DPW-8 & AePW-4

Buffet Working Group

November 19, 2024

aiaabuffet@gmail.com

AIAA
SHAPING THE FUTURE OF AEROSPACE

Test Case 1 Update

- **RANS data were due October 31**
- **Submit as much unsteady data as possible by November 30**
  - We are not specifying time step or number of CTUs
  - We want to leverage your best practices
  - We're considering developing recommendations for Test Cases 2 and 3
- **GitHub**
  - Feedback?
- **Are there questions?**

Website Updates

AePW website

https://nescacademy-d.larc.nasa.gov/workshops/AePW4/public

- Landing page for AePW-4, with particular emphasis on three AePW-aligned working groups

Buffet Working Group website

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

- Experimental data for upcoming Test Cases 2 and 3 added (link to JAXA website)

Postprocessing website

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

- Feedback?

Large File Upload

https://nasagov.app.box.com/f/fd164563283b4e85857d1a0975b0b363

- Please upload as a zip file with your name in the file name and alert the buffet email address

Grid Updates

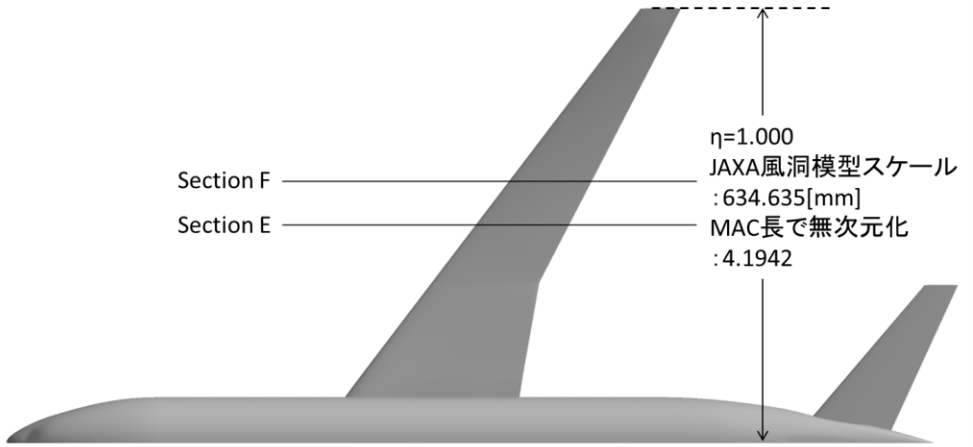
- Have any participants developed custom grids?

AIAA Conference Presence

- **SciTech: Mini Workshop 1**
  - January 6-10, Orlando, FL
  - Community-wide, open-to-all mini workshop
  - Thursday 9:30-12:00; Bayhill 29
  - Will include a hybrid component
- **AVIATION: Special Sessions**
  - July 21-25, Las Vegas, NV
  - Presentation-only and paper/presentations welcomed and encouraged
  - Can include ONERA OAT15A work or any other work to date
  - Goal is to highlight the community's work; it can be formal or informal
  - Open to submissions from all seven working groups

Test Case 2 First Look

- **Spring, summer, and fall 2025**
- **Unsteady CFD without FSI**
  - CRM wing/body/tail
  - Will be performed at JAXA scale with JAXA-scale geometry and grids (for FEM compatibility)
  - Committee-supplied deformed geometry
  - Committee-supplied RANS grids



- **Simulations**
  - Four alphas
  - Two pre-buffet, two post-buffet (1.22, 2.29, 4.84, and 5.89 deg)
  - Detailed comparisons to recent JAXA data
- **We are looking for folks to test committee-supplied RANS/URANS grids**

Test Case 2 Experimental Reference

- **Koike, S., et al. "Unsteady Pressure Measurement of Transonic Buffet on NASA Common Research Model." AIAA Paper 2016-4044. AVIATION 2016.**
- **Rich data set**
  - Unsteady C_P history
  - Surface pressures
  - F&M
  - Deformations

