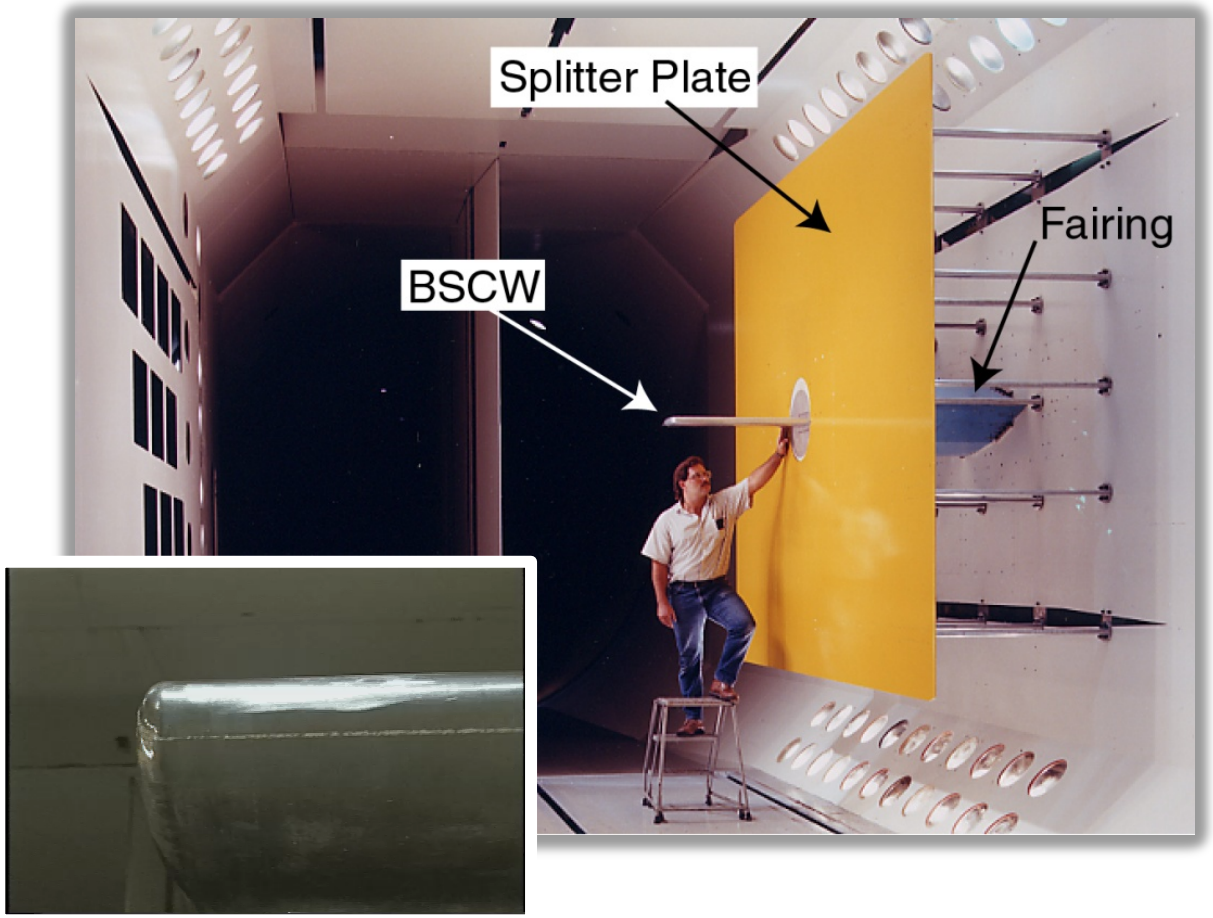
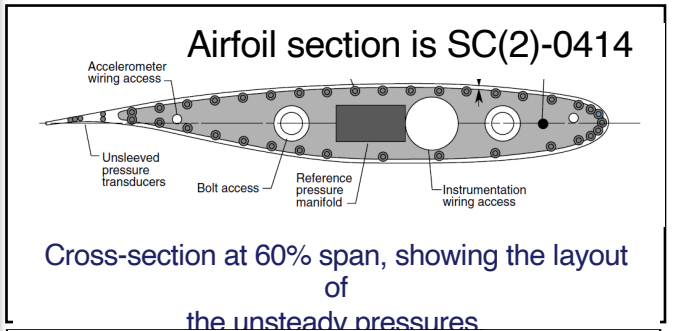
High AoA Working Group AePW-3 Telecon

