

DPW-8/AePW-4

Test Case Summary

Wind Tunnel Test Environment Working Group

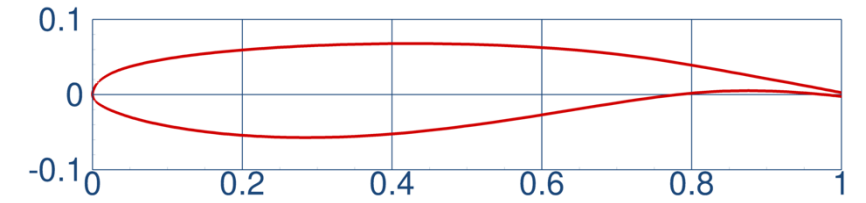
Ben Rider



- **Test Case 1a: ONERA OAT15A Airfoil (Transonic 2D)**
 - Purpose: Workshop-wide assessment of current state of scatter
- **Test Case 2b(S): NASA CRM (Wing/Body + Upper Swept Strut)**
- **Test Case 3b(S): NASA CRM (Wing/Body/Tail + USS)**
 - Purpose: Quantify impact of mounting system on tunnel measurements
- **Test Case 2b(S/T): Wind Tunnel Walls and Strut (Wing/Body + USS)**
- **Test Case 3b(S/T): Wind Tunnel Walls and Strut (Wing/Body/Tail + USS)**
 - Purpose: Quantify impact of walls and test section on tunnel measurements

Test Case 1a: Workshop-Wide Validation

- Validation of steady CFD analysis, required
- Users are encouraged to employ best practices
- **Settings**
 - Steady CFD (e.g., RANS)
 - Prefer some version of SA, multiple turbulence models can be submitted
 - Purely 2D simulations (one cell wide)
- **Grids**
 - Six-member RANS grid family; four are required, six are desirable
 - Encourage use of committee-supplied grids; user-generated grids are acceptable
 - Committee-supplied grid is one cell wide with a 230mm chord (same as experiment) and follows RANS best practices
- **Conditions**
 - Mach 0.73, $Re_c=3m$ (based on chord length), $T_{static}= 271$ K (487.8 R)
 - Alpha: 1.36, 1.50, 2.50, 3.00, 3.10

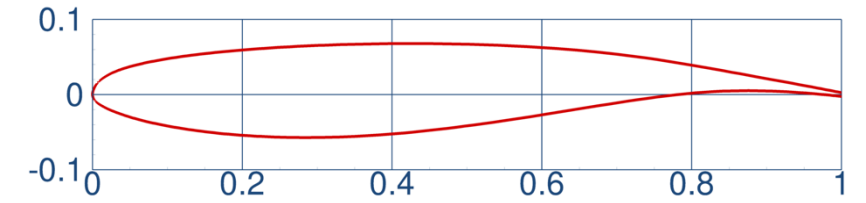


ONERA OAT15A Transonic Airfoil

Jaquin, et al. "Experimental Study of Shock Oscillation over a Transonic Supercritical Profiles." AIAA Journal, Vol. 47, No. 9, 2009. Pages 1985-1994.

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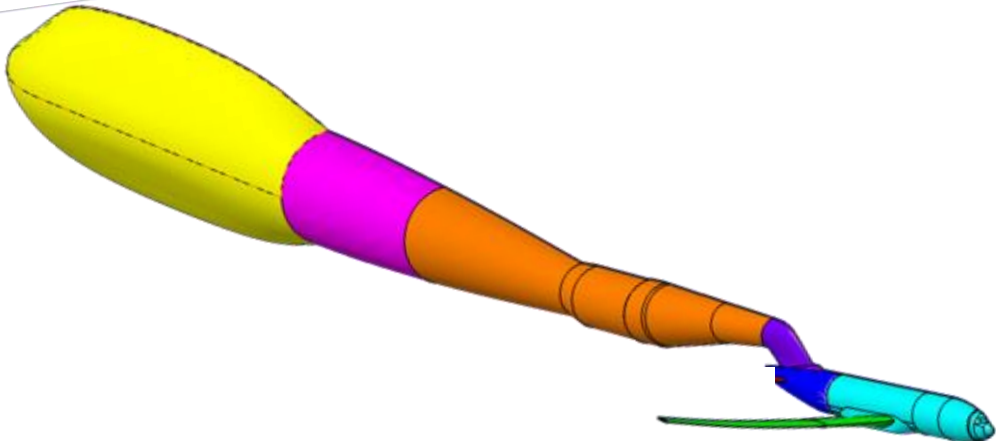
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Test Case 2b(S): T&I Study (Wing/Body)



