Buffet Working Group

Test Case 2a

Version 1
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AIAA
SHAPING THE FUTURE OF AEROSPACE

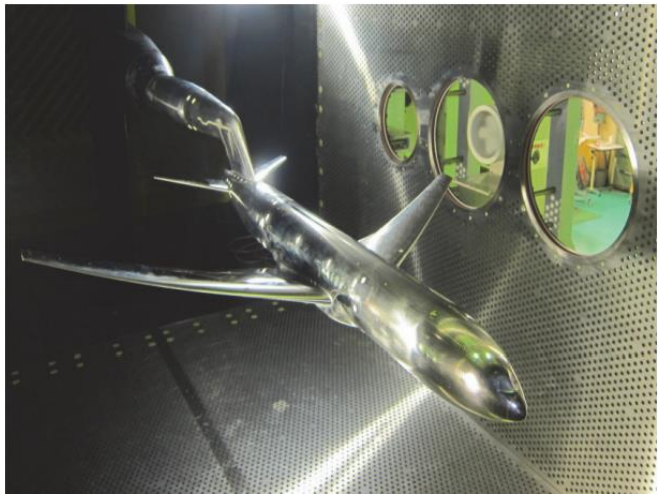
Test Case 2: Overview

- **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 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

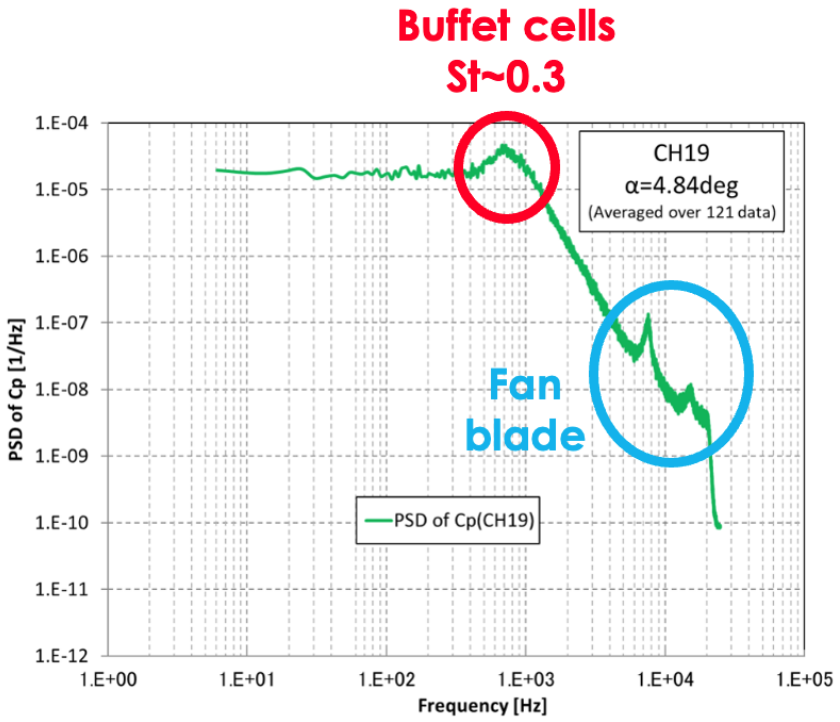
Geometry and Grid Files

- **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	In Prep
2.29	In Prep
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

- **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

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