3rd AIAA CFD High Lift Prediction Workshop
Gridding Guidelines

Please check the website (http://hiliftpw.larc.nasa.gov) periodically for updates, and/or register with hiliftpw@gmail.com to be notified directly.

Specific Configuration Guidelines:

	Grid resolution level	y+ at walls	Initial wall spacing, Δy (normal dist)	Number of cells (points) on trailing edges
Case 1: HL-CRM Re = 3.26M C_{REF} = 275.8 in	Coarse	1.0	0.00175 Inches	4 (5)
	Medium	2/3	0.00117 inches	8 (9)
	Fine	4/9	0.00078 inches	12 (13)
	Extra-Fine **OPTIONAL**	8/27	0.00052 inches	16 (17)
Case 2: JAXA JSM Re = 1.9 M C_{REF} = 529 mm	Coarse **OPTIONAL**	1.0	0.00545 mm	4 (5)
	Medium	2/3	0.00363 mm	8 (9)
	Fine **OPTIONAL**	4/9	0.00242 mm	12 (13)
	Extra-Fine **OPTIONAL**	8/27	0.00161 mm	16 (17)

Note: Data provided above are in the units of the original geometry.

General Guidelines:

1. Farfield should be located at least 100 C_{REF} for all grid levels.
2. Recommend grids have at least 2 layers of constant cell spacing normal to the viscous walls, if possible.
3. **Grid size growth**:
    a. Total grid size should grow ~3X between each grid level for grid convergence cases.
    b. For structured meshes:
        i. When creating grid levels for the grid convergence case, the increase in grid size should be approximately ~1.5X in each coordinate direction.
        ii. Ensure the mesh is multi-grid friendly. Each coordinate direction in every zone should have a multi-griddable number of grid cells. The number of grid cells should be divisible by 2 at least 4 times. Example: 192 cells – 193 points is multi-griddable 6 times.
    c. For unstructured meshes:
        i. If built for vertex based solvers, the spacings refer to inter-nodal spacings and the resulting grid sizes are expected to be similar to comparable structured grid sizes.
        ii. If built for cell-centered solvers, the spacings refer to spacings between cell centers (or surface face centers). This 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 (based on triangle centroid separation distance of 2/3h).
4. The following are recommended **cell sizes and spacings** for the medium grid level for each case. When constructing the coarser and finer grids scale these values accordingly.
    a. Cell size near body nose and tail should be ~1.0% $C_{REF.}$

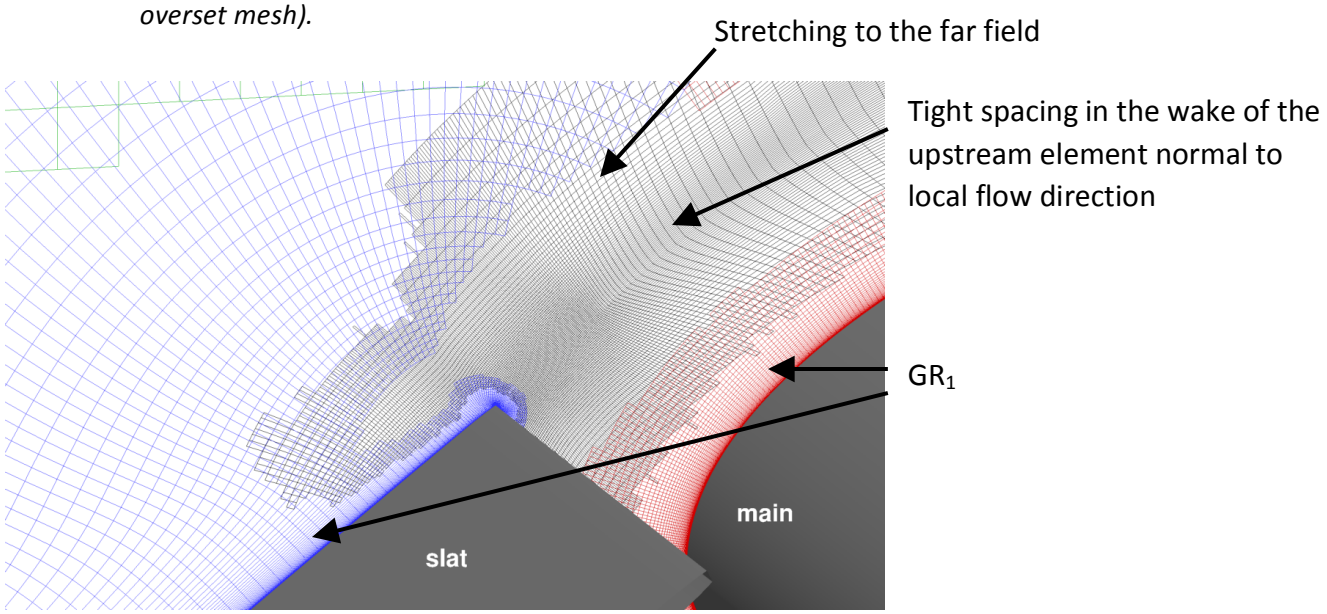
b. Chordwise spacing at leading edge (LE) and trailing edge (TE) should be ~0.1% local device chord. Use the local slat-element chord for slat grid, wing-element chord for wing grid and flap-element chord for flap grid.
c. Spanwise spacing at root and tip ~0.1% semispan.
d. Grid spacing normal to the symmetry plane should be considerably larger than the viscous wall spacing.

5. The following are recommended **cell stretching ratios**.
   a. In boundary layers normal to walls, use a Growth Rate (GR_1c) < 1.25 in the viscous layers for the coarse grid level for each case. For consistency, the Growth Rate should then be scaled (smaller) for each successively refined grid according to:

$$(GR_1)**(1/F**n)$$

   where F is the approximate factor increase in grid size in the normal direction for each successively finer grid (F~1.5 for all Test Cases, see item 3.b.i above), and n increases by one for each successively finer grid. For example: GR_1c~1.25 for the Coarse grid, GR_1m~1.16 for the Medium grid, GR_1f~1.10 for the Fine grid, and GR_1xf~1.07 for the Extra-Fine grid.
   b. Because wakes from upstream wing elements convect and diffuse downstream, interacting with the boundary layers of subsequent wing elements, the grids should be well-resolved across the wake regions (especially behind the slat element and behind the main element). Use finely spaced flow-aligned cells, where flow-aligned means that the cell's finest spacing is in the direction of the steepest velocity gradient (approximately normal to the local flow direction). Wake clustering should optimally extend well downstream, at least over the entire distance of the wing local chord, generally following the approximate wake trajectory.

Example of a recommended grid profile to capture the boundary layer and wake flow (shown here for a structured overset mesh).



6. Some localized areas of the configuration might require tighter spacings than those specified in this document.