- CRM Wing/Body with Upper Swept Strut

- 1. Wing/Body (2.7% model scale in tunnel)
- 2. Wing/Body + Upper Swept Strut
 - Wing deformed to matching condition (from DPW7)
 - Aft strut surface (shown in yellow) replaces interface to arc sector



- Geometry

- https://commonresearchmodel.larc.nasa.gov/wp-content/uploads/sites/7/2025/07/DPW-7_WBT_IGES_in_low_q.zip
- https://dpw.larc.nasa.gov/DPW8/Test_Environment/Test_Case_1/Geometry/Sting_No_Arc_Sector_Bulb_noRotation_2025_09_03.igs

- Conditions & Reference Units

Mach	Re _c	T _{static} (120° F)	α
0.85	5 × 10 ⁶	579.67 R 322.04 K	−1.50°, 0.00°, 1.50°, 2.50°, 2.75°, 3.00°, 3.25°, 3.50°, 3.75°, 4.00°, 4.25°

Sref (semi-span grid)	Cref	Semispan	Moment Center
216.77544 sq.in	7.5195 in	31.23225 in	(156.0003, 0.00, -0.00035)

- Comparison metrics

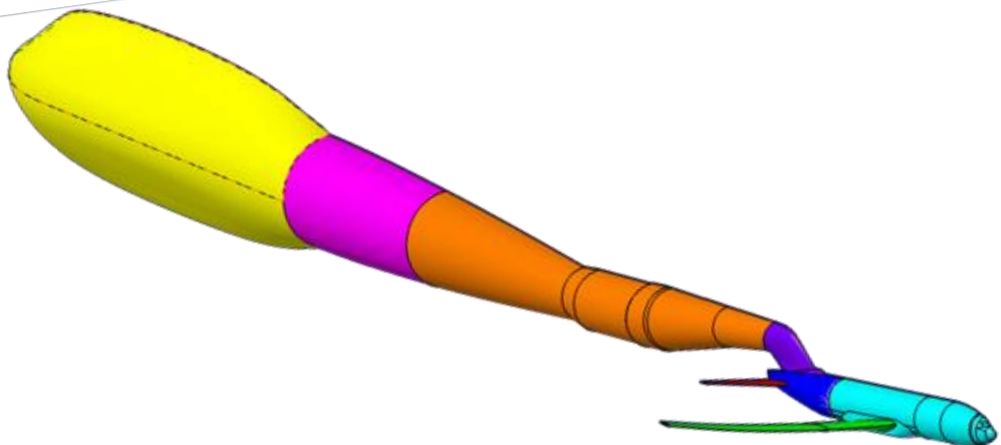
- Forces / Moments
- Sectional C_p distribution
- Residuals (Flow & Structural Solver)

Test Case 3b(S): T&I Study (Wing/Body)



- CRM Wing/Body with Upper Swept Strut

1. Wing/Body/Horizontal Tail (2.7% model scale in tunnel)
2. Wing/Body/Horizontal Tail + Upper Swept Strut
 - Wing deformed to matching condition (from DPW7)
 - Aft strut surface (shown in yellow) replaces interface to arc sector



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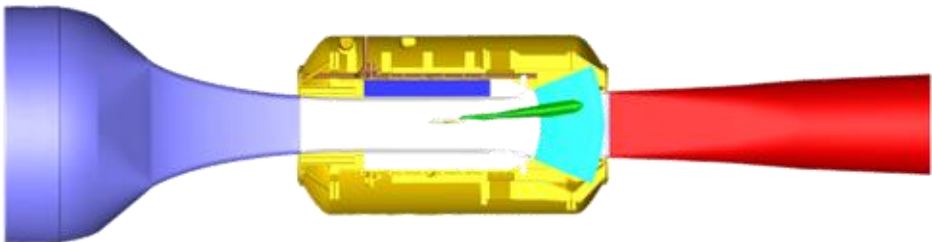
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Test Case 2b(S/T): Tunnel Study (Wing/Body)



- CRM Wing/Body with USS and Tunnel Walls

- 1. Wing/Body (2.7% model scale in tunnel)
- 2. Wing/Body + Upper Swept Strut + Tunnel Geometry
 - Wing deformed to matching condition (from DPW7)
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