

Comparison and Validation of Vortex Lattice Aerodynamic Analysis for the Learjet 24

Curtis Scholz & Andrew Hahn

ASAB

Systems Analysis and Concepts Directorate

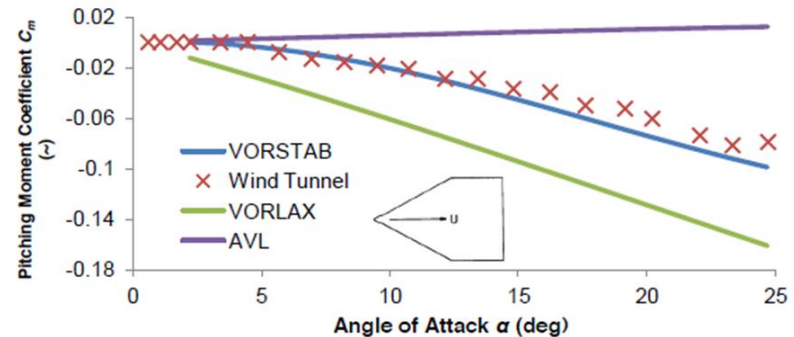
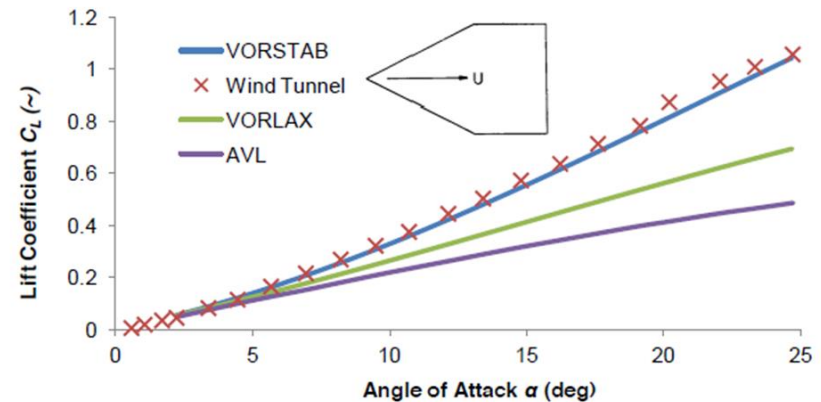
08/06/2014

Caveats

- ❖ This was done by a summer student over a few weeks.
- ❖ Results are to be considered to be preliminary.
- ❖ VSPaero is still in development and is at an Alpha state.
 - ✧ Curtis' work, along with 5 other students stress tested VSPaero, providing excellent feedback to the developer.

Motivation for Research

❖ Aerodynamic analysis performed by the Georgia Tech team competing in the AIAA Design, Build, Fly competition indicated widely varying accuracy of Vortex Lattice flow solvers.



Measure Drawings for Unknown Parameters (CANVAS or AutoCAD)

