AePW-4 High-Angle Working Group Meeting

April 10, 2025

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Agenda, April 10

- AIAA Aviation 2025: three sessions dedicated to DPW-8/AePW-4
- Summer/Fall 2025: New BSCW Experiment
- AePW-4 website: https://nescacademy.nasa.gov/workshops/AePW4/public
- AePW-4 HAWG objectives
- 2D BSCW flutter analysis status
- Jeff Thomas, Duke, update
- Next meeting, May 8
- AIAA Aviation 2026: DPW-8 and AePW-4 Workshop

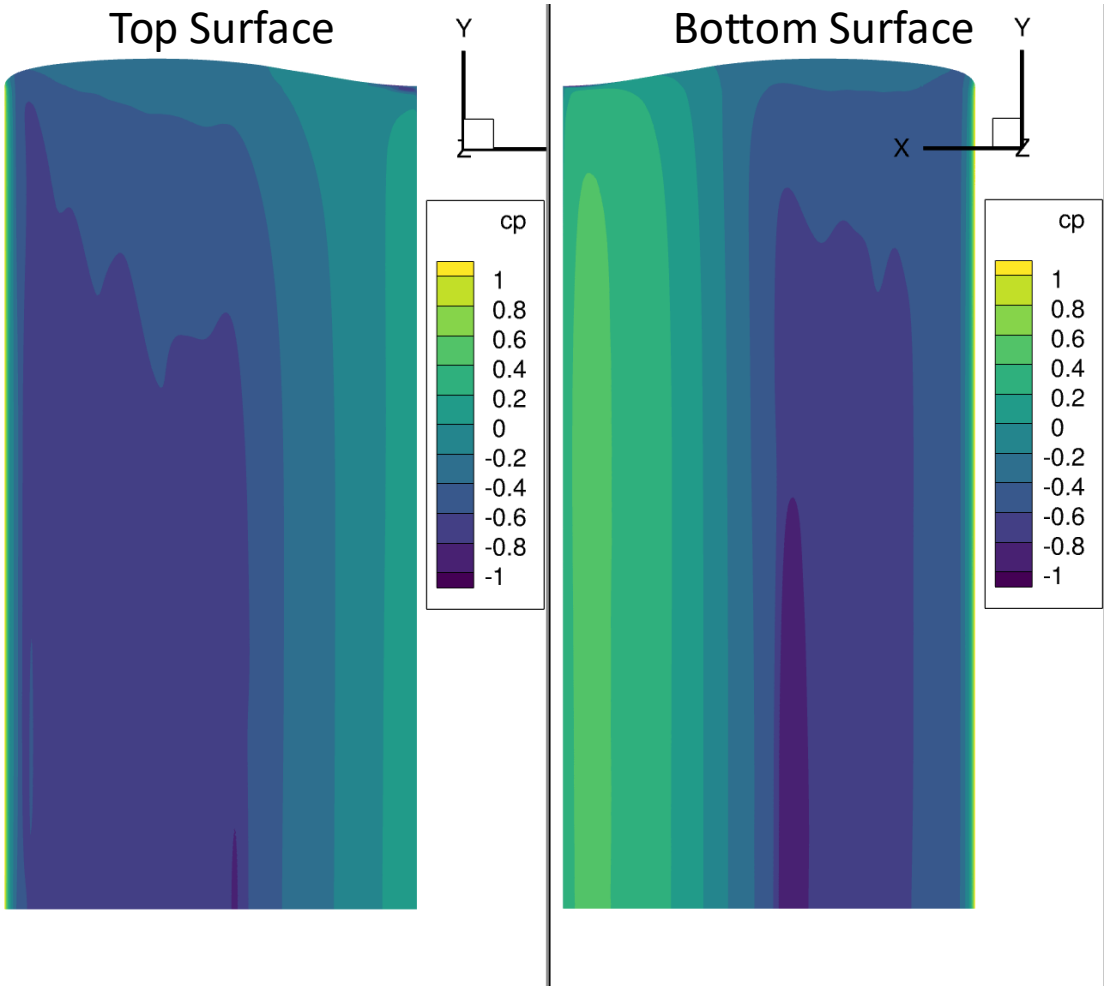
AePW-4 High-Angle WG Cases

- Mandatory
  - Flutter prediction at Mach 0.80 and angle-of-attack sweep: 0° – 6°
- Optional
  - Flutter prediction at Mach 0.78, 0.76, 0.74 and angle-of-attack 3°
- Mandatory (?)
  - 2D BSCW flutter prediction at Mach 0.80 and angle-of-attack sweep: 0° – 6°

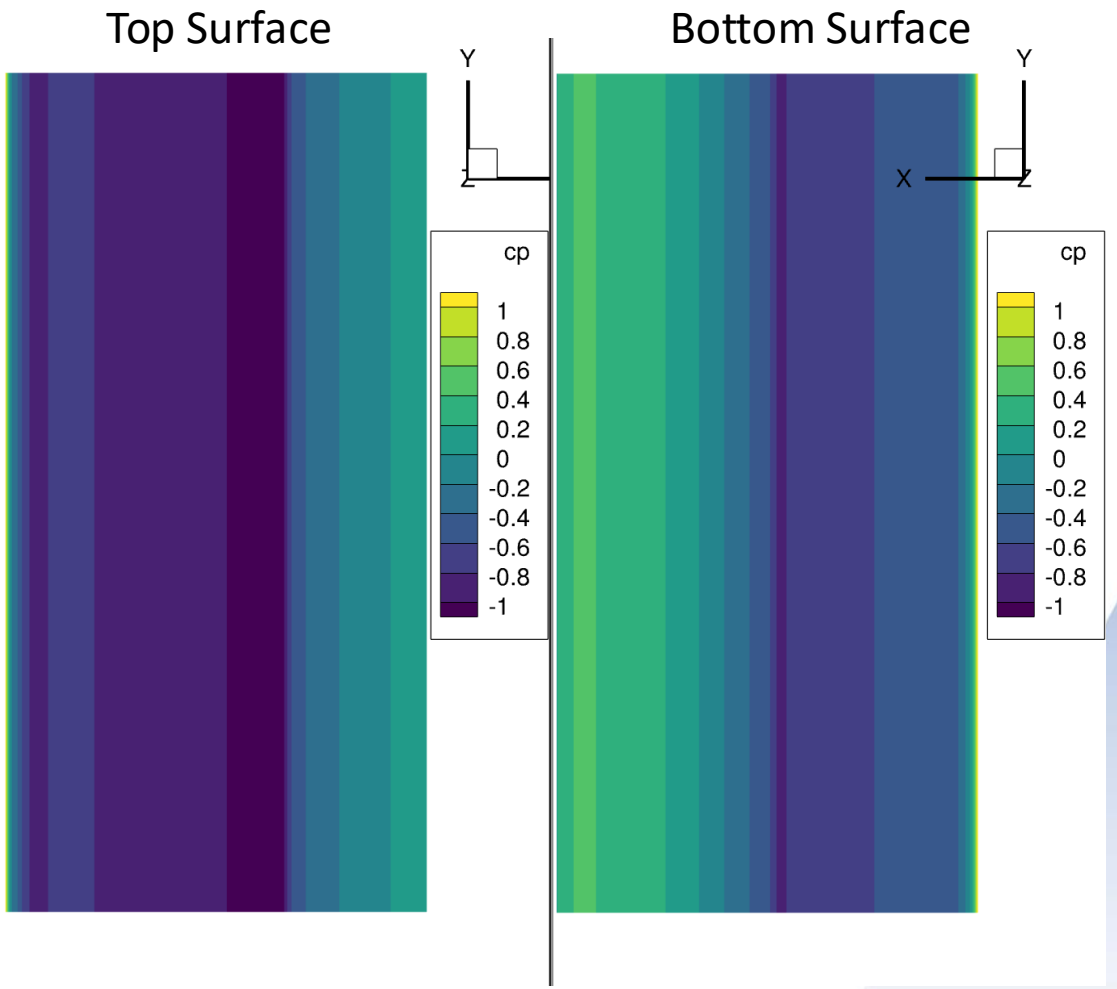
Currently we have five teams looking at 2D calculations

