Architecture, Scope, and Goals of the Multidisciplinary DPW-8/AePW-4 Workshop

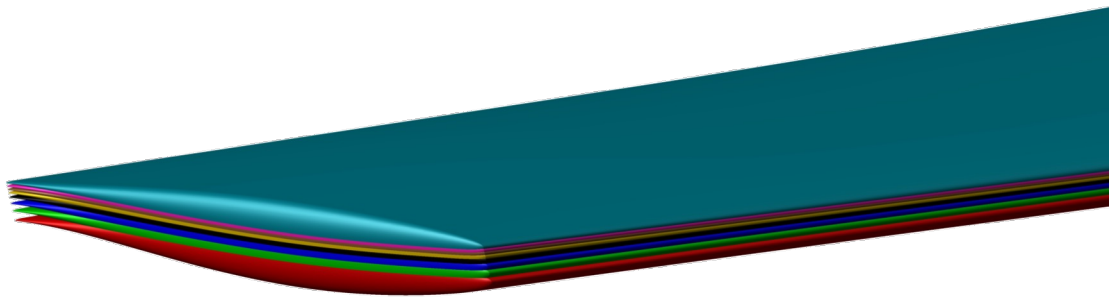
Brent Pomeroy
Configuration Aerodynamics Branch
NASA Langley Research Center

Bret Stanford and Pawel Chwalowski
Aeroelasticity Branch
NASA Langley Research Center

Ben Rider
High-Speed Aerodynamics
Boeing Commercial Airplanes Flight Sciences

Background

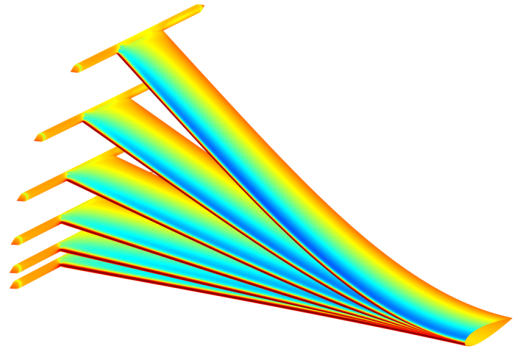
- **Next generation of computational goals is highly multidisciplinary**
  - CFD 2030 highlights edge-of-the-envelope technology needs
  - Knowledge exists in various fields, but lessons learned remain isolated
  - Identifies the need for collaboration via symbiotic partnerships
- **Workshop Collaboration Working Group**
  - Chartered by Applied Aero TC (2022)
  - Assembled four individuals for a key interdisciplinary organizing committee
  - Panels, presentations, and meetings provided a forum to continue conversations
  - Hallway conversations led to DPW/AePW collaboration
- **SciTech 2024 kickoff meeting**

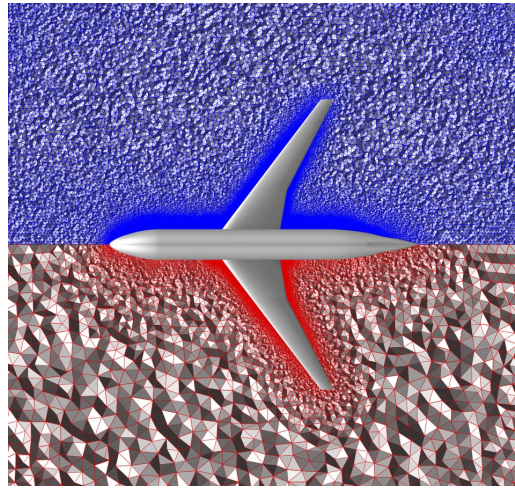


Experimentally determined lofts from DPW-VII

Community Symbiotic Relationship

- **Strengths in communities**
  - DPW: high-fidelity, transonic CFD including steady and unsteady schemes
  - AePW: multifidelity steady and unsteady aeroelastic computations, including structural and aerodynamic nonlinearities
- **Opportunities for growth**
  - DPW: increased fidelity aeroelastic methods
  - AePW: increased geometric complexity and aerodynamic models
- **Workshop scope**
  - Mature each community's state-of-the art
  - Enable multidisciplinary technical advances to improve the cutting edge and foster cross-pollination
  - Develop multidisciplinary workshop model
- **Selected a working-group model**