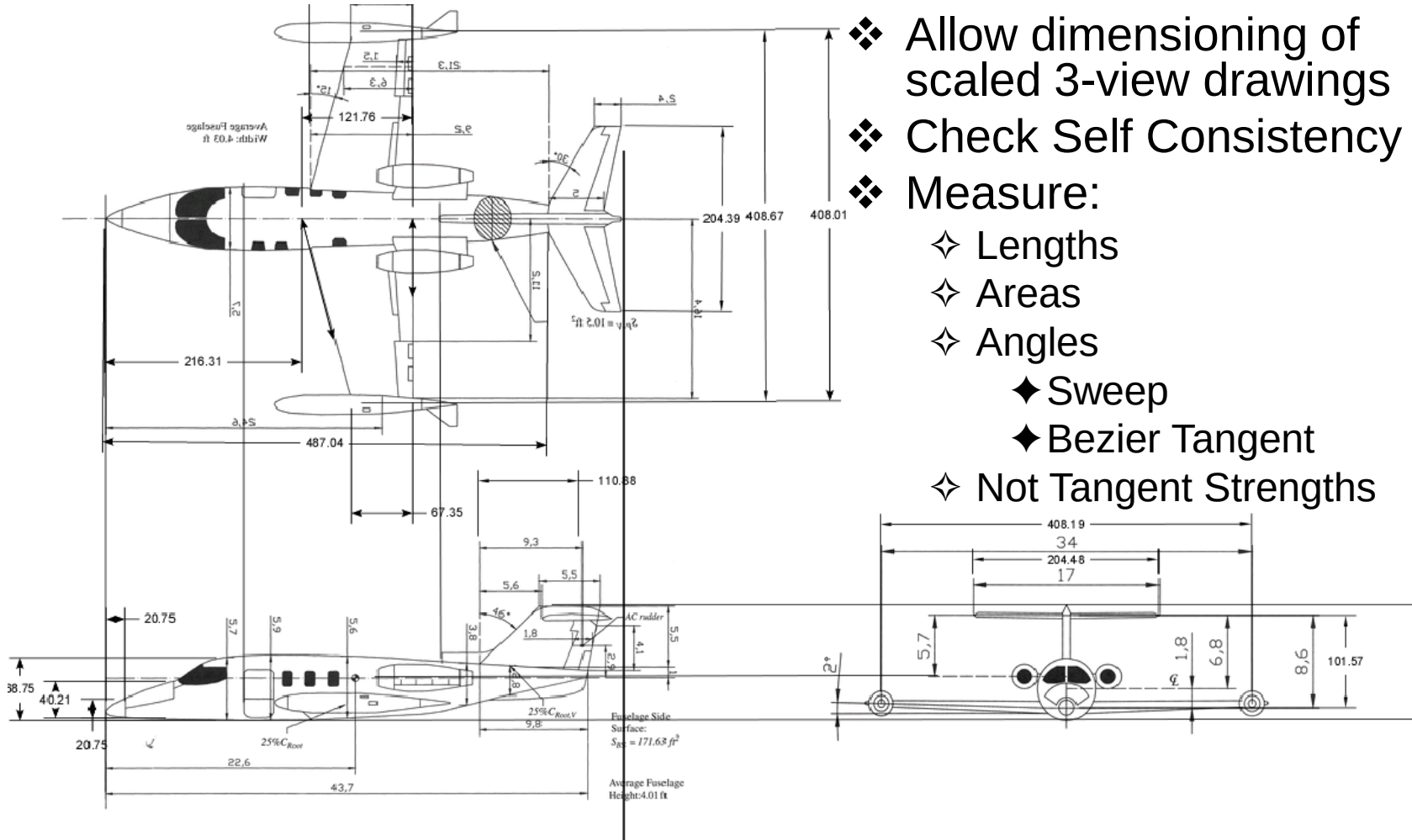
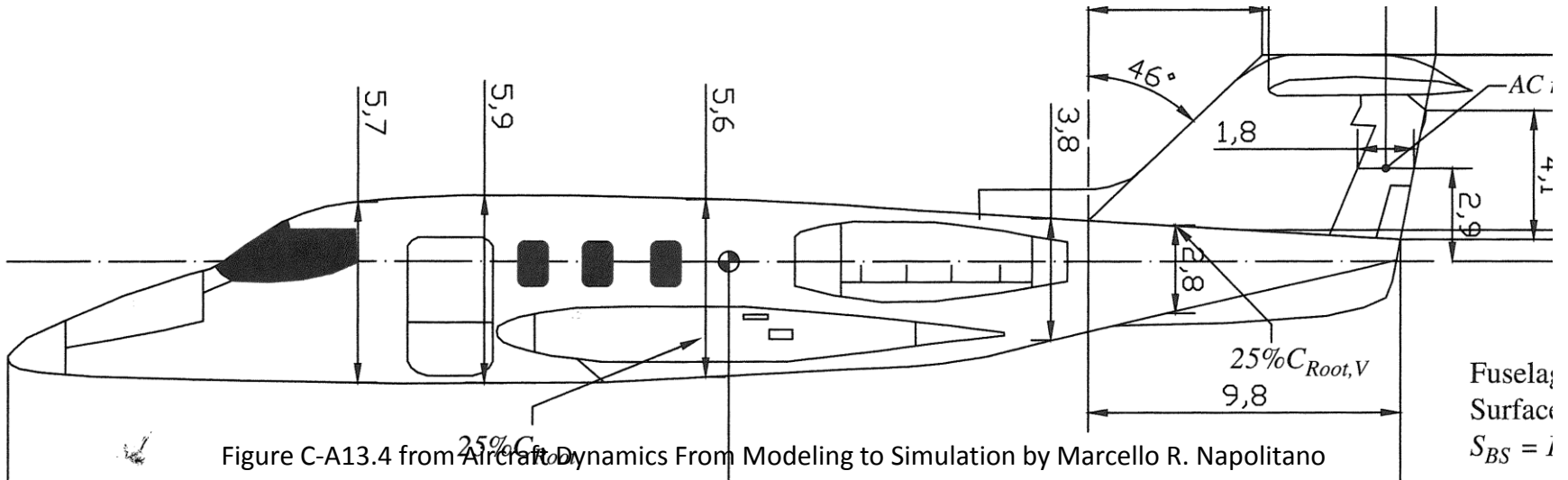
