

# Buffet Prediction: Reflections on the Present and Future

**Brent Pomeroy**

Configuration Aerodynamics Branch  
NASA Langley Research Center

`brent.w.pomeroy@nasa.gov`

2<sup>nd</sup> JAXA Buffet Prediction Workshop  
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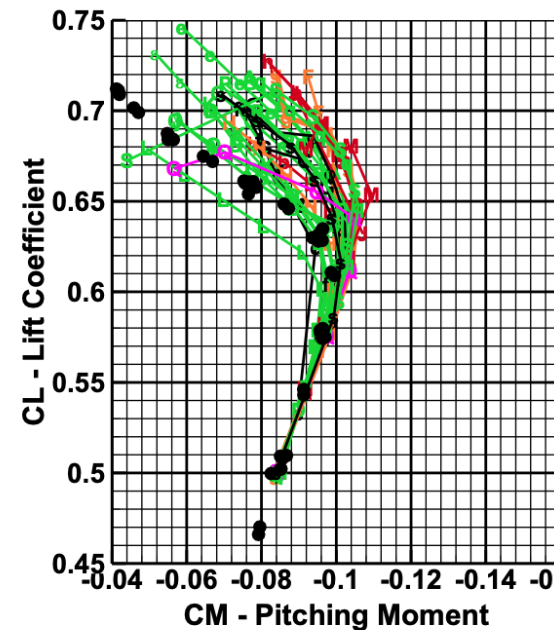
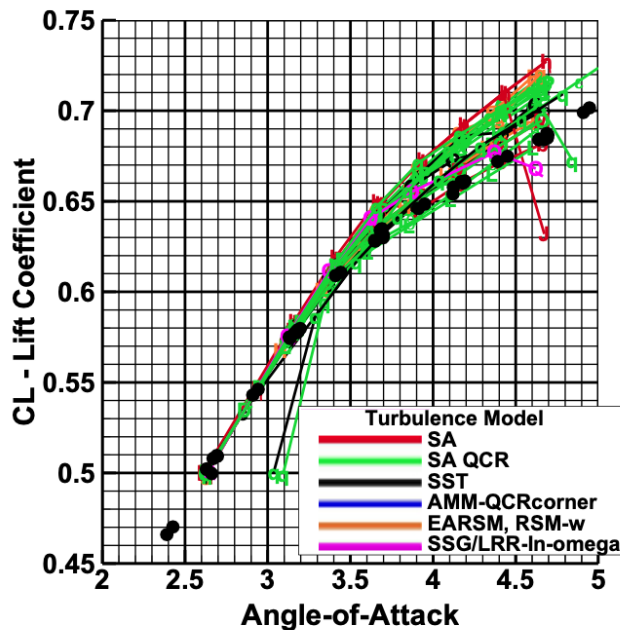
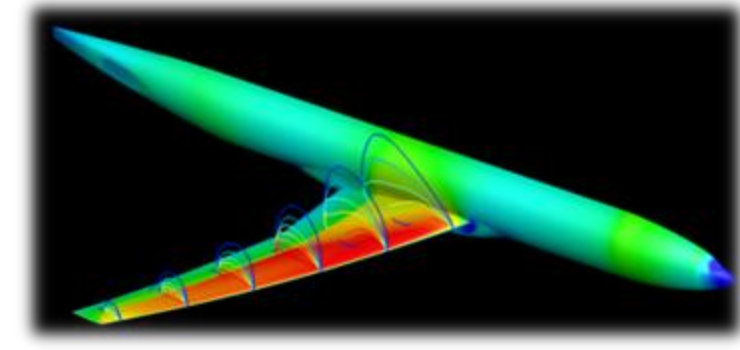


- **What fidelity of solution is adequate?**
  - How is success measured?
  - Does industry have any insight or requirements?
  - Which scheme(s) achieve appropriate accuracy with acceptable cost?
  - How will GPUs change this perspective?
- **Additional insight into more transonic flow regimes**
  - Effects of Mach number, Reynolds number, and sweep warrant further investigation
  - How do different flow regimes affect aerodynamic forces, buffet frequency, and buffet onset?
- **Integrity of computational setup**
  - Consensus on incoming turbulence levels?
  - What grid resolution is needed?
  - What is the effect of turbulence model (in addition to compressibility correction)?
- **What aeroelasticity effects need to be considered?**

# Drag Prediction Workshop 7 Scatter



- 2022 workshop focused upon high-alpha range and into buffet for the NASA Common Research Model
- Consistent results seen in linear range and into pitchup ( $C_L \sim 0.61$ )
- Significant spread in solvers post pitchup



Mach = 0.85, Re=20M - CFD Shifted to Match Test at  $C_L=0.53$

Tinoco, E., et al., "Summary Data from the Seventh AIAA CFD Drag Prediction Workshop," AIAA 2023-3492

