AePW-4 High-Angle Working Group: An Overview of Recent Progress and Future Directions

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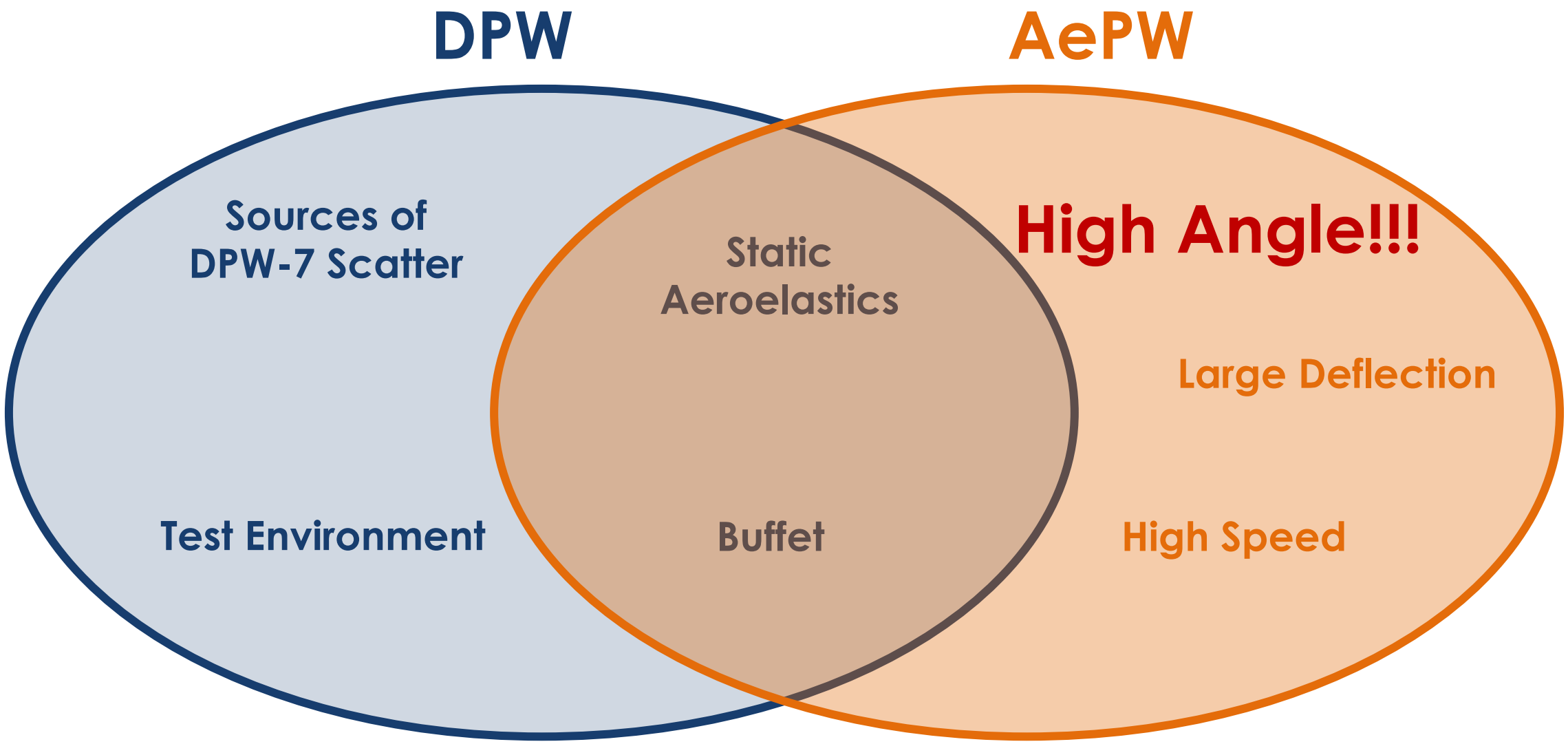
AIAA
SHAPING THE FUTURE OF AEROSPACE

Working Groups Layout



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Benchmark SuperCritical Wing (BSCW) Wing Configuration Past Workshop Conditions