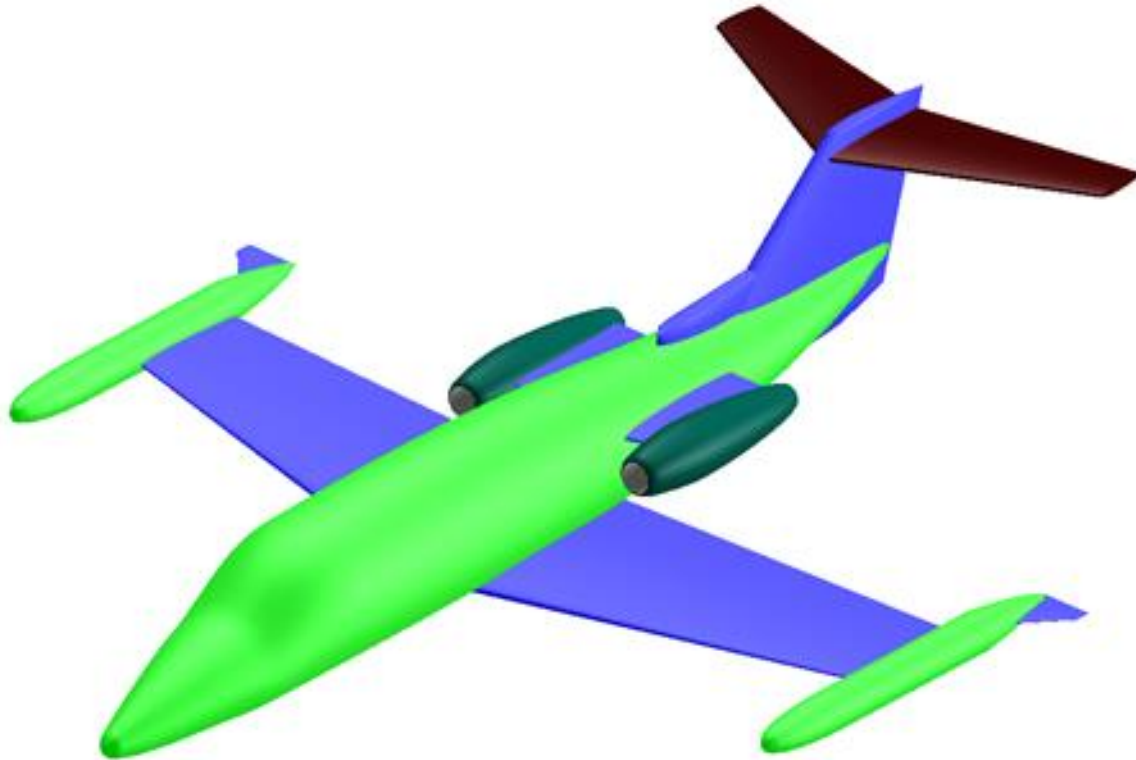


