

Overset Applications at NASA JSC

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Presentation Outline

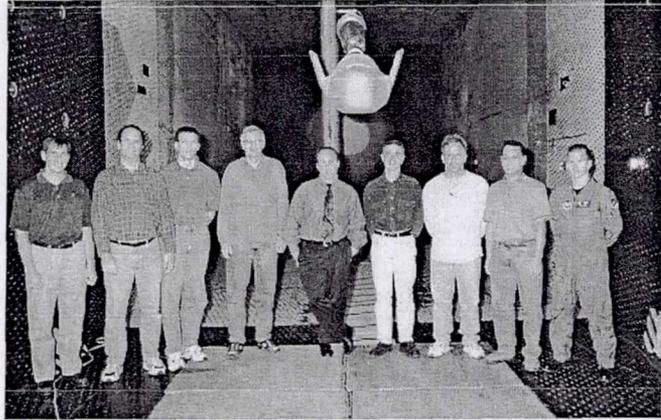
Recent applications

- X-38
 - “As-built” geometry – V131R analysis
 - High-fidelity geometry – Model G analysis
 - Aero-heating
- Aerodynamic Research Facility (ARF)
Wind Tunnel Simulations
 - Separation aerodynamics

Future plans

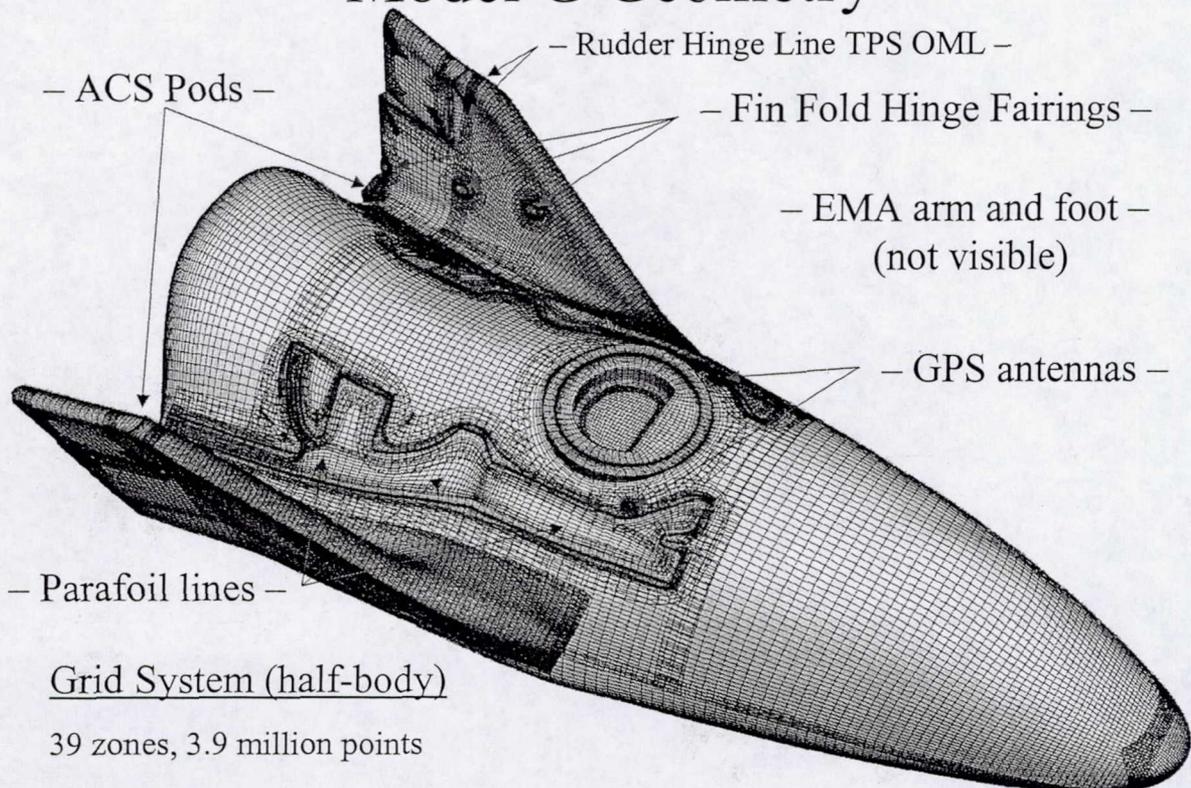
X-38 Model G

- Background