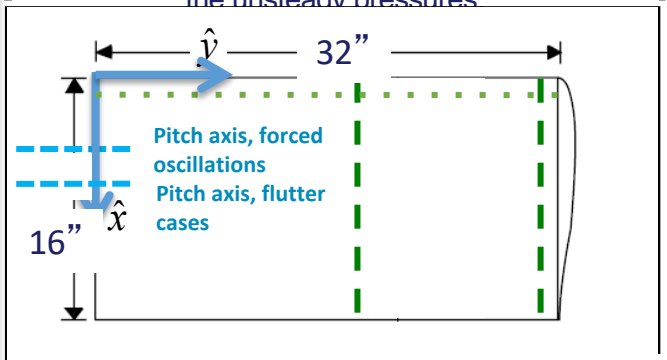
October 22, 2020

Benchmark Supercritical Wing (BSCW) Model





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



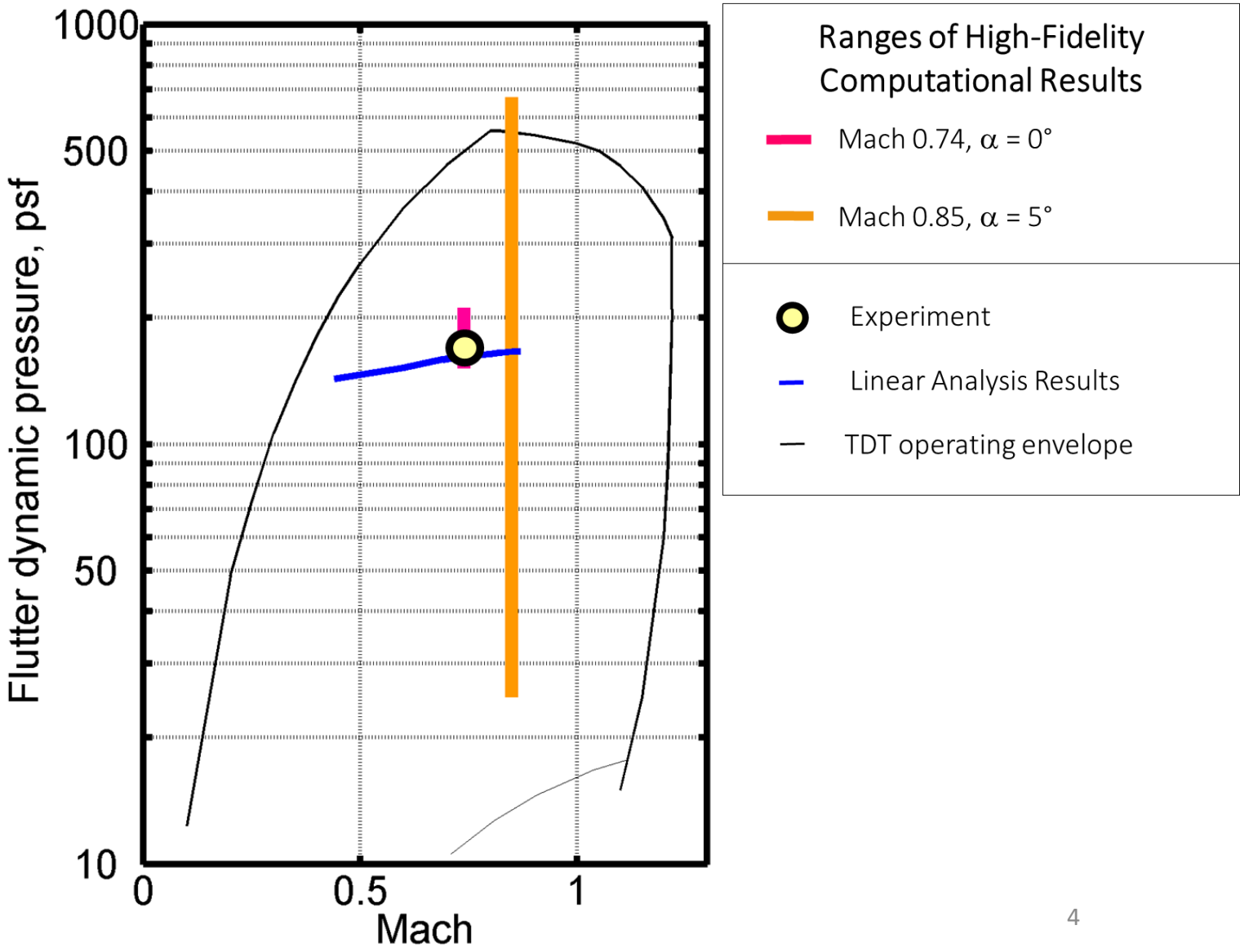
Model planform. Dimensions are in inches.

AePW-2 Configurations for Flutter Computation

Config	Mach	α	Re_c, millions	
BSCW	0.7	3	4.56	
BSCW	0.74	0	4.45	Experimental data
BSCW	0.85	5	4.49	Blind computational test

AePW-2 Summary of Results

- At Mach 0.74, $\alpha = 0°$
  - Small variation in computational results
  - Match the experimental results well
  - Match the linear results well
- At Mach 0.85, $\alpha = 5°$
  - Significant variation in predictions
  - No experimental data for comparison



