

# Buffet Working Group

## Test Case 2a



Version 2  
April 15, 2025

[aiaabuffet@gmail.com](mailto:aiaabuffet@gmail.com)



- **Version 2**
  - April 15, 2025
  - Added geometry file names for 1.22 and 2.29 cases

- CRM wing/body/tail0 configuration
- Unsteady CFD with committee-supplied static wing geometry (no FSI)
- Simulations executed at wind-tunnel scale
  - Maximize consistency with dimensional FEMs
  - Geometry and grids are model scale (2.16%)
- **Test Case 2a**
  - Released 3/18/25
  - Detailed comparisons to experimental data (Data Set B.1)
- **Test Case 2b (tentative)**
  - To be finalized in the future
  - Comparisons to uPSP (Data Set B.2)

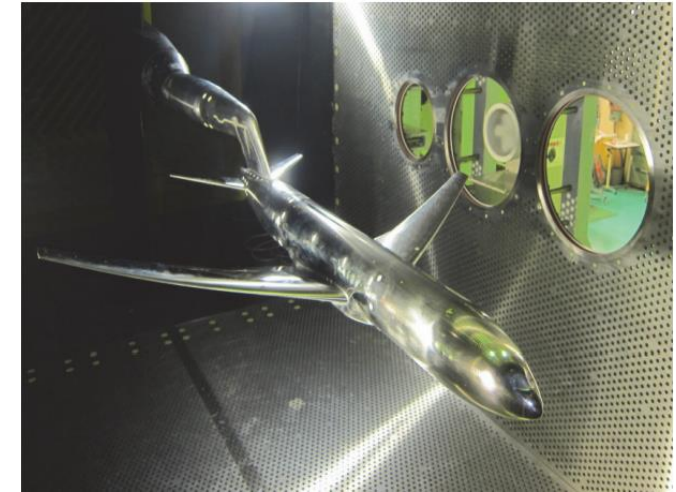
Koike, S., Ueno, M., Nakakita, K., and Hashimoto, A. "Unsteady Pressure Measurement of Transonic Buffet on NASA Common Research Model." AIAA Paper 2016-4044. AIAA Applied Aerodynamics Conference. Washington, DC. June, 2016.

Paper: <https://commonresearchmodel.larc.nasa.gov/wp-content/uploads/sites/7/2018/01/AIAA-2016-4044.pdf>

Data: <https://cfdws.chofu.jaxa.jp/apc/dpw/upc.html>

# Experimental Test

- **2.16% scale CRM (80% scale of NASA model) tested in JAXA 2m x 2m transonic wind tunnel**
  - Reynolds numbers of 1.5 and 2.3 million
  - Rich data set of steady and unsteady data
- **Model details**
  - 80% scale NASA CRM (2.16% full-scale vehicle)
  - Wing/body/tail
  - Wind-off wing shape is the as-defined (in 2008) 1-G shape (same as NASA CRM)



Data Set	Test Case	Wing	Re	Alpha	Static, Loaded Deformation	F&M	Static Taps	Kulites	Oil Flow	Wake PIV	TSP	PSP	uPSP	Strain Gauge	FEM	Release Status
A.1	---	Steady	~2.3	-2 to 6 every ~1.2 deg	X	X	X		X	X						Public
A.2	---	Steady	~2.3	-2 to 7	X	X	X				X	X				Requested
B.1	2a	Unsteady Wing #1	~1.5	1.22, 2.29, 4.84, 5.89	X	X		X								Partial
B.2	---	Unsteady Wing #2	~2.3	-2 to 7		X		X					X	X	X	Requested

- **Committee-supplied CAD for experimentally-measured deformations**

- CRM wing/body/tail (0 deg tail deflection)
- Note “updatednose” wording in CAD files
- 4.84 and 5.89 deg available now
- 1.22 and 2.29 deg being developed