 - Design evolution → detailed surface geometry
 - Major transonic wind tunnel test (WTT) at the Arnold Engineering and Development Center 16' transonic tunnel (AEDC 16T) in Tullahoma, TN
- CFD Analysis
 - Grids built on same CAD as WT Model
 - Results obtained using OVERFLOW
 - CFD data was compared to AEDC's balance and pressure sensitive paint (PSP) data



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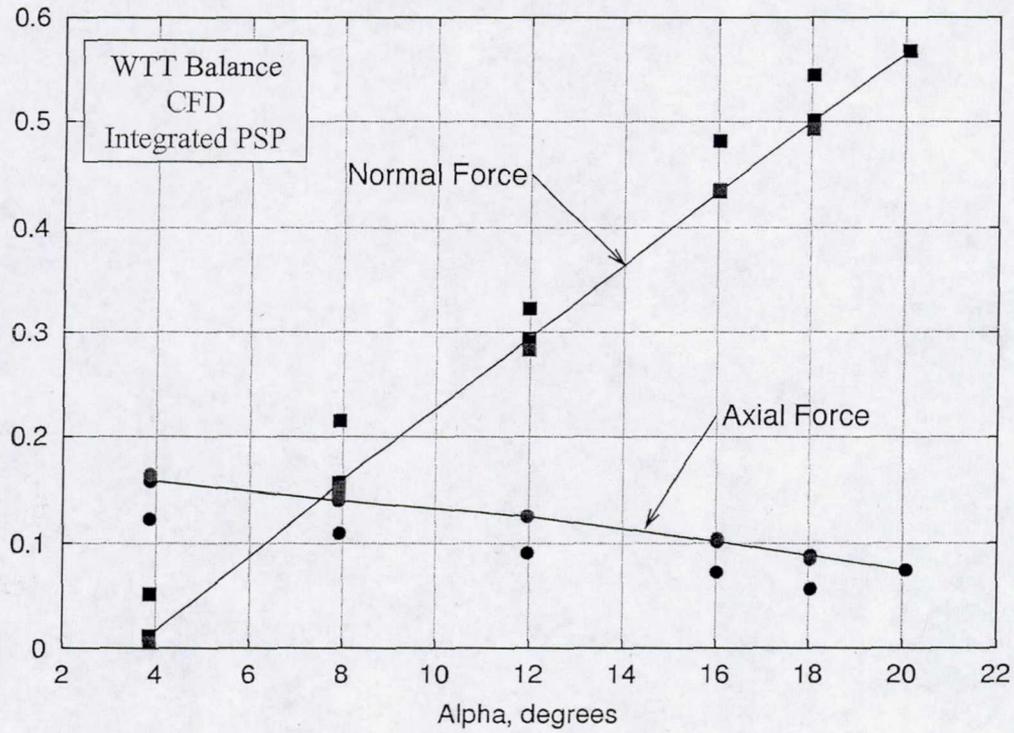
Model G Geometry