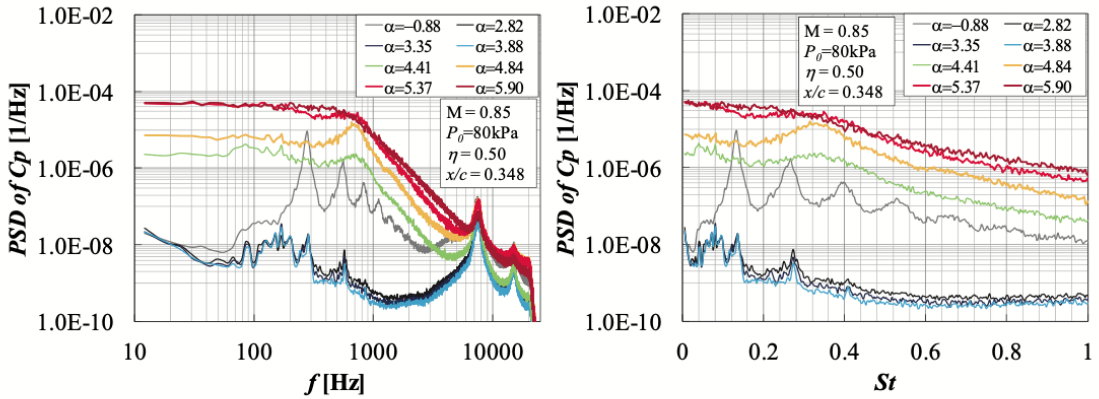
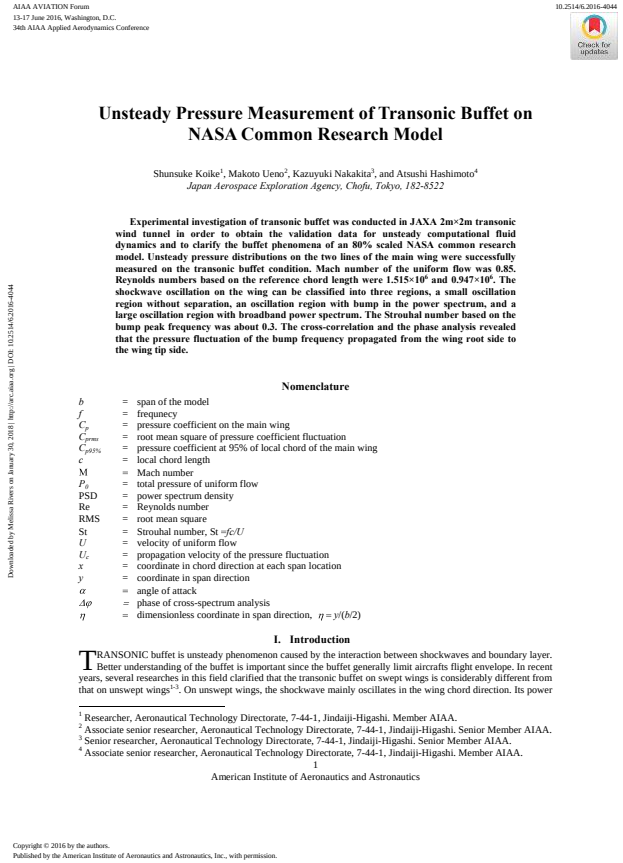


Figure 15. PSD of *Cp* fluctuation of $\eta = 0.50$ and $x/c = 0.348$ at Re=1.515x10^6 (p_0=80kPa).



AIAA AVIATION Forum
13-17 June 2016, Washington, D.C.
34th AIAA Applied Aerodynamics Conference

10.2514/6.2016-4044

Check for updates

Unsteady Pressure Measurement of Transonic Buffet on NASA Common Research Model

Shunsuke Koike[1], Makoto Ueno[2], Kazuyuki Nakakita[3], and Atsushi Hashimoto[4]
Japan Aerospace Exploration Agency, Chofu, Tokyo, 182-8522

Experimental investigation of transonic buffet was conducted in JAXA 2m×2m transonic wind tunnel in order to obtain the validation data for unsteady computational fluid dynamics and to clarify the buffet phenomena of an 80% scaled NASA common research model. Unsteady pressure distributions on the two lines of the main wing were successfully measured on the transonic buffet condition. Mach number of the uniform flow was 0.85. Reynolds numbers based on the reference chord length were 1.515×10^6 and 0.947×10^6. The shockwave oscillation on the wing can be classified into three regions, a small oscillation region without separation, an oscillation region with bump in the power spectrum, and a large oscillation region with broadband power spectrum. The Strouhal number based on the bump peak frequency was about 0.3. The cross-correlation and the phase analysis revealed that the pressure fluctuation of the bump frequency propagated from the wing root side to the wing tip side.