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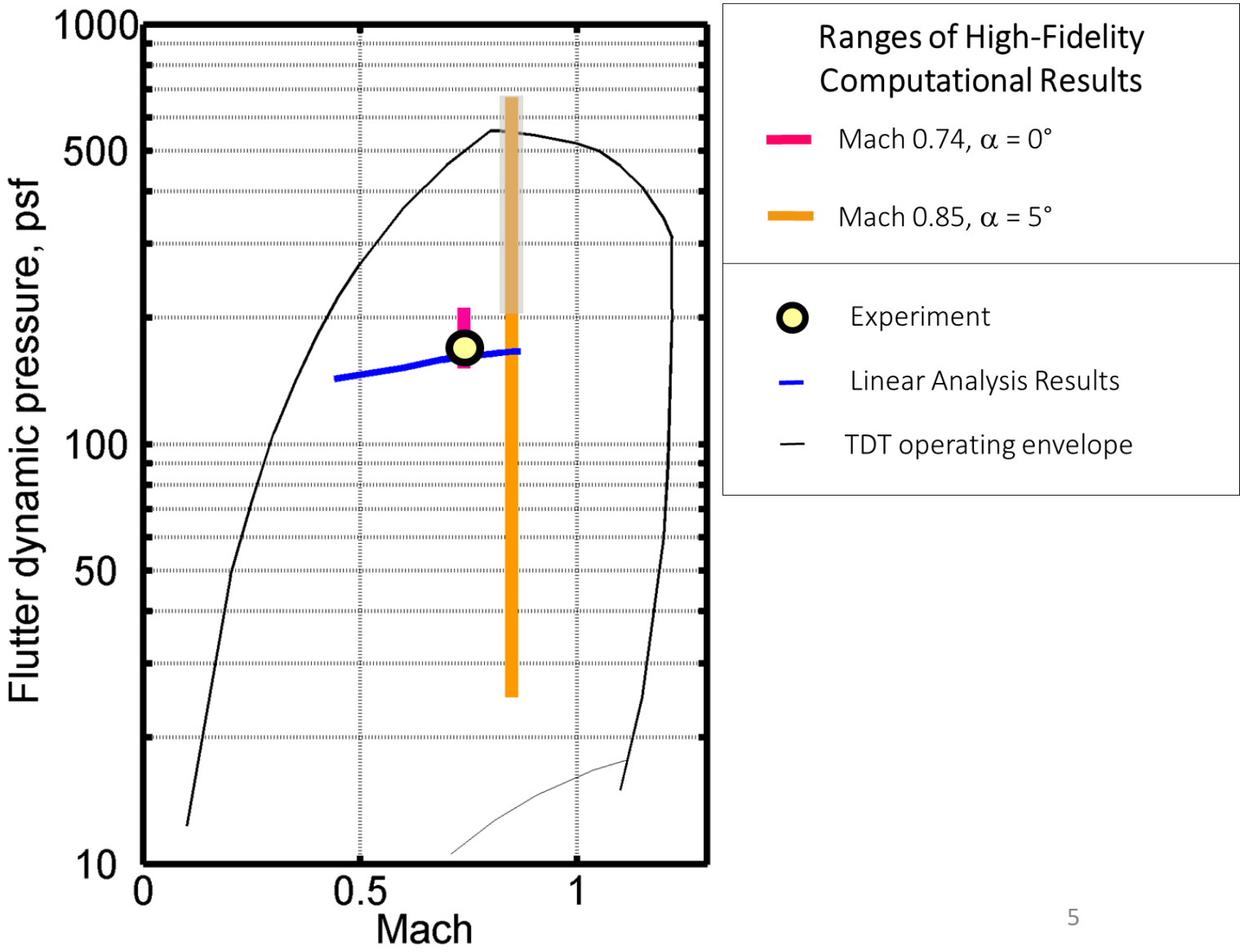
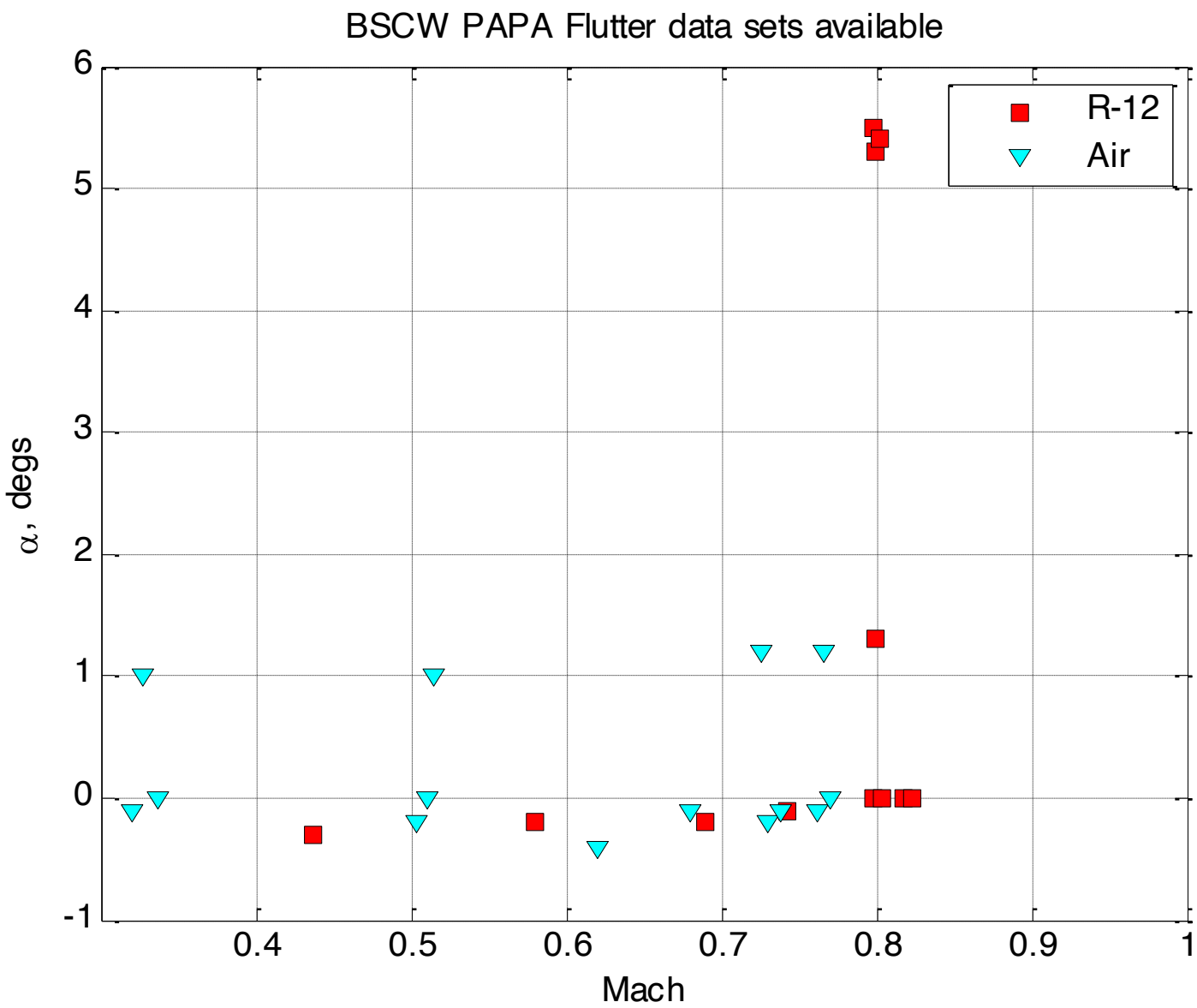