BSCW 2D vs 3D Aeroelastic Analysis, Mach 0.80 AoA = 0deg, q = 169 psf

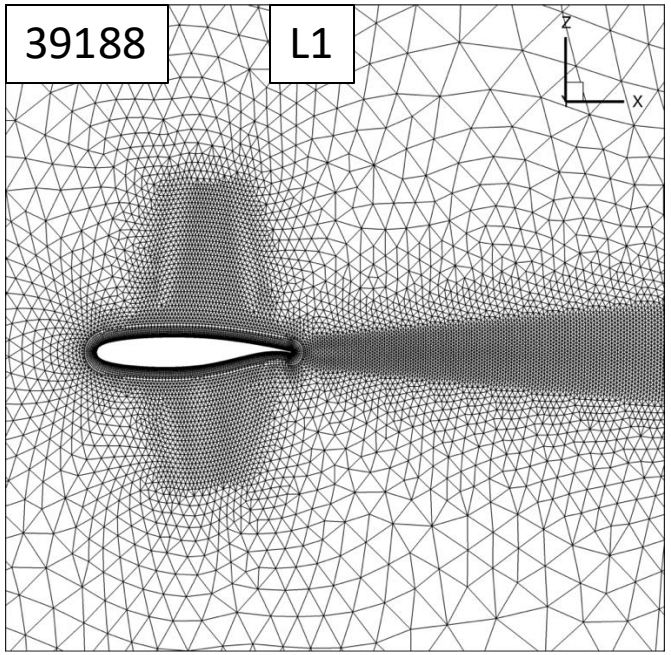
3D Wing

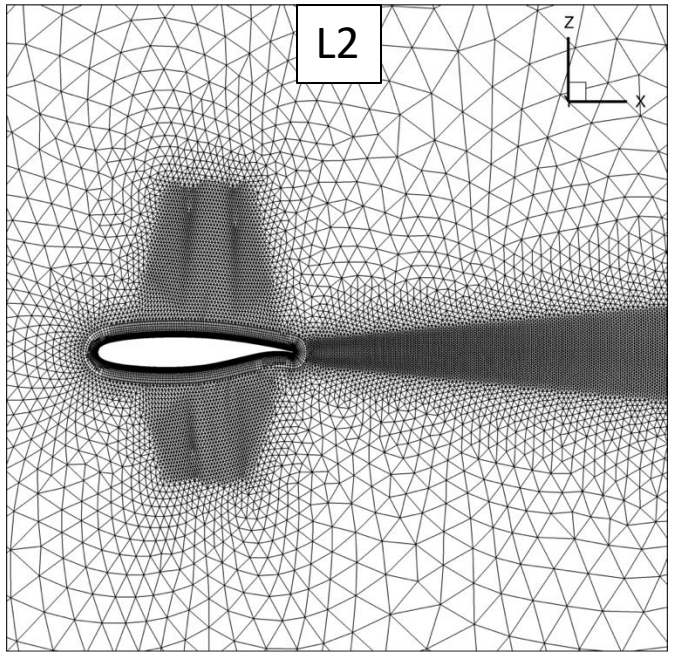


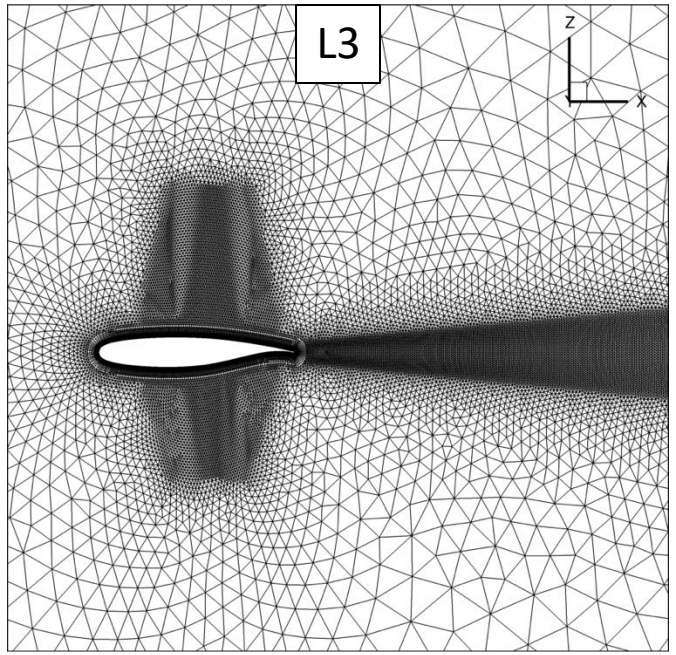
2D Wing

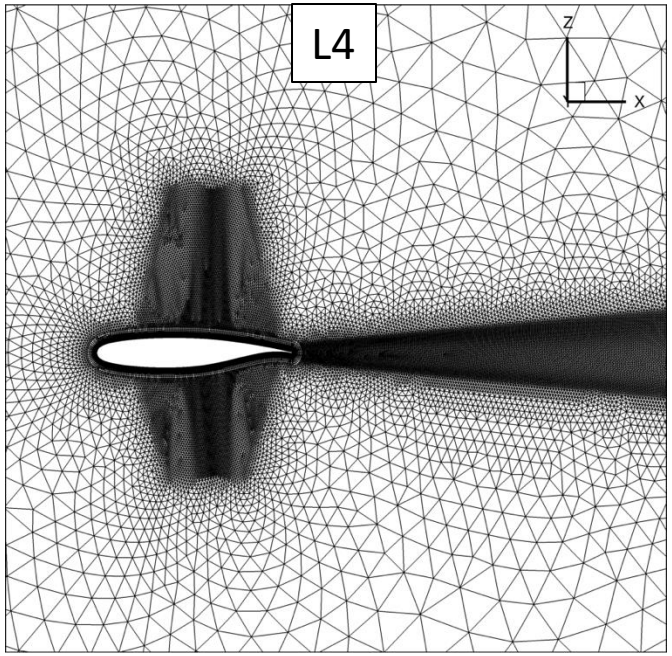


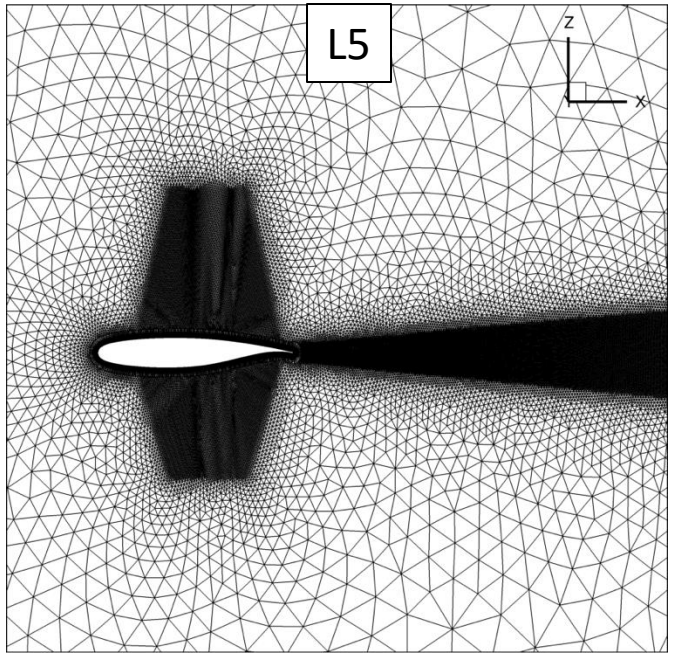
2D Mesh: 32-inch span wing with two symmetry planes

