CFD community in aerodynamic grid generation practices. For the current workshop, a sequence of coarse, medium and fine grids are required for each configuration and the guidelines can be summarized as follows:

1. RSW initial spacing normal to all viscous walls (Rec = 4M based on cref = 24”)
   1. Coarse: y+ ~ 1.0, y = 0.000158”
   2. Medium: y+ ~ 2/3, y = 0.000105”
   3. Fine: y+ ~ 4/9, y = 0.000070”
2. BSCW initial spacing normal to all walls (Rec = 4.49M based on cref = 16”)
   1. Coarse: y+ ~ 1.0, y = 0.000094”
   2. Medium: y+ ~ 2/3, y = 0.000063”
   3. Fine: y+ ~ 4/9, y = 0.000042”
3. HIRENASD wing initial spacing normal to all walls (Rec = 23.5M based on cref = 0.3445 m) Note: Same grids to be used for Rec = 7M and Rec = 23.5M cases.
   1. Coarse: y+ ~ 1.0, y = 4.40961e-7 m
   2. Medium: y+ ~ 2/3, y = 2.93973e-7 m
   3. Fine: y+ ~ 4/9, y = 1.95982e-7 m
4. Normal growth rate for cells in boundary layer region < 1.25.
5. Structured grids will have at least 2 cell layers of constant spacing normal to viscous walls.
6. Farfield will be located at ~100 cref for all grids.
7. Local spacings on medium grid:
   1. Chordwise spacing for wing leading and trailing edges ~0.1% local chord
   2. Wing spanwise spacing at root and at tip ~0.1% local semispan
   3. Cell size near fuselage nose and aftbody ~2% cref
8. Wing trailing edge: minimum 4, 6 and 9 cells for coarse, medium and fine grids, respectively.
9. Grid family:
   1. Medium mesh representative of current engineering practice
   2. Maintain a parametric family of uniformly refined grids in sequence
   3. Grid size to grow ~3X for each level of refinement [structured 1.5X in I,J,K directions]
   4. Give consideration to multigridable dimensions on structured meshes
   5. Sample sizes: coarse: 3M, medium: 10M, fine 30M

Special effort is required to ensure that sequences of coarse, medium and fine meshes constitute a consistent “family” of grids suitable for a grid convergence study. This entails the preservation of mesh topology, stretching factors, and local variations in resolution as much as possible between grids of the same sequence. The mesh spacing specifications given for the medium grid are to be scaled appropriately for the coarse and fine grids. The given grid sizes are only estimates based on the objective that the medium grid should be representative of current engineering practice enabling a solution on mid-range computational hardware in reasonable turnaround time (i.e. considerably less than 24 hours). For unstructured grids designed for vertex-based solvers, the spacing refers to inter-nodal spacing and the resulting grid sizes are expected to be similar to the structured grid sizes. For unstructured grids for cell-centered solvers, the spacing refers to spacing between cell centers (or surface face centers), which corresponds approximately to a factor of 2 reduction in the overall number of surface points compared to the nodal solver case for a triangular surface grid. For a tetrahedral cell-centered solver mesh, the total number of grid points will be approximately 1/3 of those in node based solver mesh.

These gridding guidelines are current as of May 19, 2011.

They match those published in the IFASD paper, “Plans for an Aeroelastic Prediction Workshop”