High AoA Working Group, October 22, 2020

- Experimental data review: Pawel
- BSCW UQ results from Marcello Righi
- Mesh adaptation, frequency methods from Bret Stanford
- BAE Systems results Giampaolo Pagliuca & Matt Forster: AePW-2 Mach 0.85 case

- Next Meeting: Tuesday, November 24

Experimental flutter points



Transition strip information
Is not separated out in this plot.

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

Stall Flutter: Additional flutter points were acquired at non-zero angles of attack at a constant Mach number of 0.8. These data, acquired in 11-12 with fixed transition, are presented in figure 9 as flutter dynamic pressure versus *a. The test conditions and flutter parameters for* these stall flutter points are included in table 6. Due to load limits of the PAPA mount only three points could be acquired at angles of attack greater than two degrees. The data acquired, however, shows trends consistent with those of models previously tested on the PAPA mount. Results for models previously tested on the PAPA mount show that the flutter dynamic pressure varies only slightly as *a is increased to some critical angle* (above four degrees in reference 4). At this point, a rapid decrease in flutter dynamic pressure with increasing angle of attack and a rise in the flutter frequency to very near the wind-off torsion frequency is seen. This rapid change in character from equal participation in the flutter mechanism of pitch and plunge to a pitch dominated flutter mechanism is associated with wing stall conditions during a portion of the pitch oscillation cycle.