- **AePW-1 (2012):**
  - Steady-rigid and forced-oscillation cases at Mach 0.85, AoA = 5° ✓
- **AePW-2 (2016):**
  - 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 (2023):**
  - Flutter prediction at Mach 0.80, AoA = 5° ✓
  - Shock-buffet case at Mach 0.80, AoA = 5° ✓

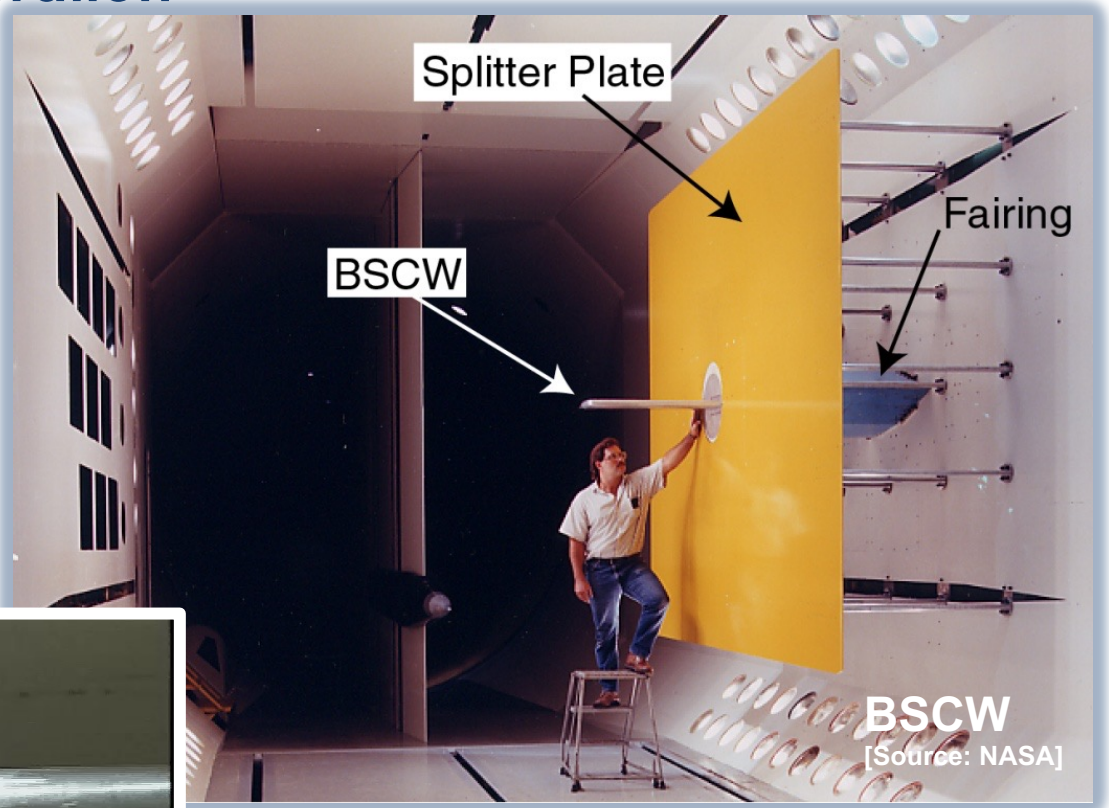
AePW-3 Summary Papers: AIAA Paper 2024-0417 and 2024-0418