Nomenclature

b	=	span of the model
f	=	frequency
C_p	=	pressure coefficient on the main wing
C_{prms}	=	root mean square of pressure coefficient fluctuation
$C_{p95\%}$	=	pressure coefficient at 95% of local chord of the main wing
c	=	local chord length
M	=	Mach number
P_0	=	total pressure of uniform flow
PSD	=	power spectrum density
Re	=	Reynolds number
RMS	=	root mean square
St	=	Strouhal number, St =fc/U
U	=	velocity of uniform flow
U_c	=	propagation velocity of the pressure fluctuation
x	=	coordinate in chord direction at each span location
y	=	coordinate in span direction
α	=	angle of attack
$\Delta\varphi$	=	phase of cross-spectrum analysis
η	=	dimensionless coordinate in span direction, $\eta = y/(b/2)$

I. Introduction

TRANSONIC buffet is unsteady phenomenon caused by the interaction between shockwaves and boundary layer. Better understanding of the buffet is important since the buffet generally limit aircrafts flight envelope. In recent years, several researches in this field clarified that the transonic buffet on swept wings is considerably different from that on unswept wings[1-3]. On unswept wings, the shockwave mainly oscillates in the wing chord direction. Its power

[1] Researcher, Aeronautical Technology Directorate, 7-44-1, Jindaiji-Higashi. Member AIAA.
[2] Associate senior researcher, Aeronautical Technology Directorate, 7-44-1, Jindaiji-Higashi. Senior Member AIAA.
[3] Senior researcher, Aeronautical Technology Directorate, 7-44-1, Jindaiji-Higashi. Senior Member AIAA.
[4] Associate senior researcher, Aeronautical Technology Directorate, 7-44-1, Jindaiji-Higashi. Member AIAA.

Test Case 2 Experimental Data Set

- **Scaled-down NASA CRM 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	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	Unsteady Wing #1	1.5	4.84, 5.89	X	X		X								Public
B.2	Unsteady Wing #2	2.3	-2 to 7		X		X					X	X	X	Requested

Subgroup Update and Participant Presentations

- **Updates from subgroup leaders**
  - URANS: Fulvio Sartor, ONERA Centre de Meudon fulvio.sartor@onera.fr
  - Hybrid RANS/LES: Jeff Housman, NASA Ames jeffrey.a.housman@nasa.gov
  - WMLES & Beyond: Johan Jansson, KTH jjan@kth.se
- **Email the subgroup leader if you are interested in participating**
- **Individuals are welcome to attend these meetings and not submit data**

Nominal Schedule

- **May, 2024**
  - ONERA OAT15A geometry release ✔
- **July, 2024**
  - ONERA OAT15A grids released ✔
  - AVIATION in-person meeting ✔
- **September, 2024**
  - Modified ONERA OAT15A grids released ✔
- **October 31, 2024**
  - ONERA OAT15A RANS data submission deadline ✔
- **November 30, 2024**
  - ONERA OAT15A unsteady data submission initial deadline
- **January, 2025**
  - Mini Workshop 1 (hybrid)
- **Winter, 2025**
  - First look of Test Case 2 grids
- **Fall, 2025**
  - Mini Workshop 2, virtual (???)
- **March, 2026**
  - Delivery of final data set
- **June, 2026**
  - Workshop in San Diego, CA
- **January, 2027**
  - SciTech Special Sessions in Orlando, FL

Buffet Working Group Leadership

- **For questions, please contact** aiaabuffet@gmail.com
- **Working group leadership**
  - Hadar Ben-Gida IL
  - Brent Pomeroy US
  - Daniella Raveh IL
  - Andrea Sansica JP
  - Bret Stanford US
- **Subgroup leaders**
  - Jeff Housman US
  - Johan Jansson SE
  - Fulvio Sartor FR

Upcoming Meetings

- **Subgroup meetings**
  - Monthly cadence with deconflicted meetings
  - All held on Tuesday at 10:00 Eastern time (EST right now)
  - First Tuesday: URANS
  - Second Tuesday: Hybrid RANS/LES
  - Third Tuesday: Buffet Working Group
  - Fourth Tuesday: WMLES & Beyond
- **Buffet Working Group meeting is Tuesday, November 19**
  - Meeting may or may not be held… To be determined

aiaabuffet@gmail.com

Test Case 3 Vision (Optional)

- **Spring, summer, and fall 2025; spring 2026**
- **Unsteady CFD with FSI**
  - CRM wing/body/tail
  - Want to include DPW and AePW communities
  - Committee-supplied wind-off ("jig") geometry
  - Committee-supplied wind-off ("jig") RANS grids
  - Hardest analysis point
- **Simulation plan (as of now)**
  - Extensive analysis, limited flow conditions
  - One alpha pre-buffet (required)
  - One alpha post-buffet (optional)
  - Detailed comparisons to recent JAXA data