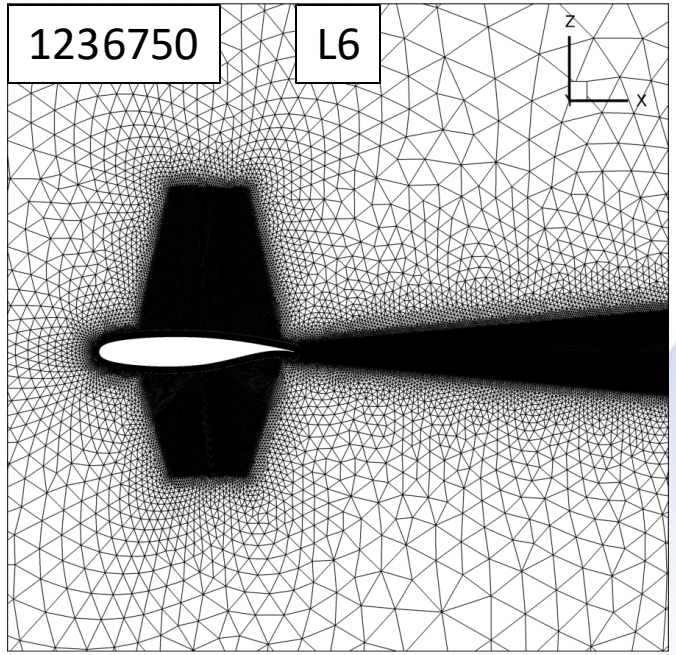












2D Mesh: 32-inch span wing with two symmetry planes

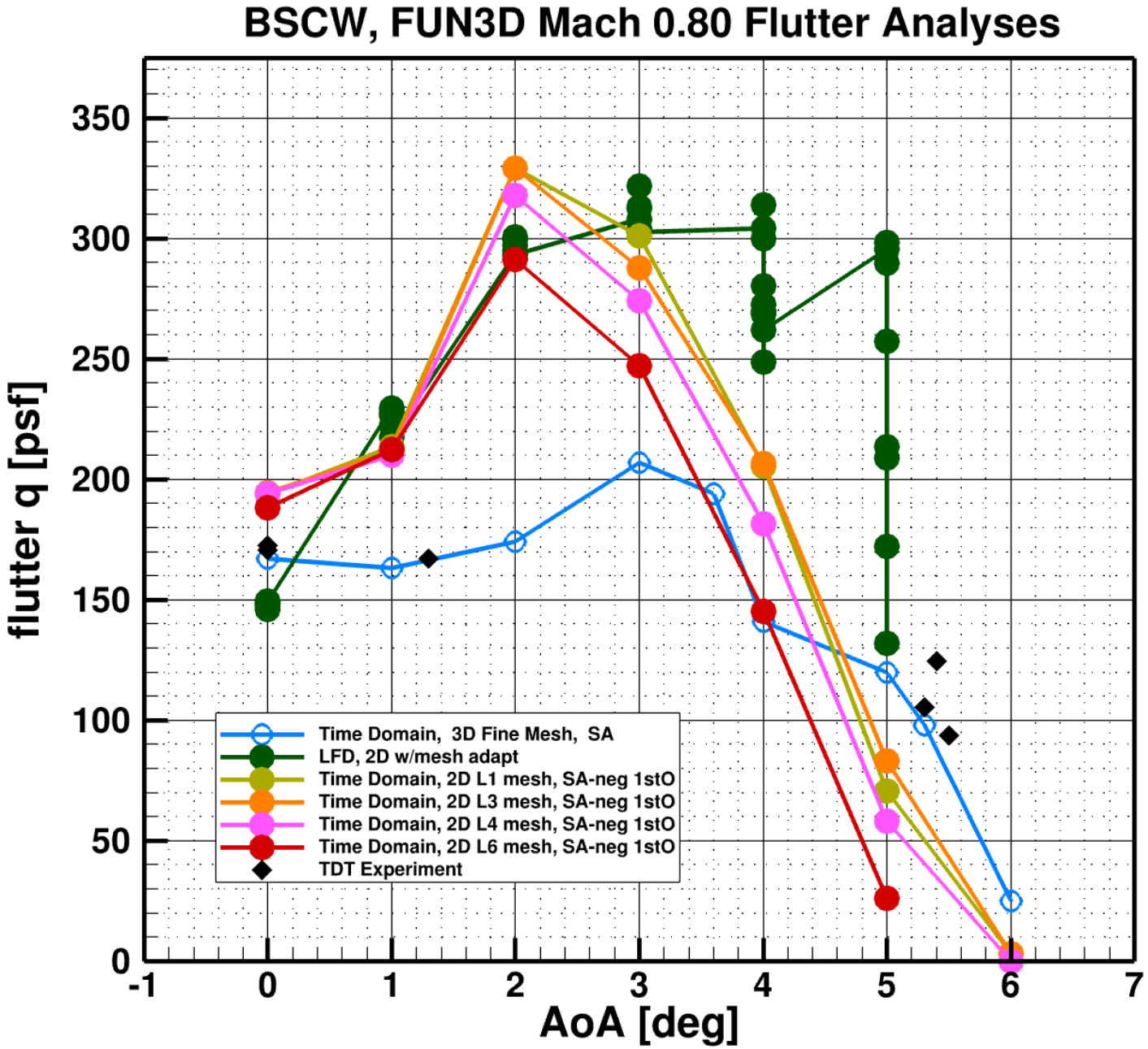
1. From the BSCW iges file (https://nescacademy.nasa.gov/workshops/AePW2/public/BSCW/analystsInfo), I have extracted airfoil profile at 60% wing-span station.