Workshop Leadership Global Presence

Source: OpenStreetMap
Open source, subject to Open Database License

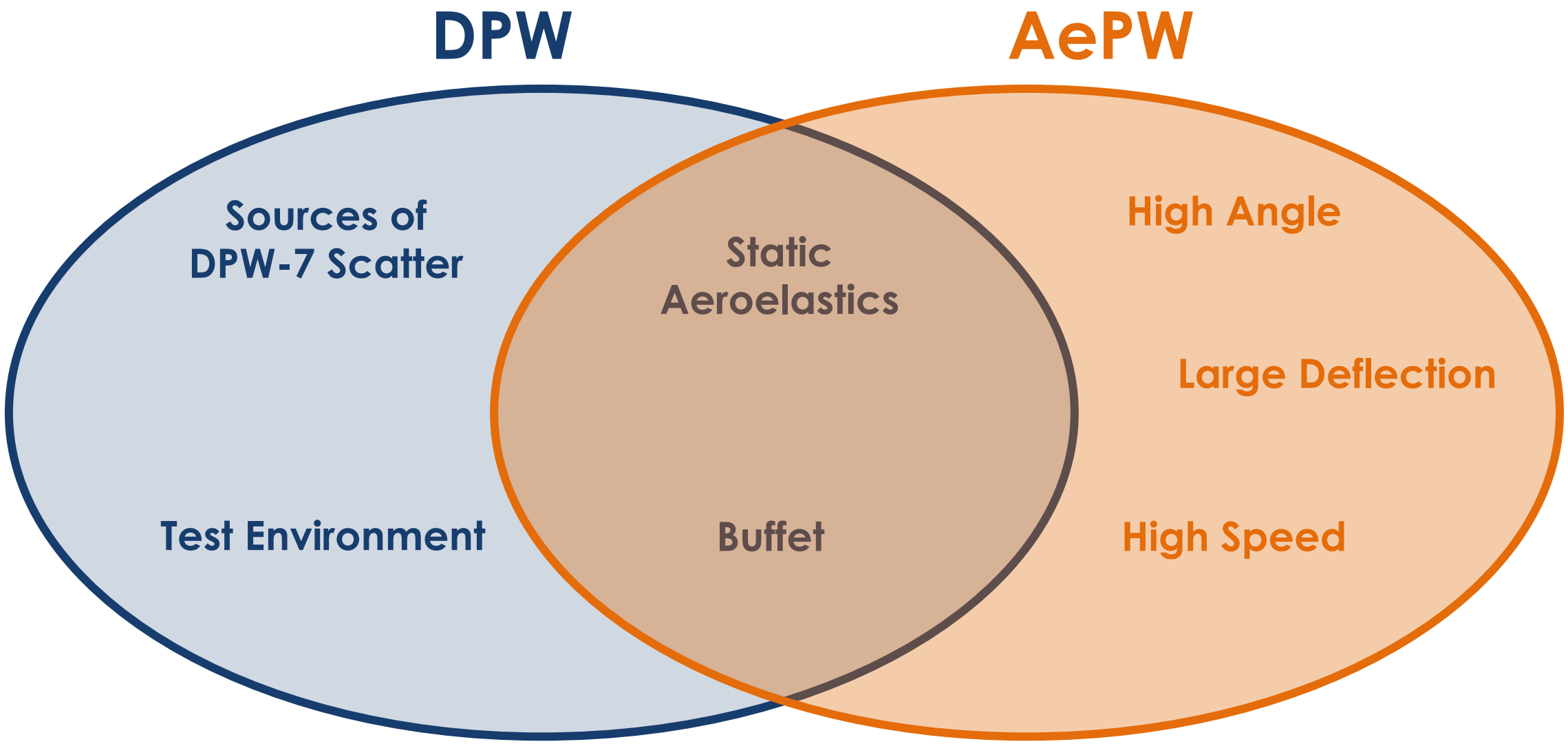
Organizing Committees

- **Interdisciplinary**
  - Pawel Chwalowski, US
  - Brent Pomeroy, US
  - Ben Rider, US
  - Bret Stanford, US

- **AePW**
  - Kirk Brouwer, US
  - Carlos Cesnik, US
  - Pawel Chwalowski, US
  - Adam Jirasek, US
  - Jeff Ouellette, US
  - Rafael Palacios, UK
  - Daniella Raveh, Israel
  - Markus Ritter, Germany
  - Walt Silva, US
  - Bret Stanford, US

- **DPW**
  - Hadar Ben-Gida, Israel
  - Seth Kelly, US
  - Stefan Keye, Germany
  - Mitsuhiro Murayama, Japan
  - Raj Nangia, UK
  - Ilias Petropoulos, France
  - Brent Pomeroy, US
  - Andrea Sansica, Japan
  - Ben Rider, US
  - Melissa Rivers, US
  - Ed Tinoco, US
  - Chris Toomer, UK
  - John Vassberg, US