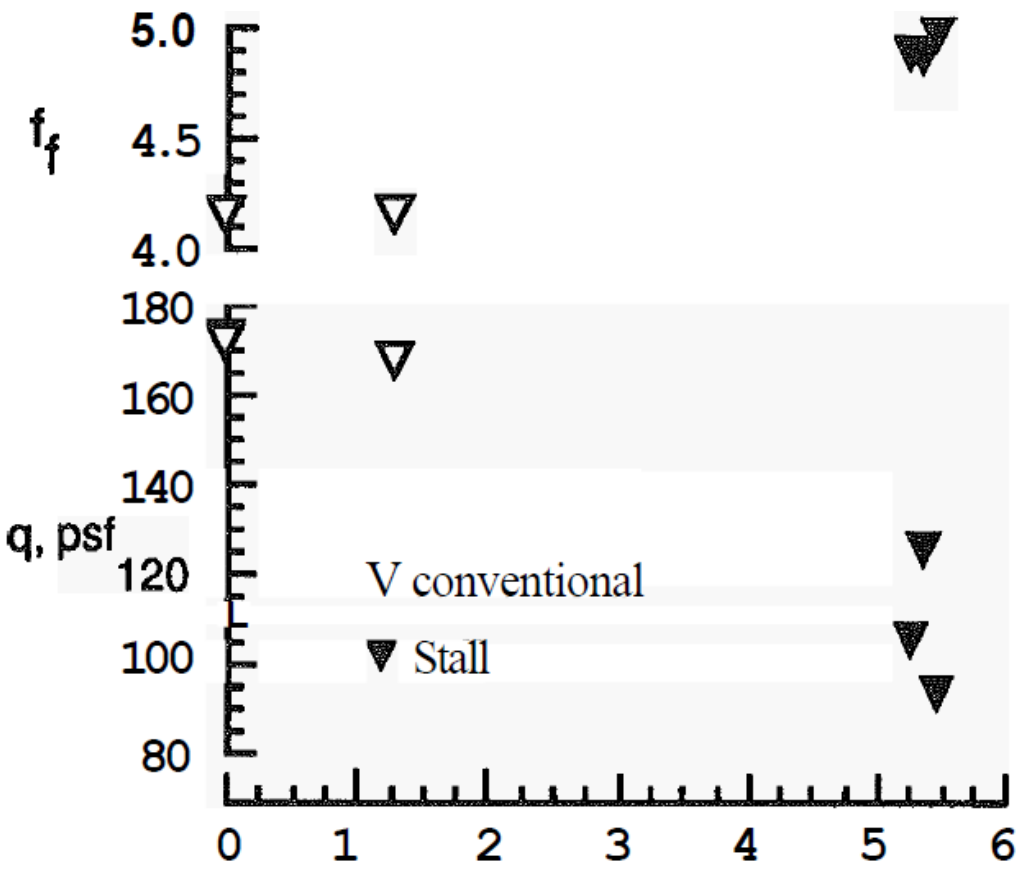


Figure 9. Stall flutter boundary in R-12 at M = 0.80.

What they have termed “stall flutter” corresponds to the test conditions where separated flow is first observed for the unforced system. For the oscillated system, the time histories from the OTT test indicate that the wing goes in and out of separated flow as the wing is Pitched nose up and nose down.

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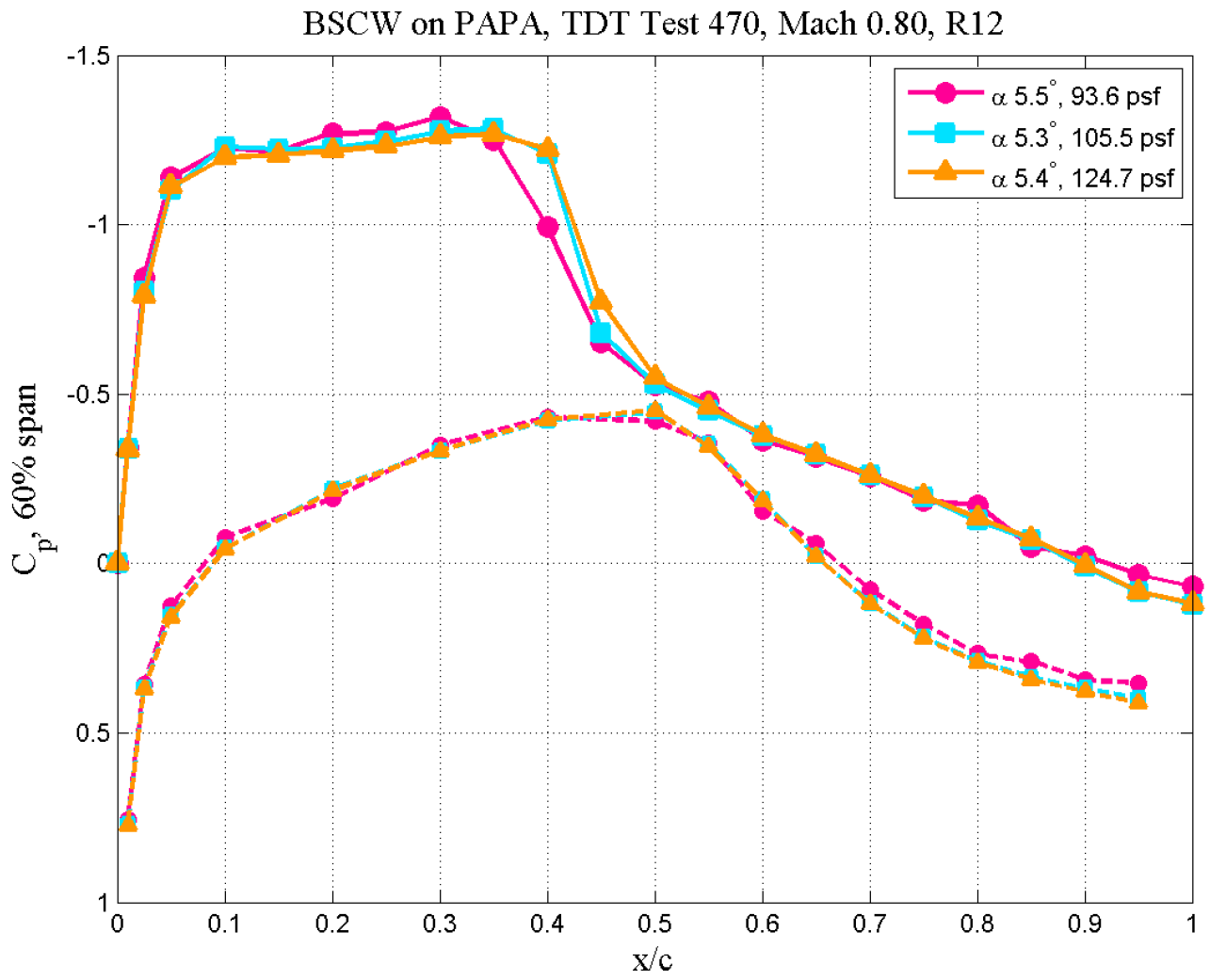