Figure C-A13.2-4 from Aircraft Dynamics From Modeling to Simulation by Marcello R. Napolitano

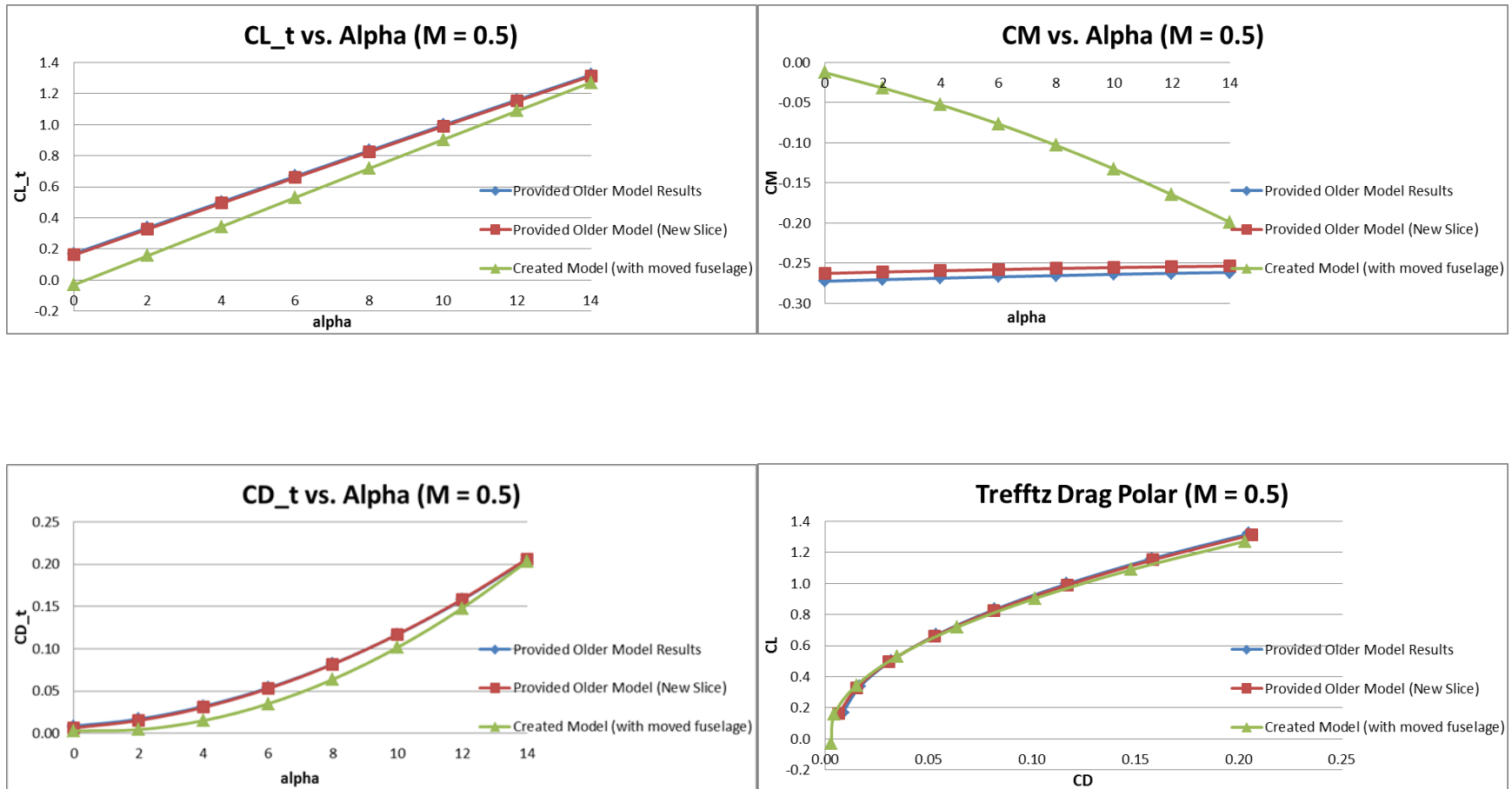
Good Information Is Hard To Come By