2. Using the airfoil profile above, I generated family of meshes using Heldenmesh. Heldenmesh allows for a one-cell depth mesh where y1= 0" and y2 = 32" are the symmetry planes.

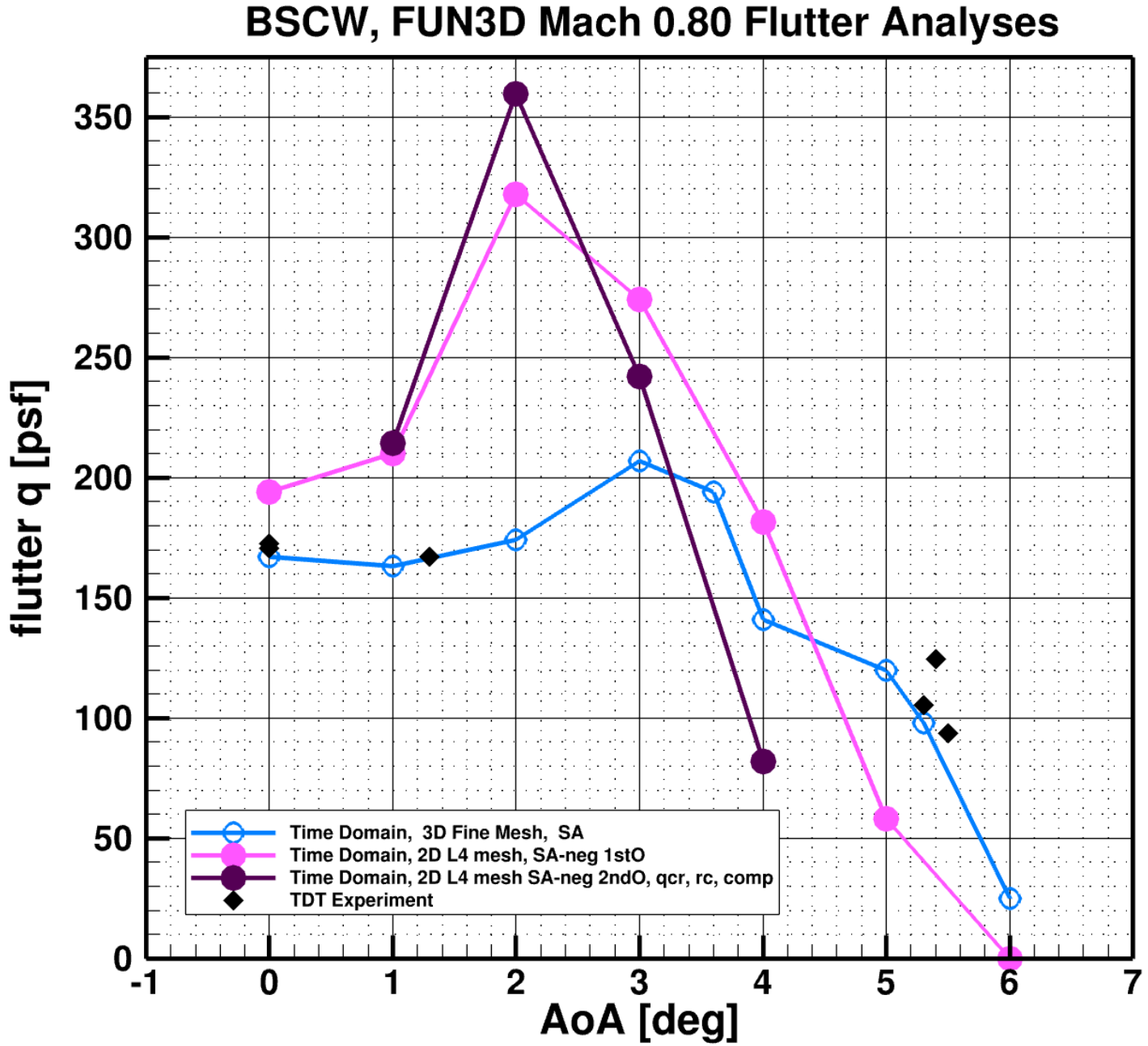
3. Family of six meshes was constructed based on the Drag Prediction Workshop meshing guidelines found on their website. However, I added two sources on the top and bottom surfaces to refine the mesh.

4. The link to these meshes in afrl stream .ugrid format is here https://nasa-ext.box.com/s/1py56597wunooq1tm58i74wfzj88ci4b There is a no requirement to use these meshes.