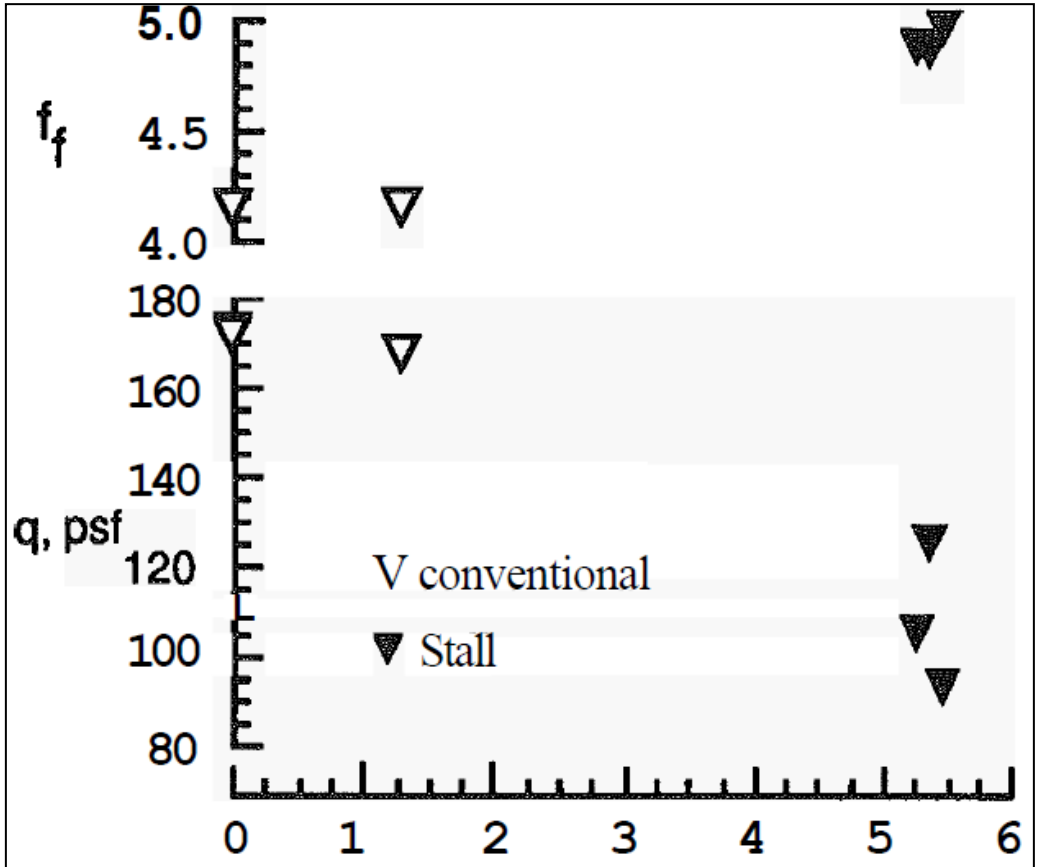
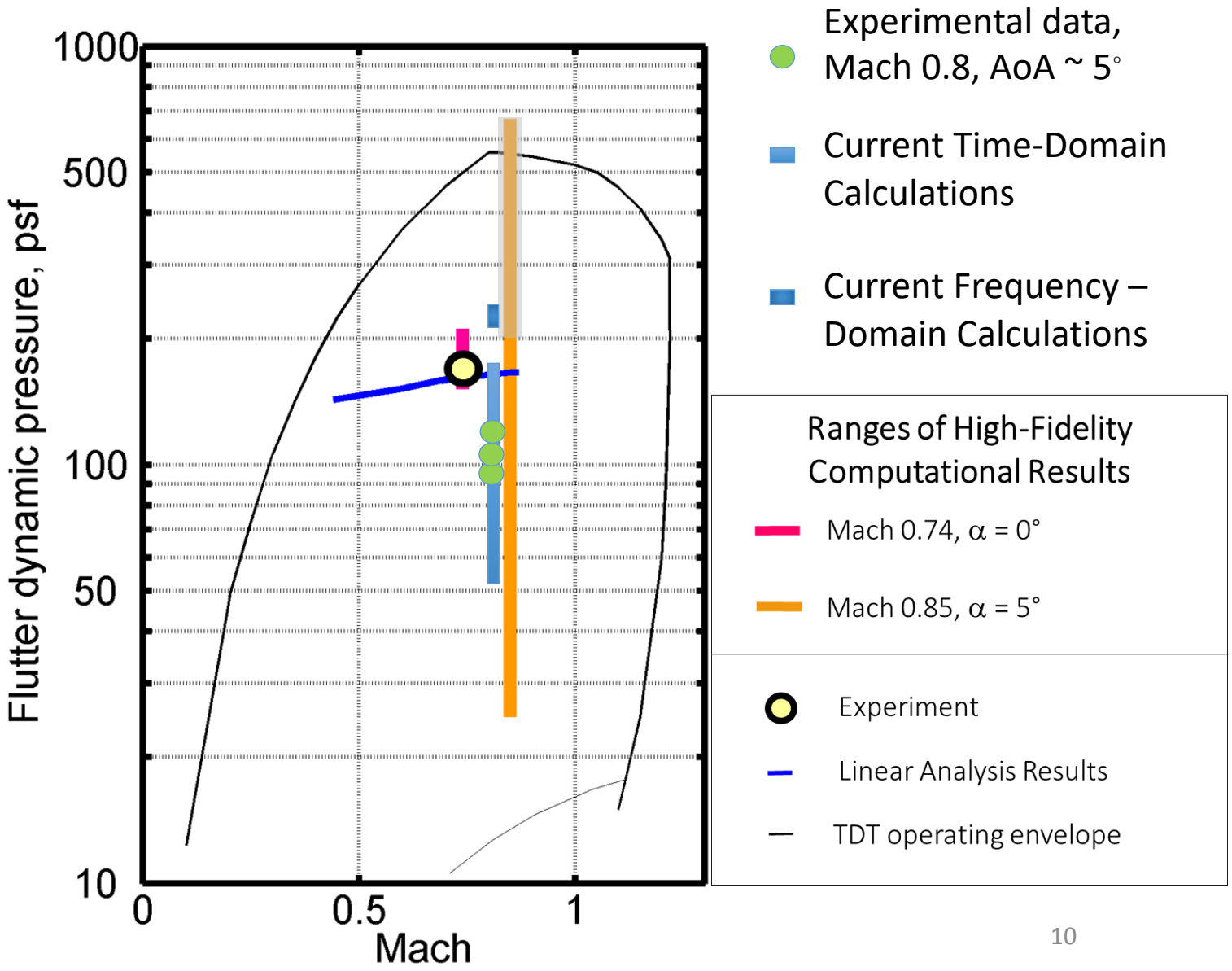