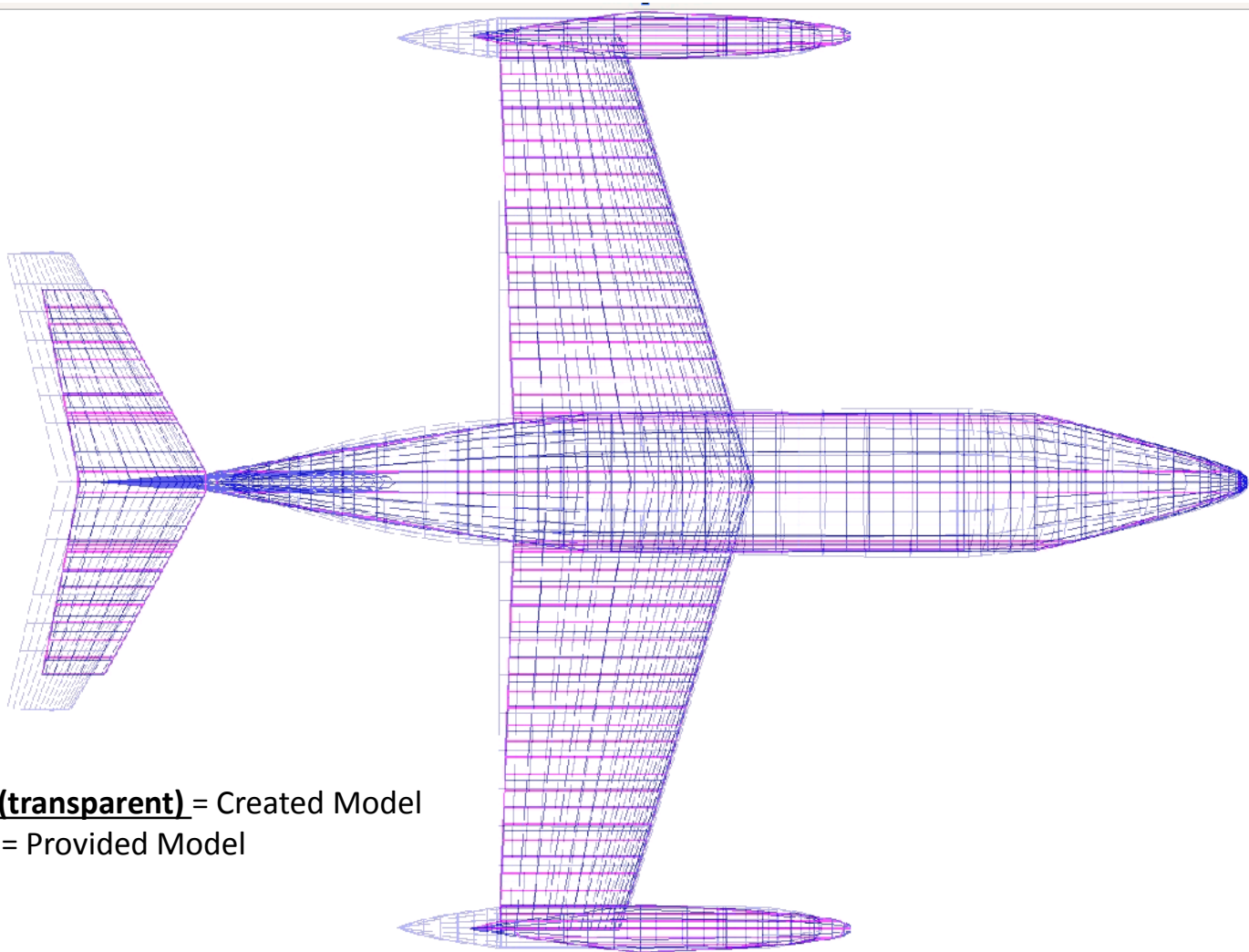
Curtis Scholz's OVSP Learjet 24 Model



VorView Analysis: Model Comparison – Learjet 24



Meta-geometry Comparison – Learjet 24



