



Boeing Perspective on the CFD Grand Challenges

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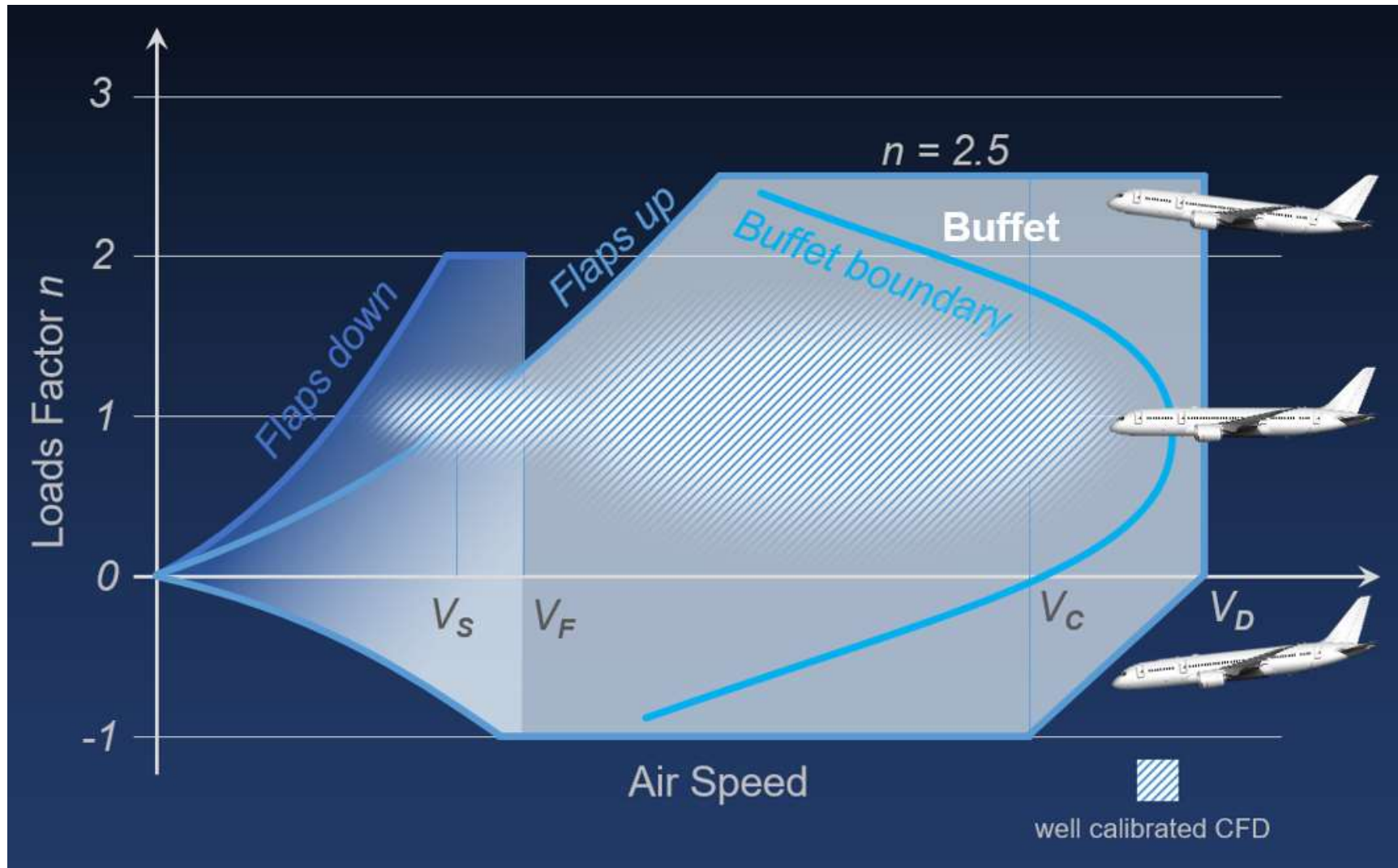
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The Boeing Company

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CFD for the full flight envelope is essential for improved product development



Grand Challenges accelerate technology development

Advancing High Lift Aerodynamic Prediction

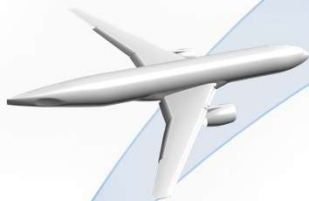
Series of Technical Challenges

Focus on key technical obstacles for specific time periods to make progress towards solving the grand challenge

Ground-Based Experimental Testing

FLOW PHYSICS PREDICTION

Sub-Challenge #1 1-3 years



Representative WT Geometry

Landing/TO configuration + nacelle/pylon
Re effects (atmospheric, pressurized, cryogenic environments)
Interactional flow physics (separation, vortex flow)
Static aeroelastics

CFD-generated data compared to WT data

Sub-Challenge #2 3-6 years



Representative WT Geometry

S&C (tail/control surfaces/trim)
Cross-flow effects
Acoustics (landing gear)
Engine propulsion effects
Ice effects

CFD-generated data compared to WT data

Sub-Challenge #3 6-10+ years

LOW-SPEED STALL SPEED DETERMINATION

NASA G-III*



NASA AirSTAR*



Generic Flight Vehicle

Sub- or full-scale flight geometry
Flight Re
Steady flight
Basic maneuver
Dynamic structural response

CFD-generated data compared with flight-derived data

* Potential flight test vehicle configuration

Grand Challenge 15+ years

LOW-SPEED WIND-UP TURN



Generic Flight Vehicle

Full scale flight geometry
Flight Re
Dynamic, maneuvering flight
Dynamic structural/system response
Environmental effects
Engine power effects

CFD-based flight simulation (flight test used to verify flight simulation)

High Lift Common Research Model Ecosystem



Decision Gate From CFD Vision 2030 *with modifications*