Figure 9. Stall flutter boundary in R-12 at M = 0.80.

AePW-2 Summary of Results

- At Mach 0.8, α = 5°, R-134a



BSCW Current Analysis:

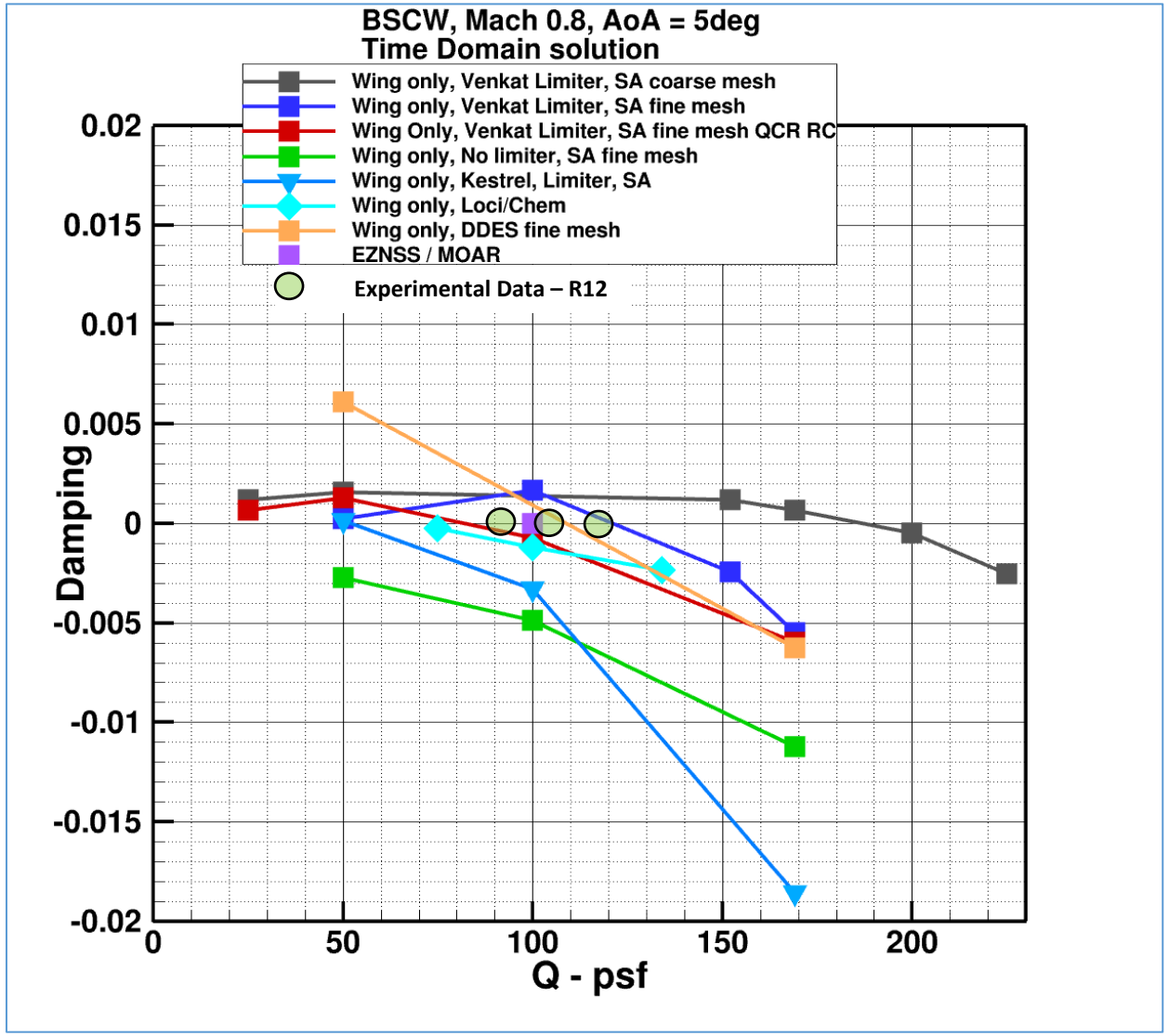
FUN3D

Loci/Chem

Kestrel

EZNSS / MOAR

SA – Splarart-Allmaras model
QCR - Quadratic Constitutive Relationship
RC - rotation/curvature correction
Venkat - Venkatakrishnan limiter
DDES – Delayed Detached Eddy Simulation