Background (transparent) = Created Model

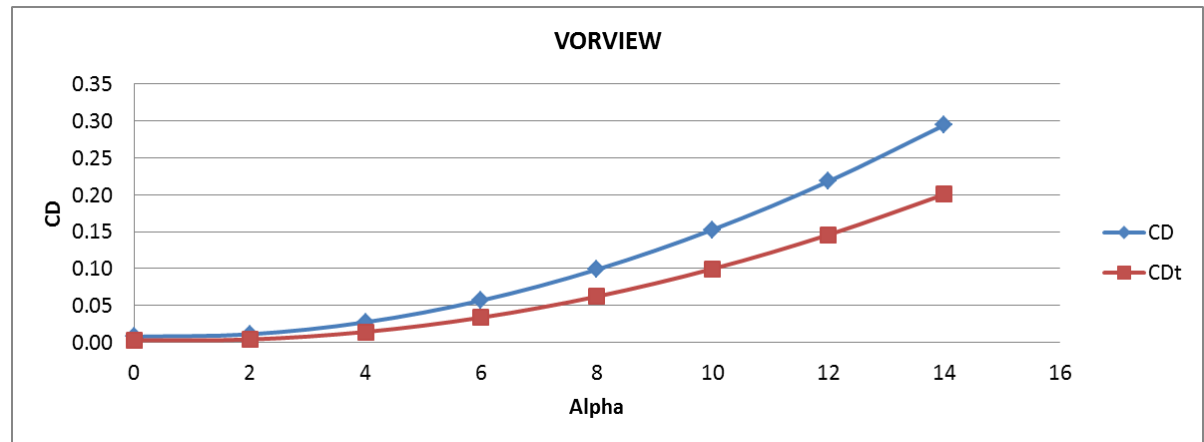
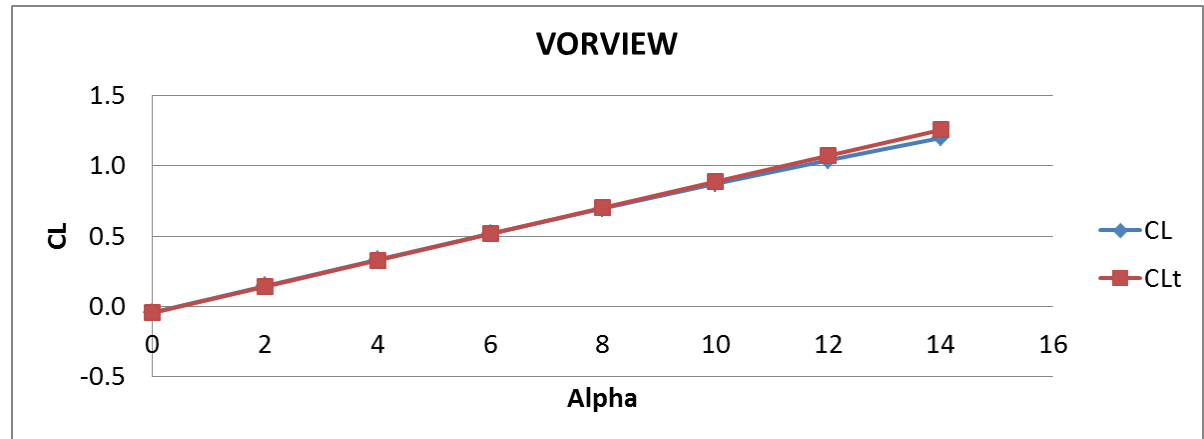
Front (solid) = Provided Model