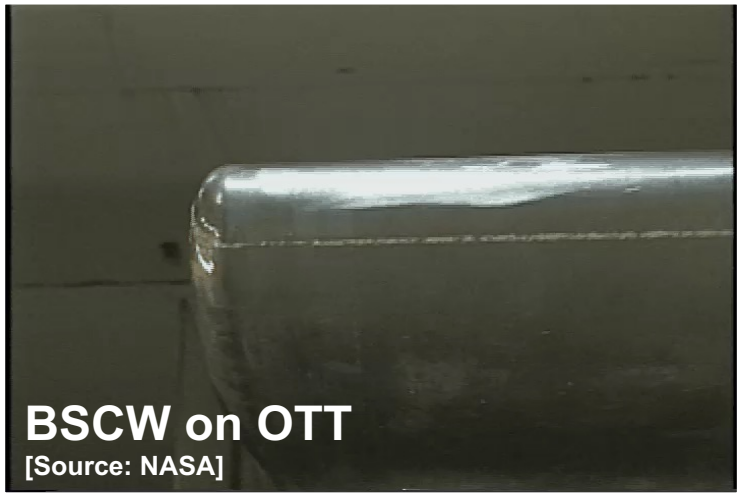
✓ - good

✓ - poor

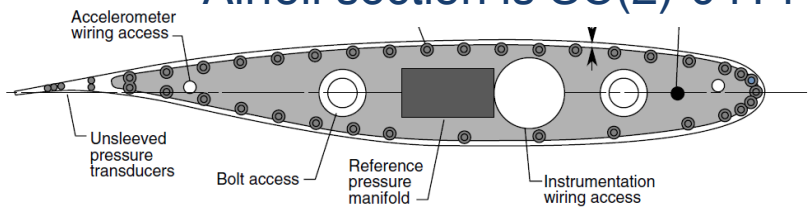
✓ - mixed

BSCW Wing Configuration

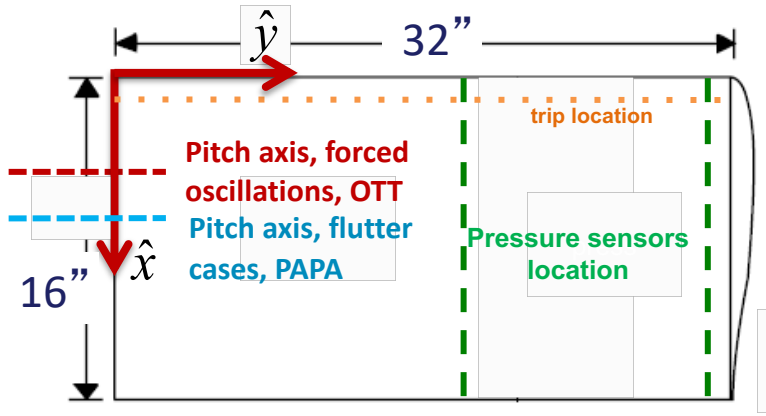




Airfoil section is SC(2)-0414



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



Model planform. Dimensions are in inches.