2D BSCW


BSCW, FUN3D Mach 0.80 Flutter Analyses
flutter q [psf]
AoA [deg]
0
50
100
150
200
250
300
350
-1
0
1
2
3
4
5
6
7
Time Domain, 3D Fine Mesh, SA
LFD, 2D w/mesh adapt
Time Domain, 2D L1 mesh, SA-neg 1stO
Time Domain, 2D L3 mesh, SA-neg 1stO
Time Domain, 2D L4 mesh, SA-neg 1stO
Time Domain, 2D L6 mesh, SA-neg 1stO
TDT Experiment

2D BSCW


BSCW, FUN3D Mach 0.80 Flutter Analyses
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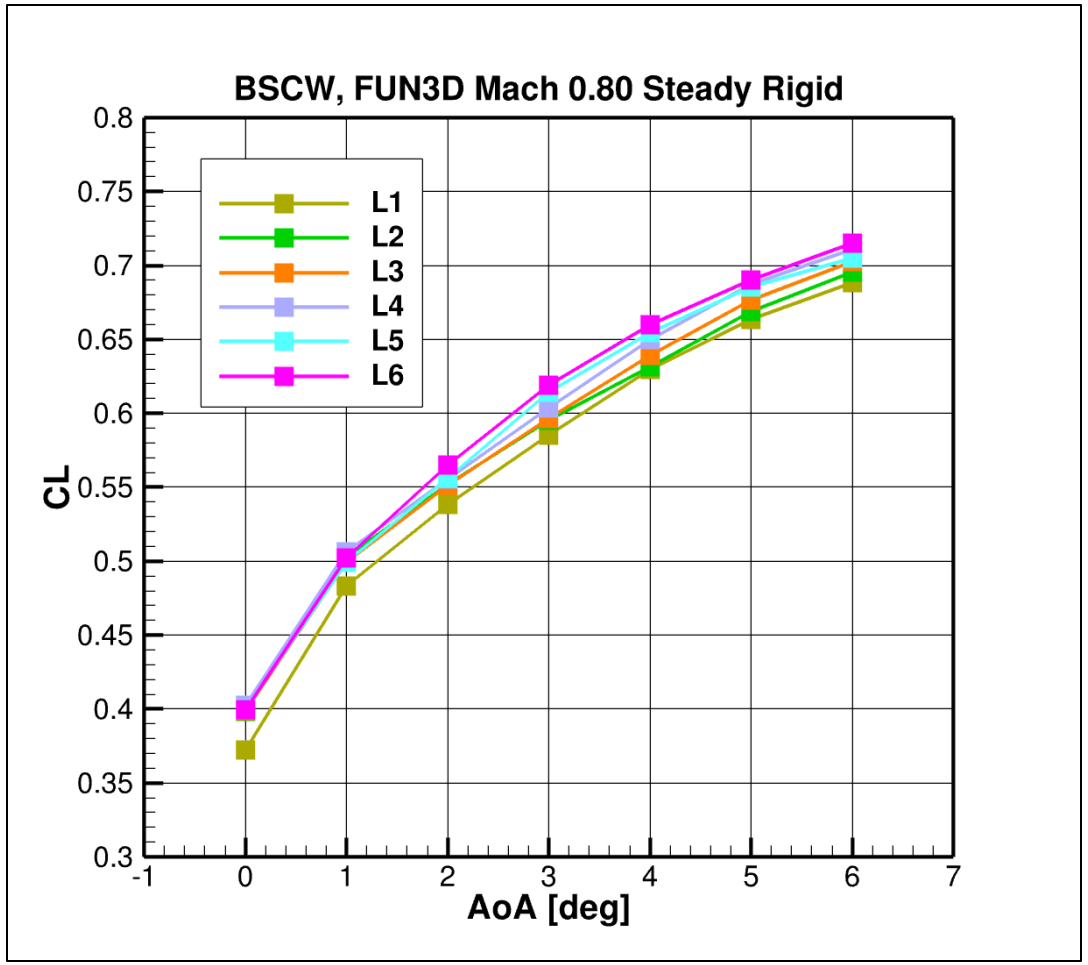
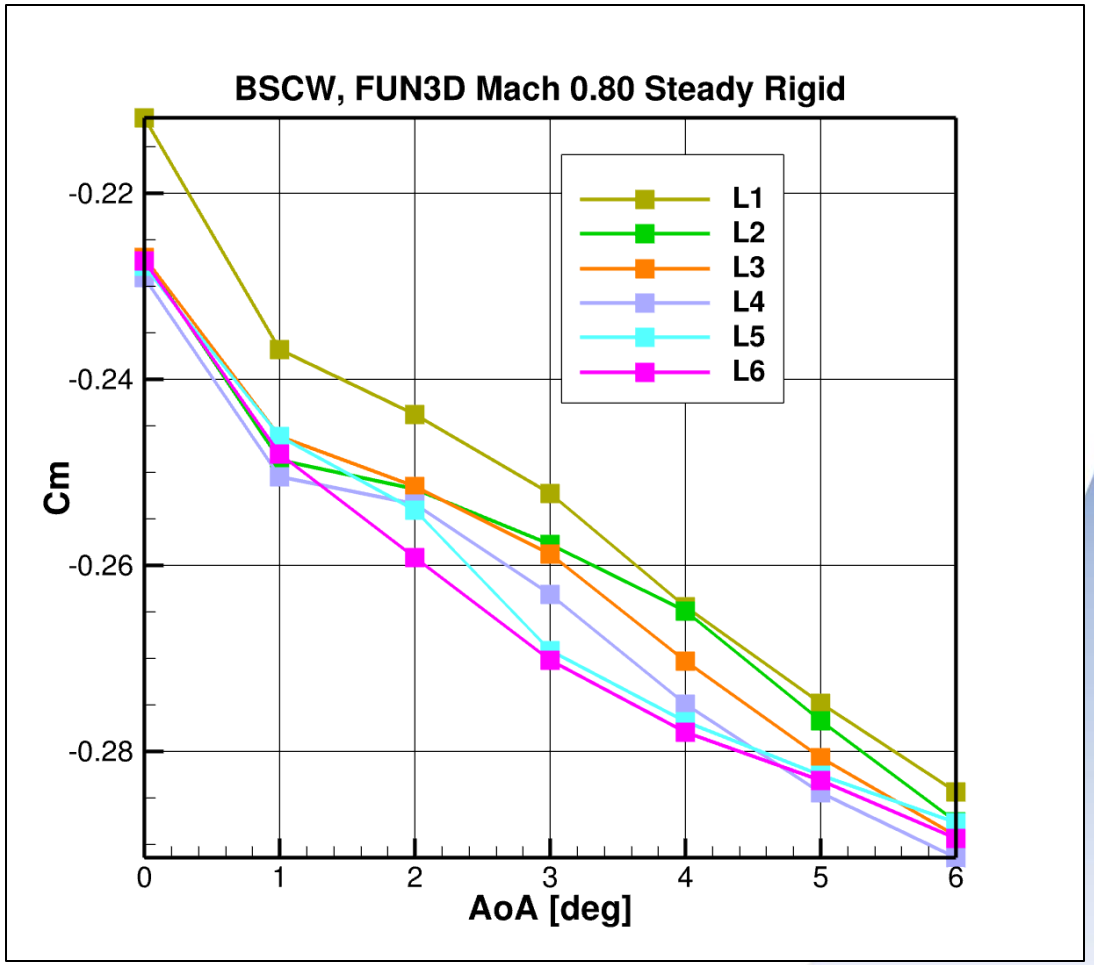
3
4
5
6
7
Time Domain, 3D Fine Mesh, SA
Time Domain, 2D L4 mesh, SA-neg 1stO
Time Domain, 2D L4 mesh SA-neg 2ndO, qcr, rc, comp
TDT Experiment