Working Groups Layout

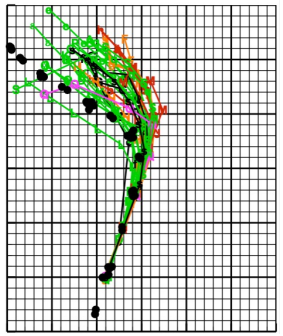


Scheduling

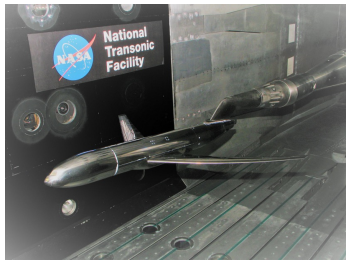
- **Deconflicted seven working groups recurring meeting time**
  - Settled on a least-bad meeting time for all time zones
  - Bi-weekly or monthly cadence
  - Some groups alternate time every-other meeting
- **Working group leadership entrusted with scoping group's efforts**
- **Buffet Working Group further segmented**
  - Subgroups selected by scheme
  - Three groups meet during the month, one asynchronous (email) group

Community-Centric Working Group Goals

- **Sources of DPW-7 Scatter**
  - Increase understanding and quantify expectations for comparisons between CFD and measured wind tunnel "truth"

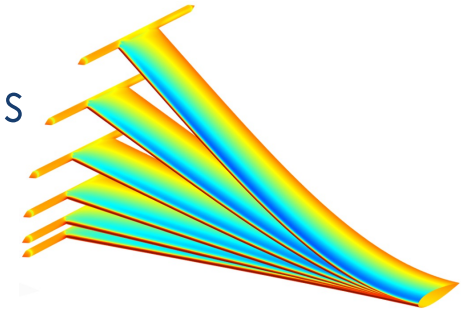


- **Test Environment**
  - Resolve differences between free-air CFD and the test environment

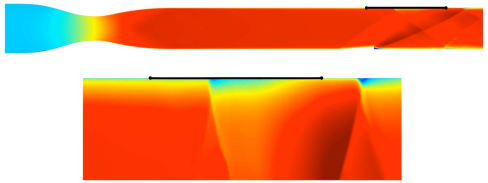


- **High Angle**
  - Improve flutter predictions in the transonic region using a variety of CFD models

- **Large Deflection**
  - Mature predictions for low-speed deformations with nonlinear stiffness

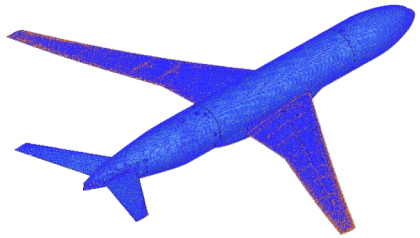


- **High Speed**
  - Advance predictions of supersonic fluid structure interactions

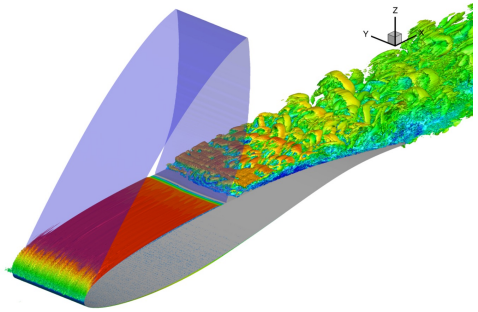


Hybrid/Intersectional Working Group Goals

- **Static Deformation**
  - Determine accuracy and uncertainty of transonic, center-of-the-envelope wing calculations



- **Buffet**
  - Establish state of the art and identify opportunities for improvement of transonic, high-alpha unsteady CFD and unsteady coupled FSI



Working Group Scope Development

- **Establish key questions to be answered**
  - Three working groups continued from previous workshops
  - Two working groups were direct fallout from workshop lessons learned
  - Two hybrid working groups are new
- **Engage students and low-computational-capacity contributors**
  - Coarsest simulations scoped to run on a laptop
  - Short-term Tecplot licenses available to students

Workshop Structure

- **Two-day, pre-conference workshop at AVIATION ‘26**
- **First day**
  - Community centric in two separate rooms
  - Technical lessons learned
  - Future plans
- **Second day**
  - Everyone together
  - Hybrid groups
  - Workshop lessons learned
  - Future plans
- **Potential plans**
  - Miniature expo
  - Student poster session