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AEDC 16T Comparison

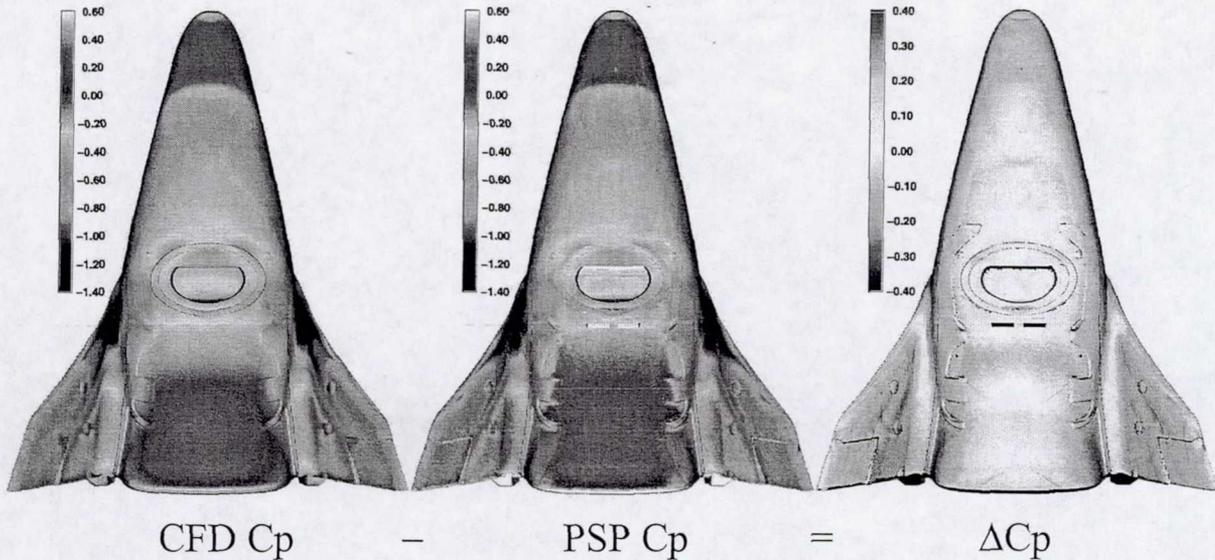
Mach 0.6, Flap = 20°, Rudder = 0°



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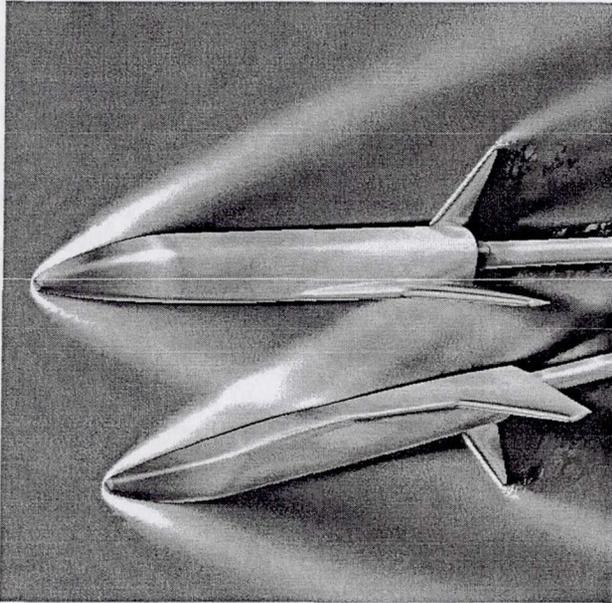
PSP vs. CFD

Mach 0.95, Alpha 16°, Beta 0°, Flap 20°, Rudder 0°



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MSFC ARF Wind Tunnel Simulations



Flow Solver: OVERFLOW
Freestream: Mach 2.99, $\alpha = 0^\circ$
Booster: $\delta \alpha = 5.123^\circ$
 $\delta x = 0.2/L_{ref}$
 $\delta z = 0.15/L_{ref}$
Log(pressure) on surface
Log(density) in symmetry plane

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Future Plans

- Multiple body simulations
 - Both static and dynamic (OVERFLOW 2.0)
 - Requires good geometry definition, automated control surface movement, scripting, etc.
 - Currently working on automated control surface movements for shuttle
- Addition of chemistry to OVERFLOW
 - Have added equilibrium air to OVERFLOW
 - In the process of validating (shuttle, HALIS test case)

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