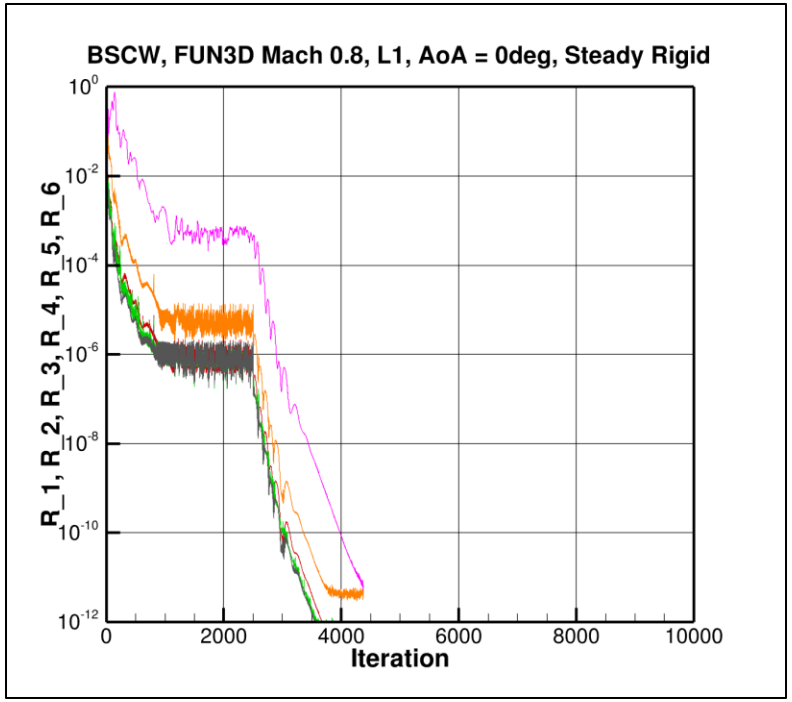
Aerodynamic Coefficients

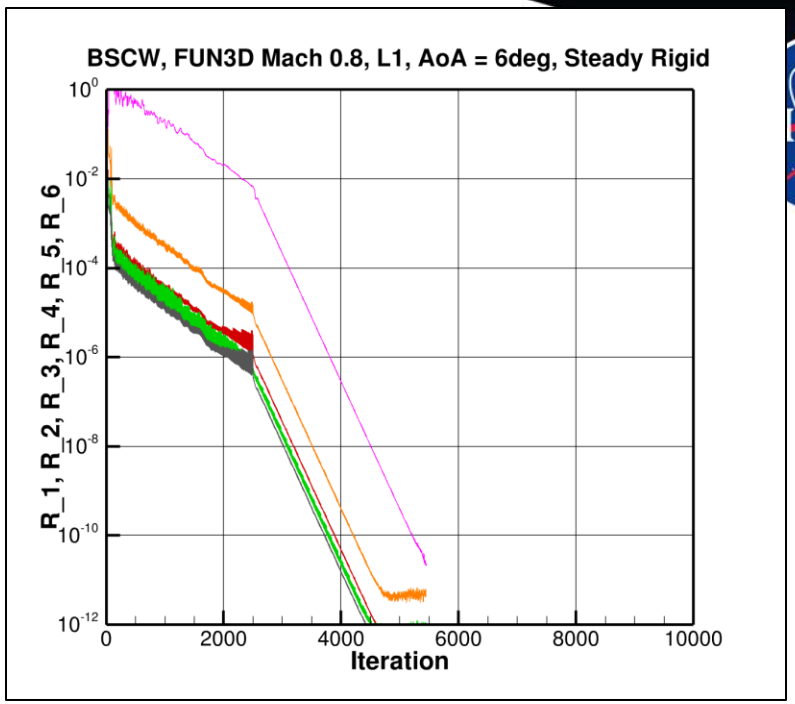




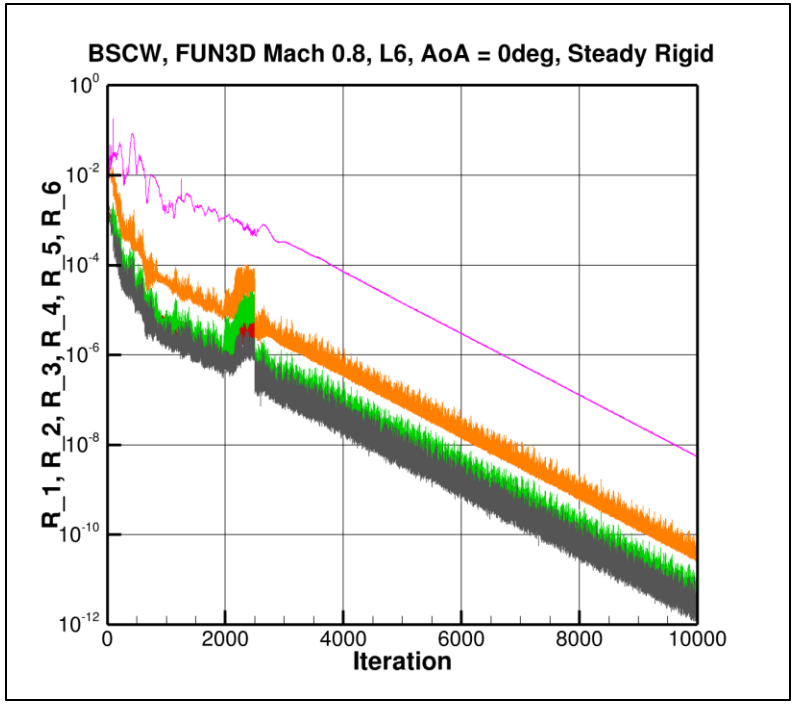
Convergence Plots
Steady rigid

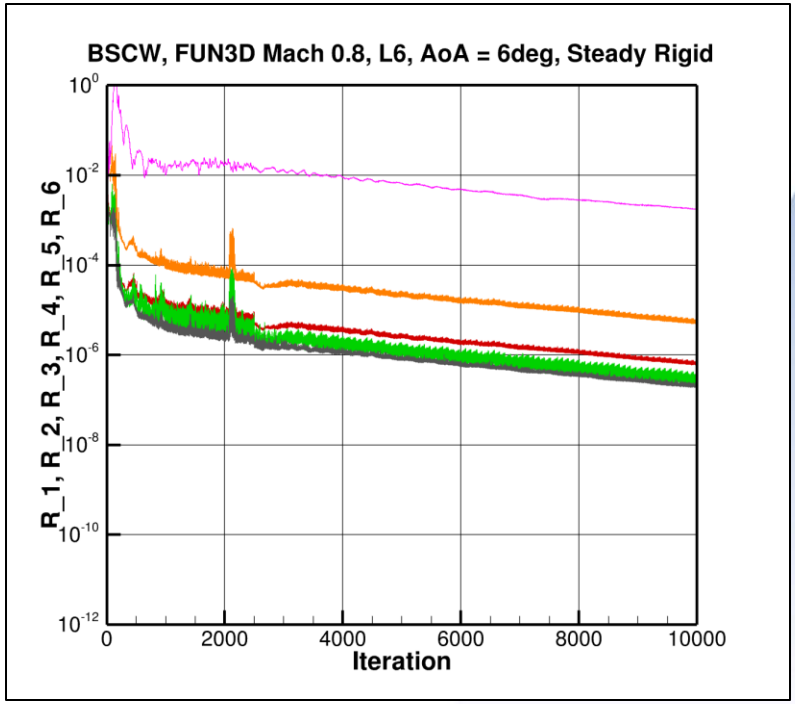
Mesh L1





Mesh L6