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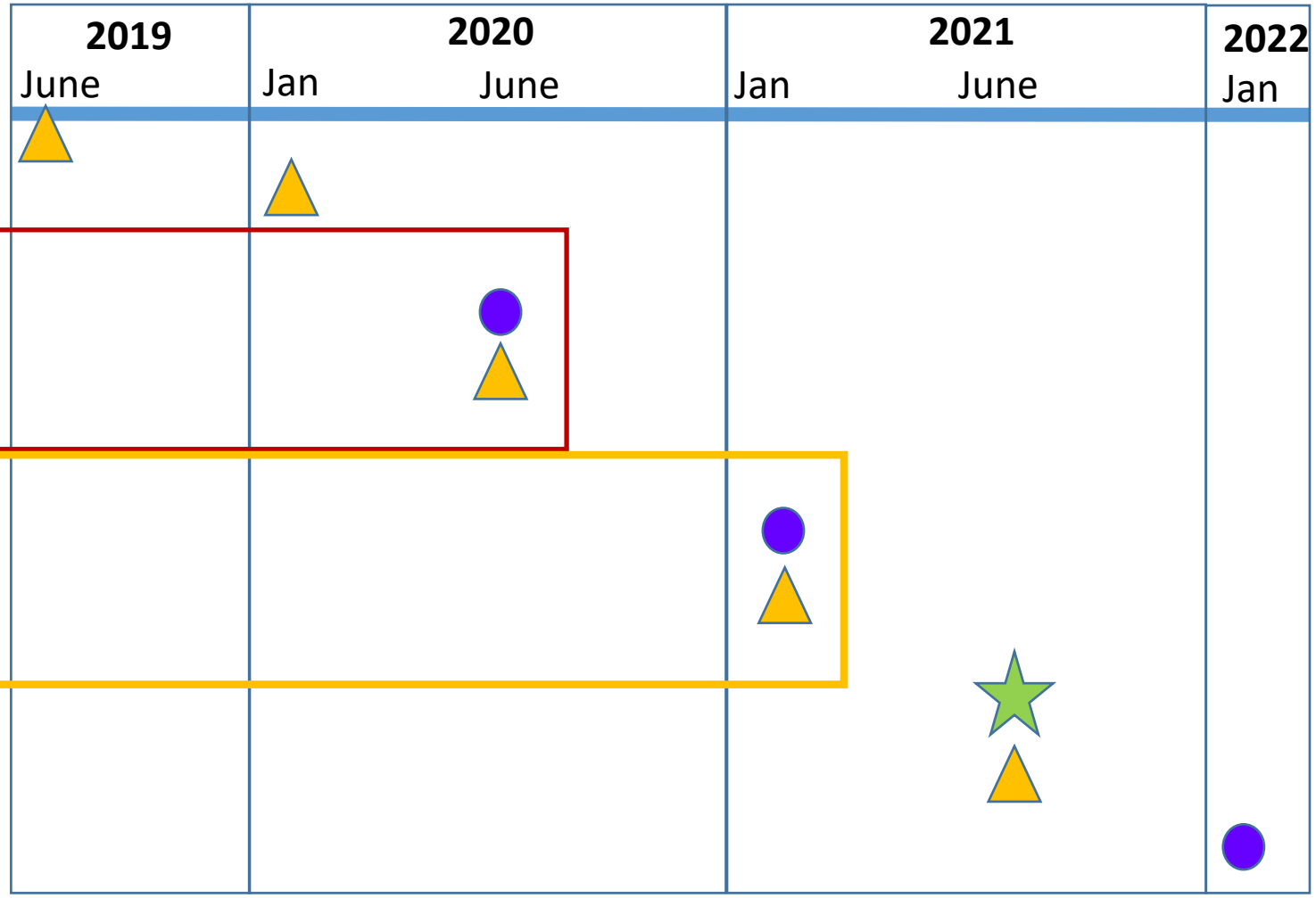
Toward the next Aeroelastic Prediction Workshop (AePW-3): Requesting Conference-Associated Support

Requesting Co-sponsoring between Structural Dynamics TC & Applied Aerodynamics TC:

- **Specific SDTC items are in Blue**
- **Specific APATC items are in Green**

- IFASD 2019 Discussion Session
- SciTech 2020 Evening Discussion Sessions
- Aviation 2020
  - **Special session on Large Deflection FSI (oral presentations only) canceled!!!**
  - ~~Evening discussion sessions: Kick off meetings for AePW-3~~ → **Canceled**
- SciTech 2021
  - Special session reporting intermediate results (oral presentations only)
  - Evening discussion sessions for collaboration among participants
- Aviation 2021 and/or IFASD 2021
  - AePW-3 (oral presentations only)
  - Evening discussion session to debrief workshop(s)
- SciTech 2022 Special sessions on results (technical publications & presentations)