- **CRM tested in JAXA 2m x 2m transonic wind tunnel (JTWT1)**
  - Reynolds numbers of 1.5 and 2.3 million based upon mean aerodynamic chord
  - Mach 0.85
  - Datasets published by Koike, et al. (2015) and Sugioka, et al. (2021)
- **Model details**
  - 80% scale NASA CRM (2.16% full-scale vehicle)
  - Wing/body/tail
  - Static aeroelastic deformation measurements and finite element model (FEM) available
- **Very rich data set**
  - Force and moment, static pressure taps, Kulites, oil flow, PIV, temperature-sensitive paint, pressure-sensitive paint, unsteady pressure-sensitive paint, and strain gauges
  - Will allow new comparisons to pressure spectra and shock movement

# Drag Prediction Workshop 8 Plan



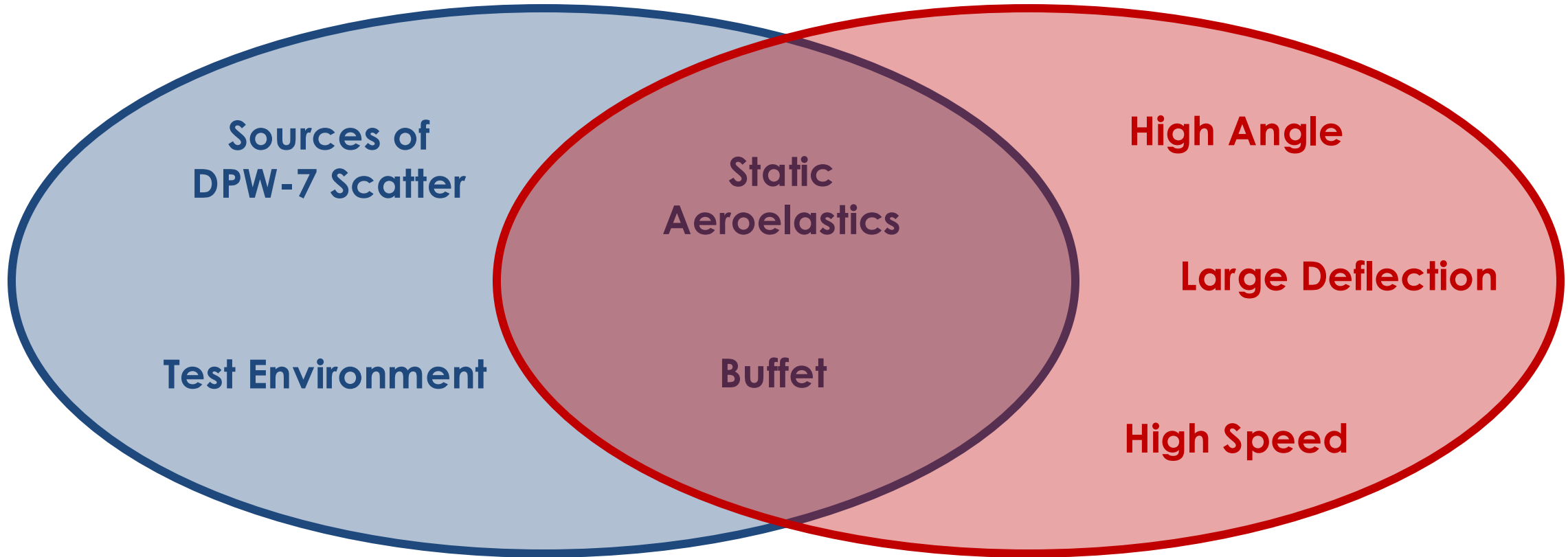
- **Unique multidisciplinary workshop between drag and aeroelastic communities**
  - Centered on spread in DPW-7 results, static deformation, buffet, and test environments
  - Significant participant interest (~50%) in buffet group
  - Simulations will involve RANS, unsteady schemes, static geometry, and fluid/structure interactions
  - Exercise tools and identify opportunities for improvement
- **Compare current best practices to the ONERA OAT15A transonic airfoil**
  - Leverage previously-collected ONERA data
  - Includes static pressure taps and Kulites
- **Buffet Working Group**
  - Leaders: Pomeroy, Stanford, Sansica, Raveh, Ben-Gida
  - Can RANS or URANS resolve pitchup, or is a DES/LES scheme necessary?
  - Leverage Drag Prediction Workshop (DPW) and Aeroelastic Prediction Workshop (AePW) knowledge



Source: NASA

## DPW

## AePW



<https://aiaa-dpw.larc.nasa.gov>

<https://aiaa-dpw.larc.nasa.gov/WorkingGroups/Group3/group3.html>

# Questions?



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