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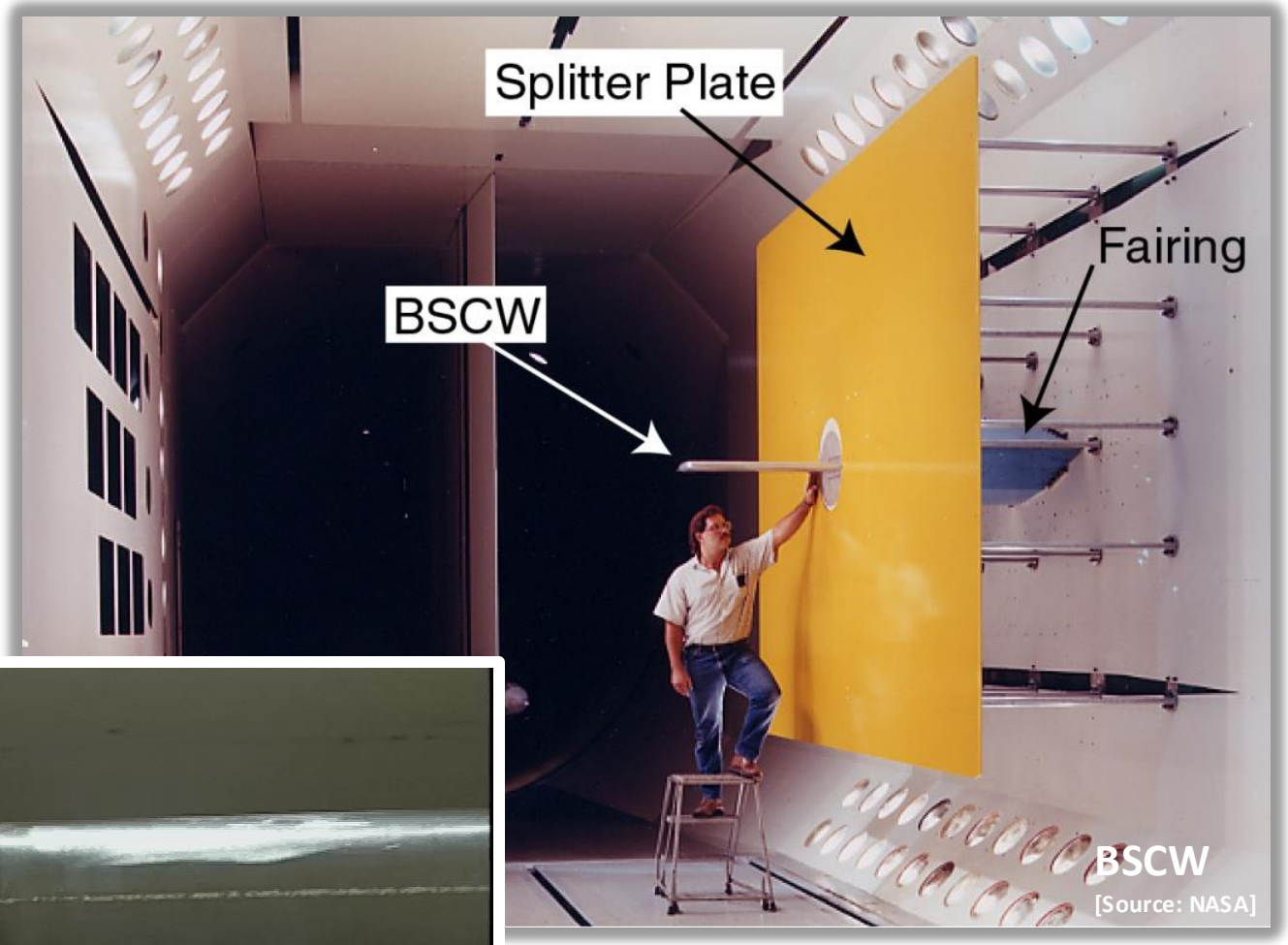
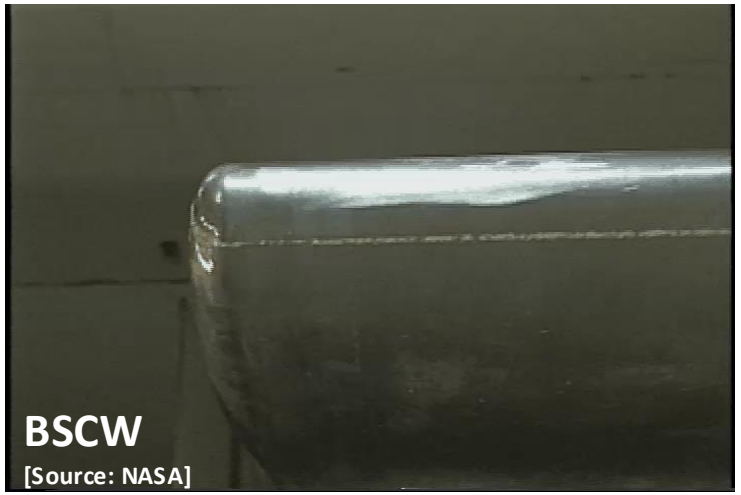
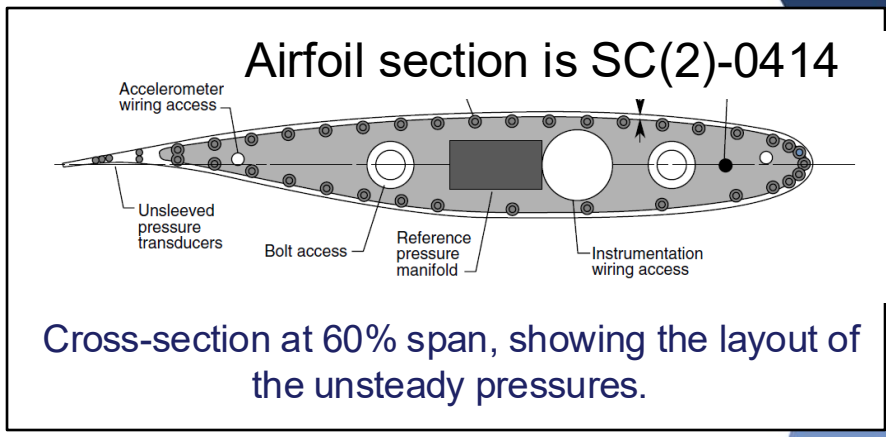
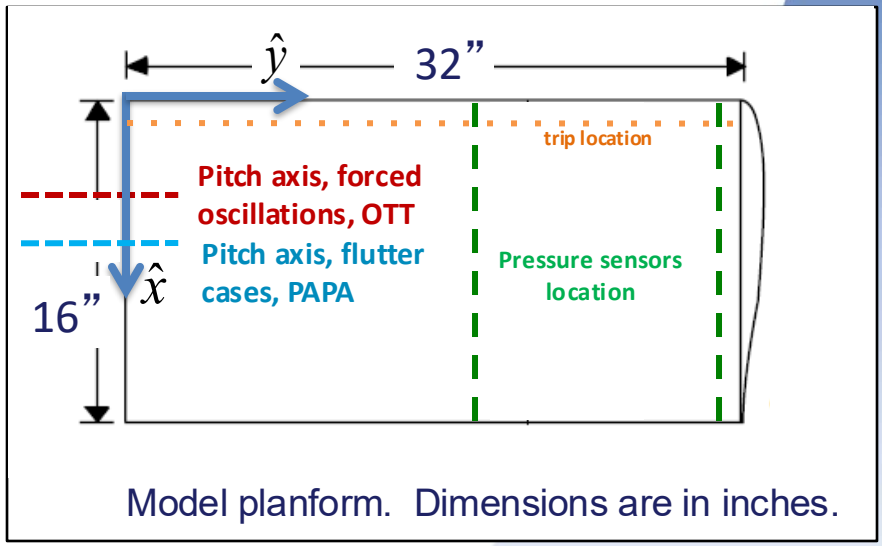
High-Angle WG: BSCW Wing Configuration