Organizing Committees Lessons Learned

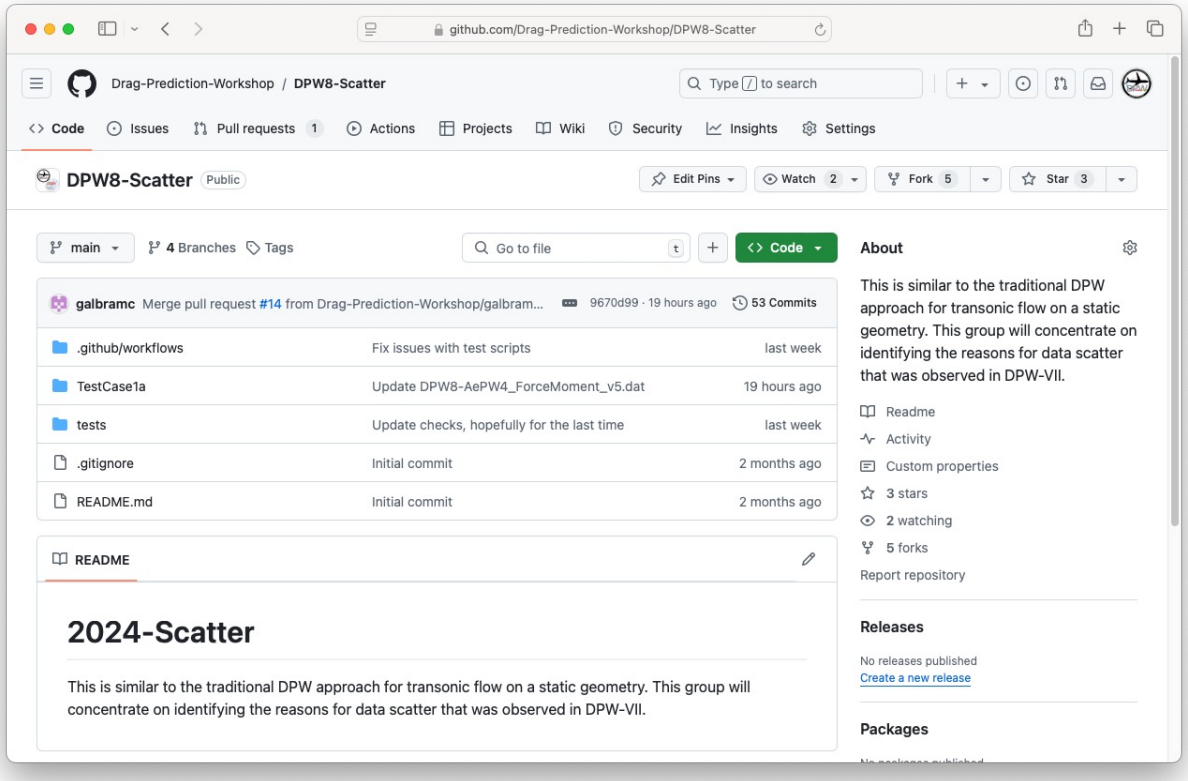
- **Organizing committee formulation is key**
  - Interdisciplinary Organizing Committee
  - DPW Organizing Committee
  - AePW Organizing Committee
  - Working Group Organizing Committees
- **Clear, consistent communication is key**
  - Interdisciplinary OC members also attending community-centric meetings
  - Development of the key questions is encouraged to support a central theme
  - Consistent touch-base communication and meetings

Enabling Cross Pollination

- **Quarterly workshop-wide tagups**
  - Workshop overview provides insight into all working groups
  - Technical scope and updates from all working groups
  - Provides opportunity for follow-on Q&A
  - Encourages individuals to engage with opposite-community working groups
- **Hybrid working groups**
  - Empower working group leaders to develop key questions under workshop scope
  - Collaborative effort between communities to formulate the group's goals
  - Identify strengths and weakness of community simulation methods and establish opportunities for multidisciplinary advancements
  - Strong presence from both DPW and AePW communities

GitHub Repository

- **One stop shop for four working groups data submission**
  - Improves version control
  - Ensures all committee members are analyzing the most recent data
  - Responsibility lies with participants to ensure data are up to date
- **Public and outward-facing**
- **Automatic checks ensure files are in the appropriate format**



Next Steps

- **Multiple special sessions at AVIATION highlight group progress to date**
  - Committee presentations
  - High-Speed AePW Working Group
  - Buffet DPW/AePW Working Group
  - High-Angle and Large Deflection AePW Working Groups
- **Mini workshop scheduled for SciTech (as a panel session, open to all)**
- **Full workshop at AVIATION next year**

Questions?

https://www.aiaa-dpw.org

https://nescacademy.nasa.gov/workshops/AePW4/public