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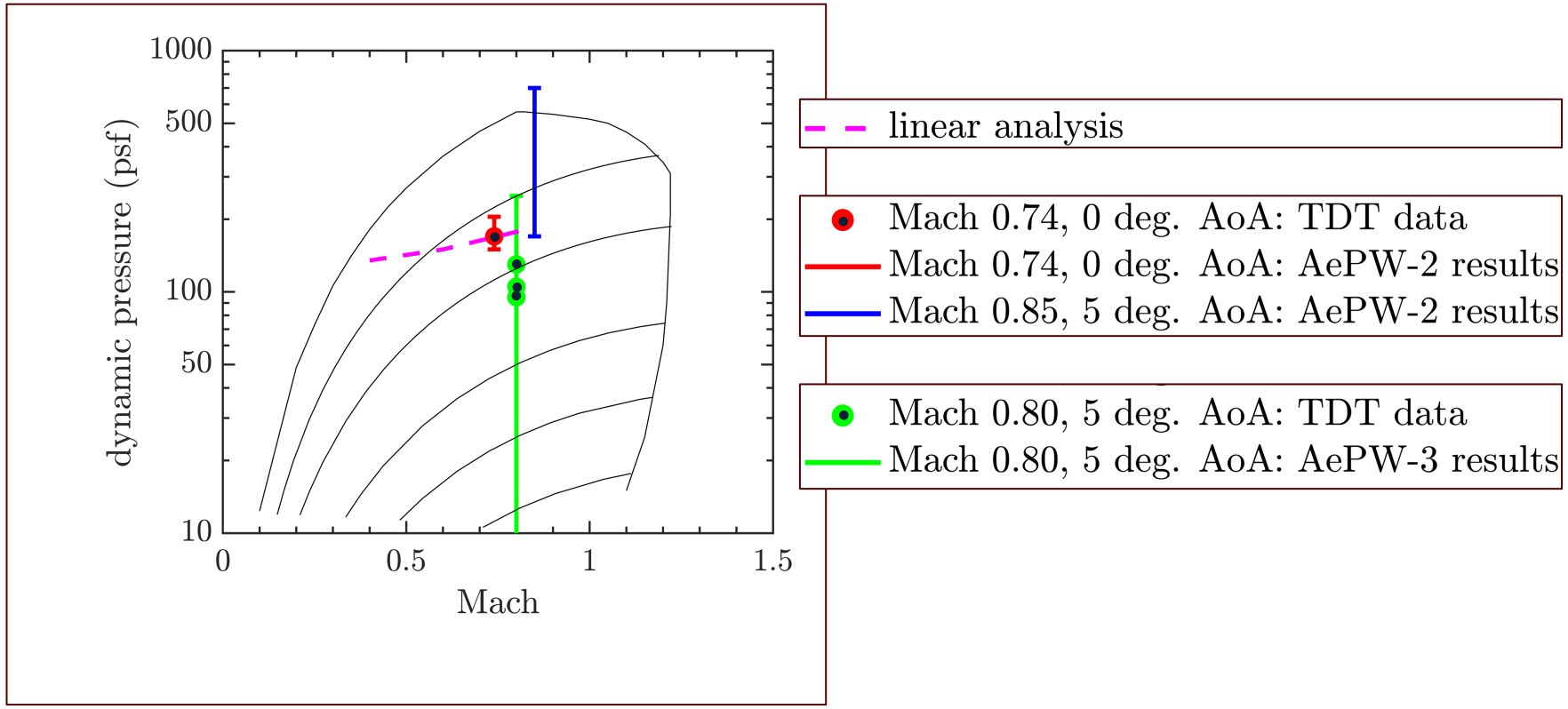
AePW-3: What have we learned?



- **Large spread in BSCW flutter predictions from AePW-3 (though not as bad as AePW-2)**
- **We need more experimental data: more flutter data points, and more on-and off-body flow data at each flutter point**

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BSCW wing configuration will be retested in TDT to obtain flutter and buffet data at Mach, dynamic pressure, and AoA range: September 2025

- Unsteady Pressure Sensitive Paint
- Flutter Stopper Safety Mechanism
- Two Rows of Pressure Sensors