Cross-section at 60% span, showing the layout of the unsteady pressures.



Model planform. Dimensions are in inches.

Past Experimental Data

EXPERIMENTAL UNSTEADY PRESSURES AT FLUTTER ON THE SUPERCRITICAL WING BENCHMARK MODEL

AIAA-93-1592-CP

Bryan E. Dansberry, Michael H. Durham*, Robert M. Bennett**, José A. Rivera*, Walter A. Silva*, and Carol D. Wieseman*; Structural Dynamics Division, NASA Langley Research Center, Hampton, VA 23681-0001
and David L. Turnock*
Lockheed Engineering and Sciences Corporation

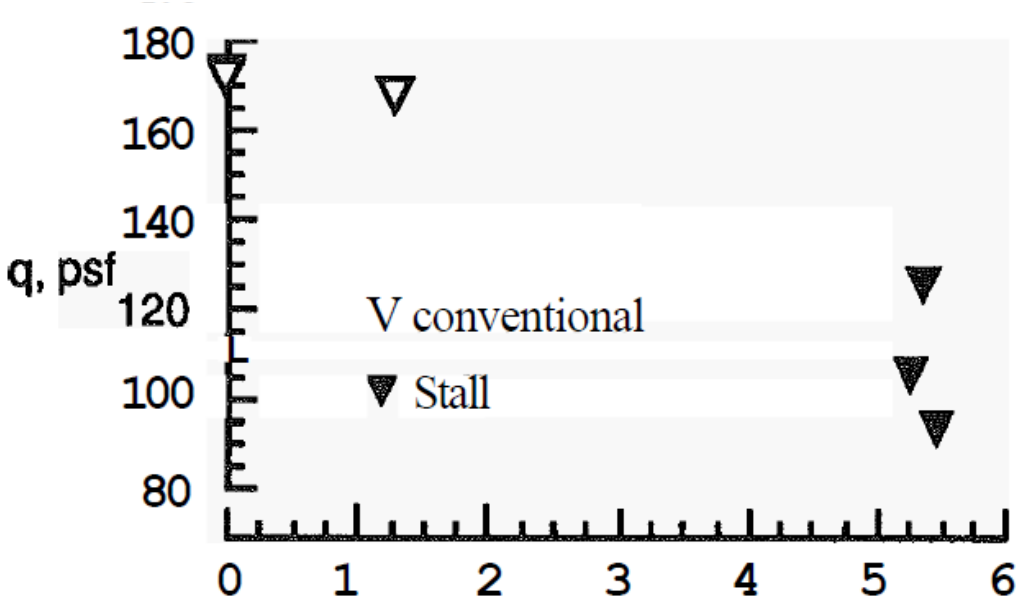


Figure 9. Stall flutter boundary in R-12 at M = 0.80.

BSCW Wing Configuration Past Workshop Conditions

- AePW-1:
  - Steady-rigid and forced-oscillation cases at Mach 0.85, AoA = 5° ✓
- AePW-2:
  - Forced-oscillation case at Mach 0.70, AoA = 3° ✓
  - Flutter prediction at Mach 0.74, AoA = 0° ✓
  - Unsteady-rigid, forced-oscillation, and flutter cases at Mach 0.85, 5° ✓ ✓ ✓
- AePW-3:
  - Flutter prediction at Mach 0.80, AoA = 5° ✓
  - Shock-buffet case at Mach 0.80, AoA = 5° ✓