<https://cfdws.chofu.jaxa.jp/apc/dpw/geometry.html>

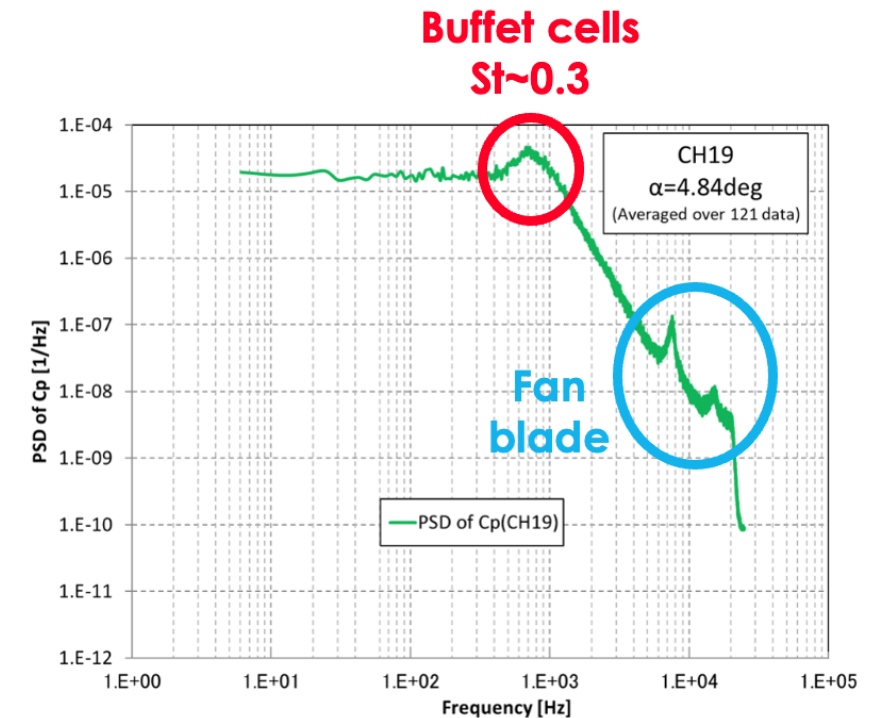
- **Committee-supplied URANS grids**

- Cadence, Helden, and Ames
- Recommended to use model-scale grids
- Model scale maximizes postprocessing consistency and FEM compatibility
- Scale-resolving schemes will need custom grids
- Provide custom grids to the committee for posting to the DPW site

[https://dpw.larc.nasa.gov/DPW8/Buffer/Test\\_Case\\_2](https://dpw.larc.nasa.gov/DPW8/Buffer/Test_Case_2)

Alpha	File Name
1.22	wbh_aoa122_buffet_deformed_updatednose.iges.gz
2.29	wbh_aoa229_buffet_deformed_updatednose.iges.gz
4.84	wbh_aoa484_buffet_deformed_updatednose.iges.gz
5.89	wbh_aoa589_buffet_deformed_updatednose.iges.gz

- Recommended to use your best practices from Test Case 1b
- Freestream settings
  - Mach 0.85,  $Re_c=1.515m$  (based on chord length),  $T_{total} = 323.0\text{ K}$  (121.7 F)
  - Alpha: 1.22, 2.29, 4.84, 5.89
- Experimental conditions (for reference):
  - $P_{total} = 80\text{ kPa}$
  - Trip dots at 10% chord on wing
  - Investigating location on nose and tail (an update will be provided in the future)
- Grids
  - Baseline grid is Medium (L3)
  - Grid convergence study optional for  $AoA=4.84$
- Optional sensitivities
  - Time step, simulation length, turbulence model, etc.



- **Goal**
  - Resolve frequency peak at  $St=0.3$
  - Capture as much of the spectra as reasonably possible
- **Recommended baseline settings**
  - 30 CTU after initial solution stabilized
  - 100 time steps per CTU
  - More CTU may be required to resolve frequency at high resolution
- **Limitations**
  - Computational resources will limit the user's selected time step and simulation time
  - Utilize your best practice for iterations per CTU and simulation length

- **Follow these instructions**

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

- **Required data**

- Forces and Moments

DPW8-AePW4\_UnsteadyForceMoment\_v5.dat

- Surface cuts

DPW8-AePW4\_UnsteadySectionalCuts\_v5.dat

- Spectral content

DPW8-AePW4\_UnsteadySpectra\_v5.dat

- **Spectral content at four locations**

- Section E ( $\eta = 0.5$ ):  $x/c = 0.3040$  and  $0.7903$

- Section F ( $\eta = 0.6$ ):  $x/c = 0.3097$  and  $0.7677$





[dpwaiiaa@gmail.com](mailto:dpwaiiaa@gmail.com)