Buffet Working Group

Test Case 2

Version 5
September 8, 2025

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Change Log

- **Version 5**
  - September 8, 2025
  - Added more detailed coordinates to “Data Submission” slide

- **Version 4**
  - August 19, 2025
  - Updated “Data Submission” slide

- **Version 3**
  - August 4, 2025
  - Changed all references to “Test Case 2a” to “Test Case 2” as there will be no 2b
  - Updated JAXA data table to indicate Test Case 3 data have been released

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

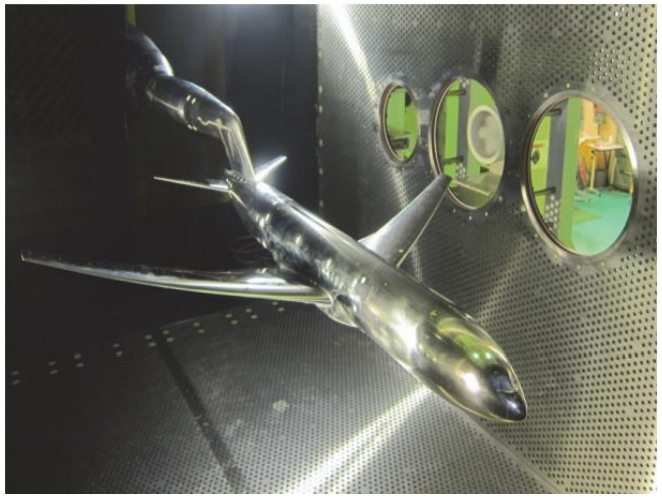
Test Case 2: Overview

- **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 2**
  - Released 3/18/25
  - Detailed comparisons to experimental data (Data Set B.1)

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	2	Unsteady Wing #1	~1.5	1.22, 2.29, 4.84, 5.89	X	X		X								Public
B.2	3	Unsteady Wing #2	~2.3	-2 to 7		X		X					X	X	X	Public

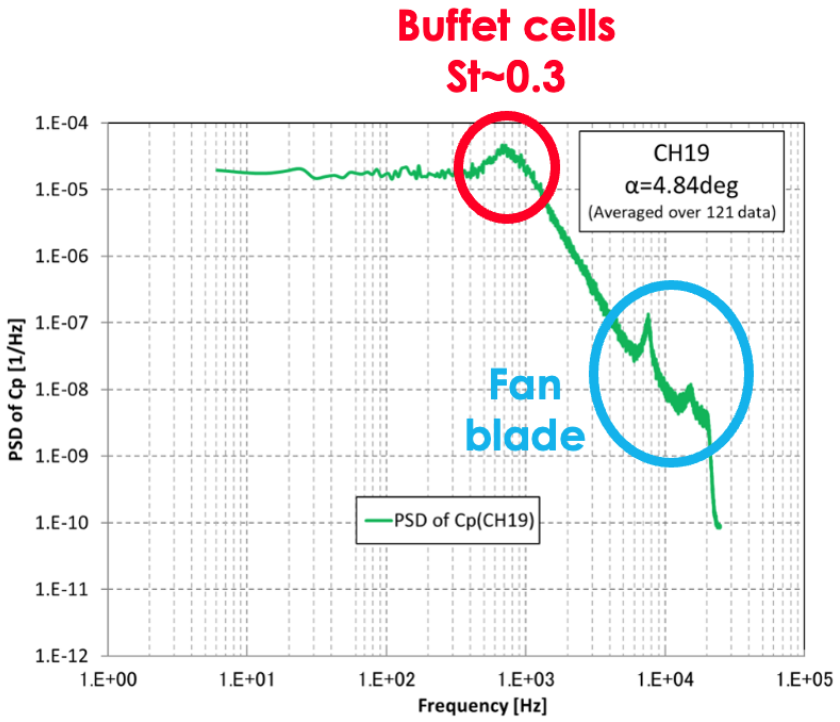
Geometry and Grid Files

- **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/Buffet/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

Simulation Conditions

- **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 K (121.7 F)
  - Alpha: 1.22, 2.29, 4.84, 5.89
- **Experimental conditions (for reference):**
  - P_{total} = 80 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.



Time Step Settings

- **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

Data Submission

- **Required**
  - Integrated Forces and Moments
  - Surface Cuts
  - Time Series of a Single Point at Kulite coordinates (see table)
  - Custom Grid Metrics (or clear reference to committee-supplied grids; this information must be submitted for inclusion in the ensemble analysis)
  - Boundary Layer Profiles
- **Optional**
  - Contour Plots

Eta	x/c	Probe Type
0.5021	0.3040	ESP
0.5021	0.7903	ESP
0.4997	0.3040	Kulite
0.4997	0.7903	Kulite
0.6028	0.3097	ESP
0.6028	0.7677	ESP
0.6004	0.3097	Kulite
0.6004	0.7677	Kulite

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