  + Several On Splitter Plate
- Particle Image Velocimetry, PIV

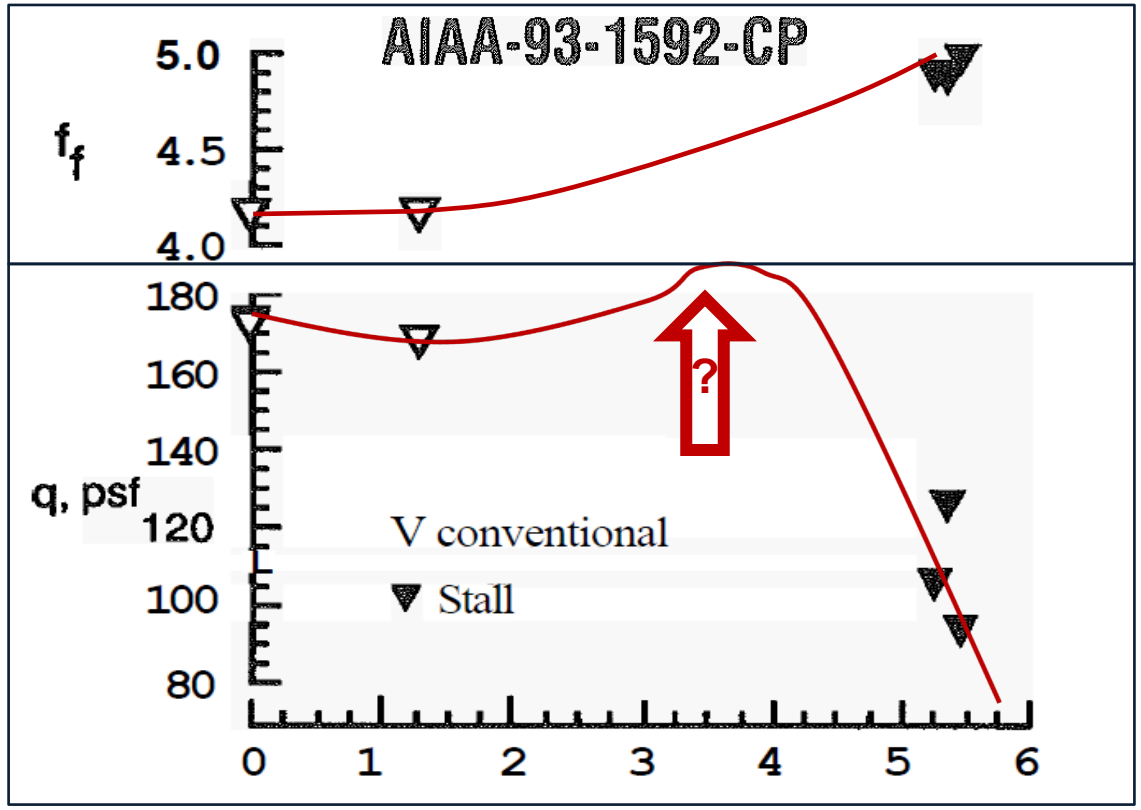

Figure 9. Stall flutter boundary in R-12 at M = 0.80.

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Workshop Cases:

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

Currently we have seven teams looking at flutter calculations

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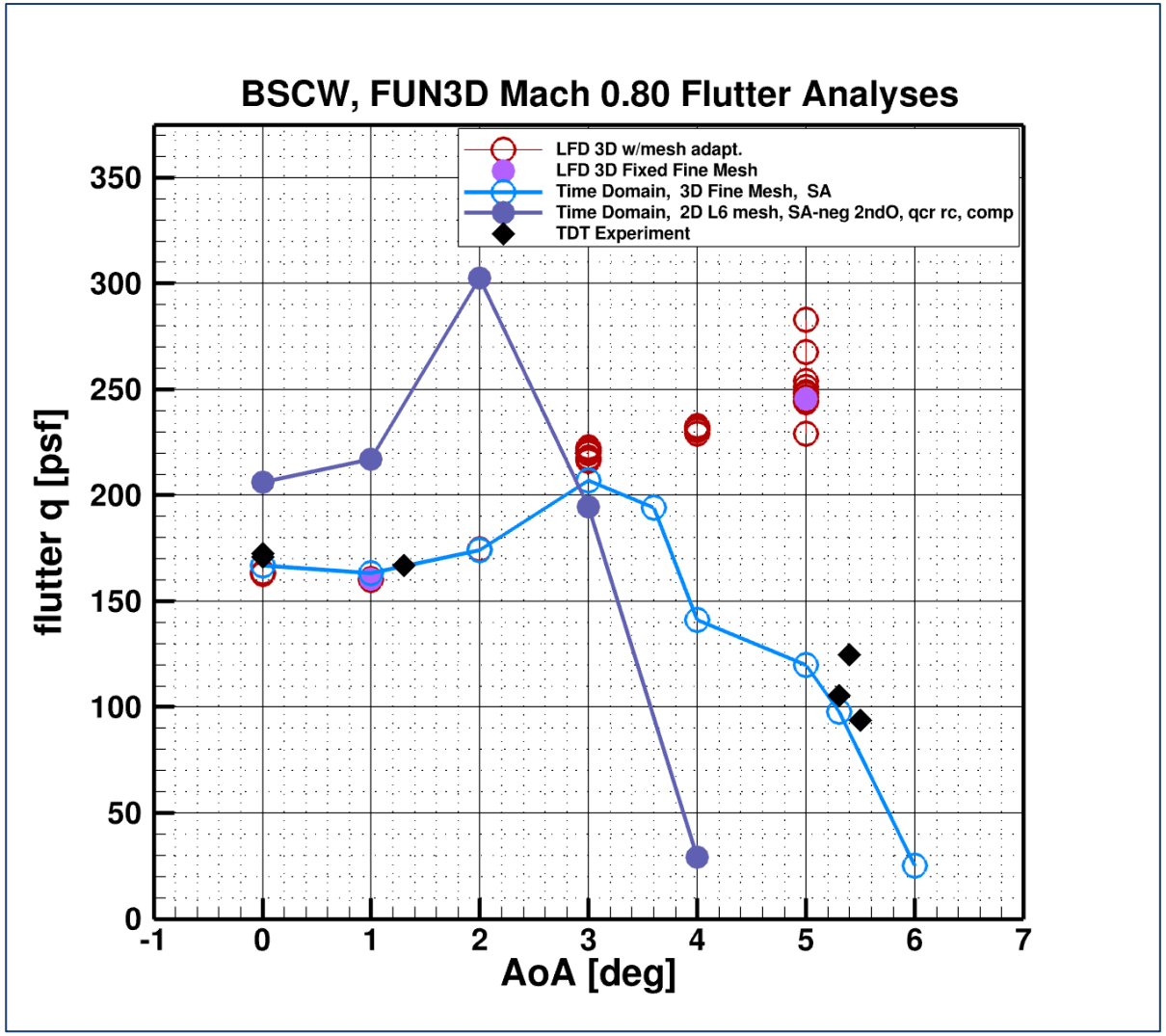
Sample of results from NASA Langley using FUN3D software:

- Linearized Frequency Domain and Time Domain methods
- 2D vs 3D
- Fixed mesh and with mesh adaptation



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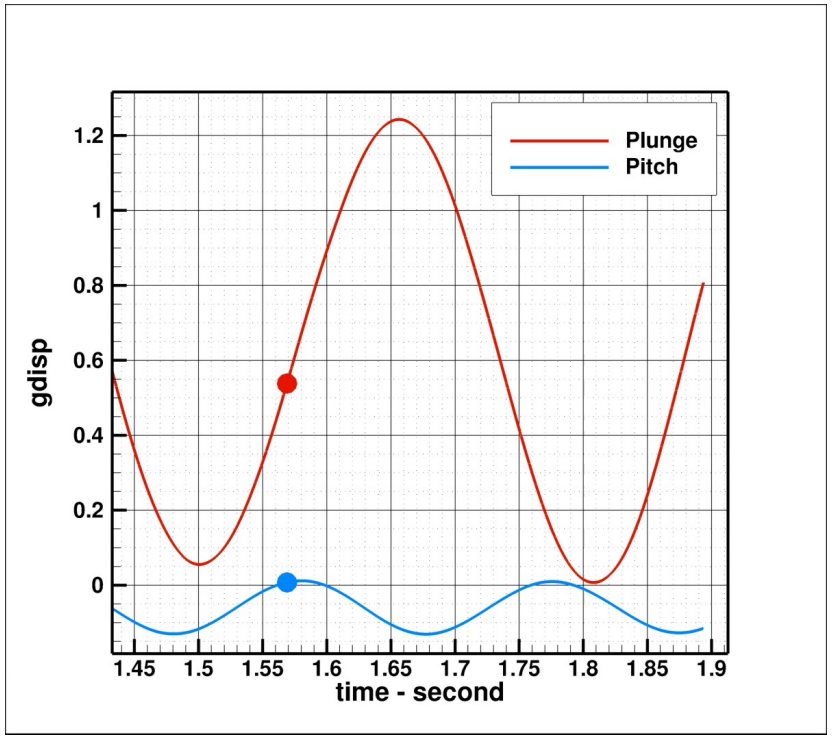
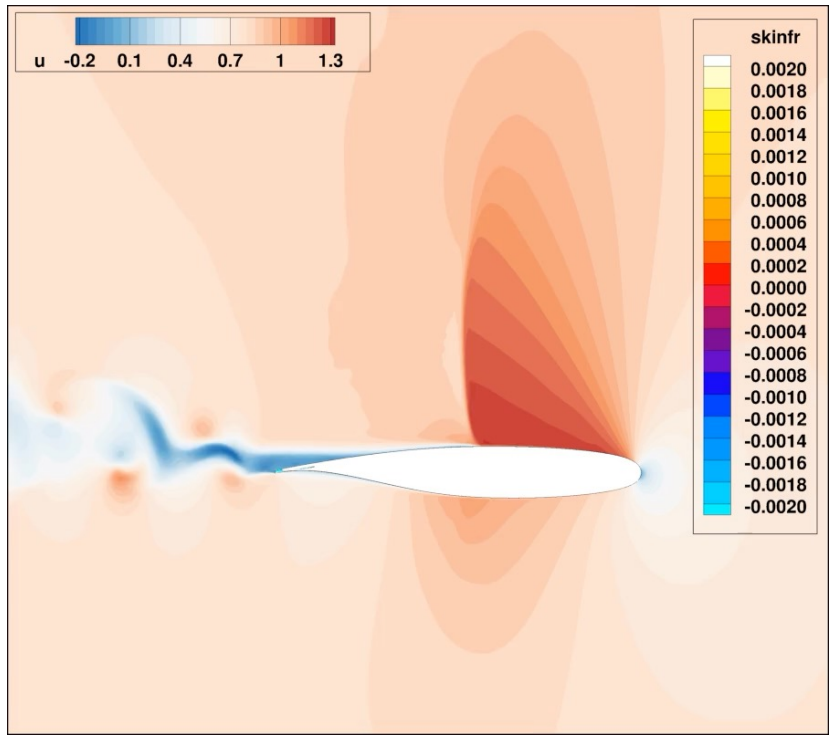
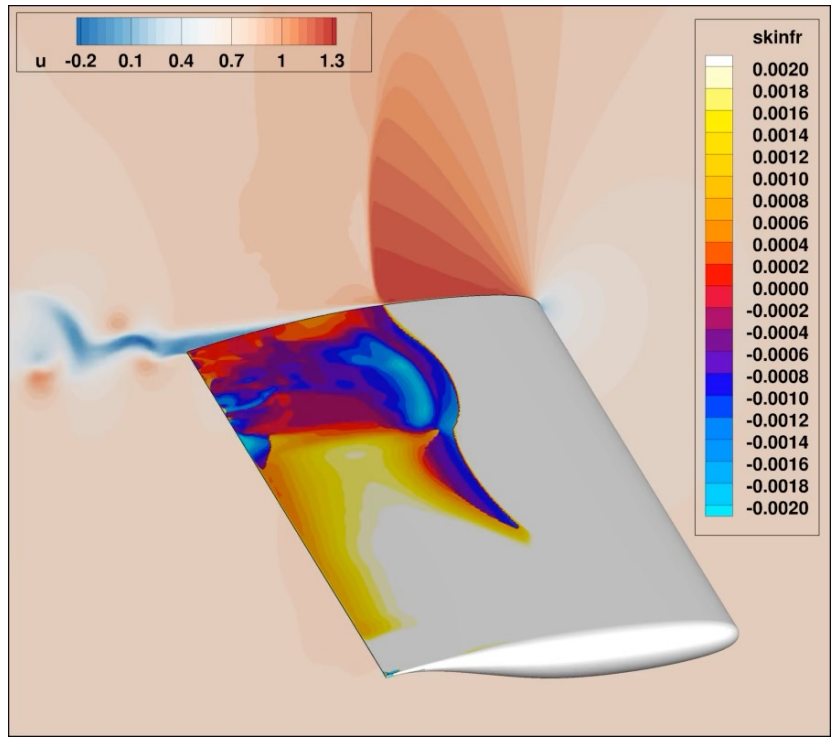
- FUN3D DDES solution at Mach 0.8, 5deg AoA at Q=100 psf (near flutter), 99M mesh







Questions?

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