VorView Analysis: Curtis' Learjet 24

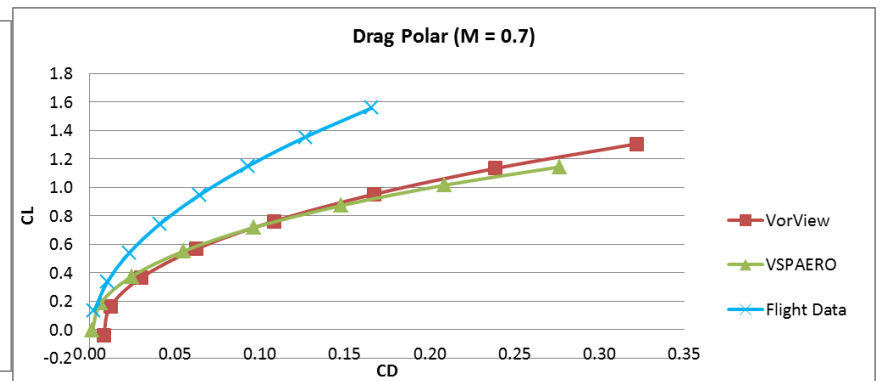
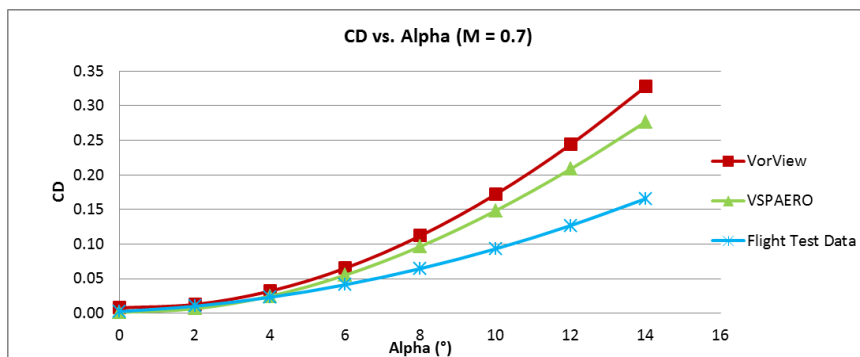
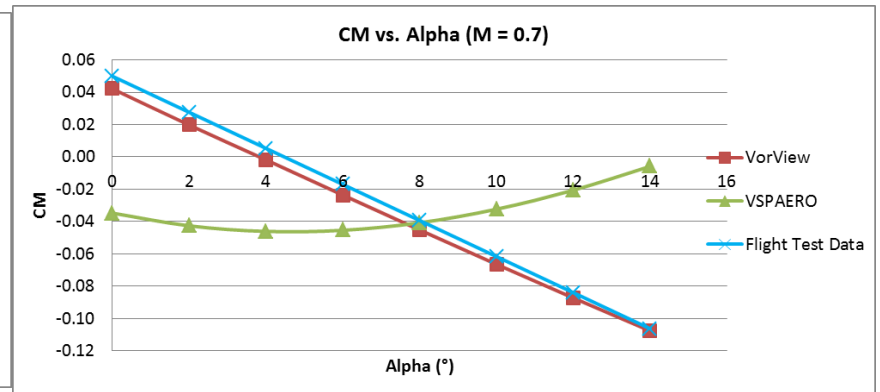
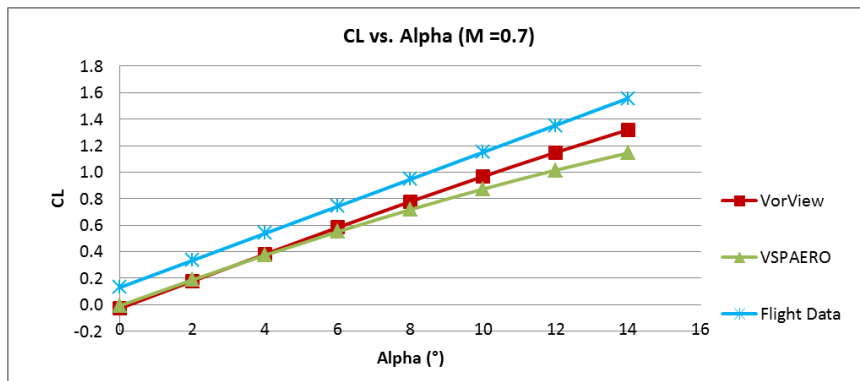
❖ Aerodynamic Coefficients

❖ Surface Pressure Integration

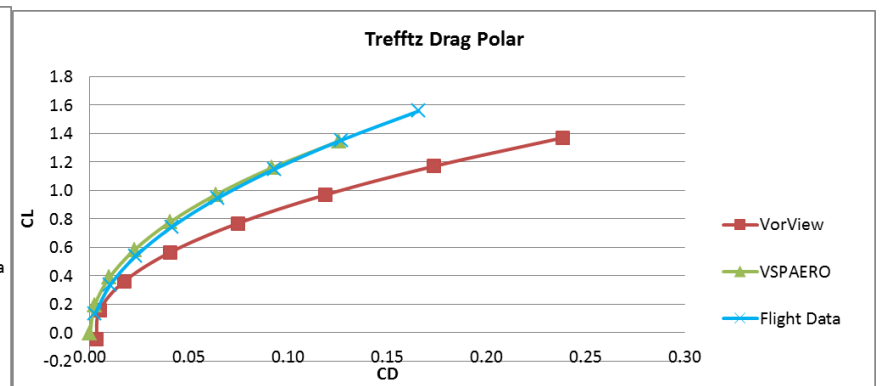
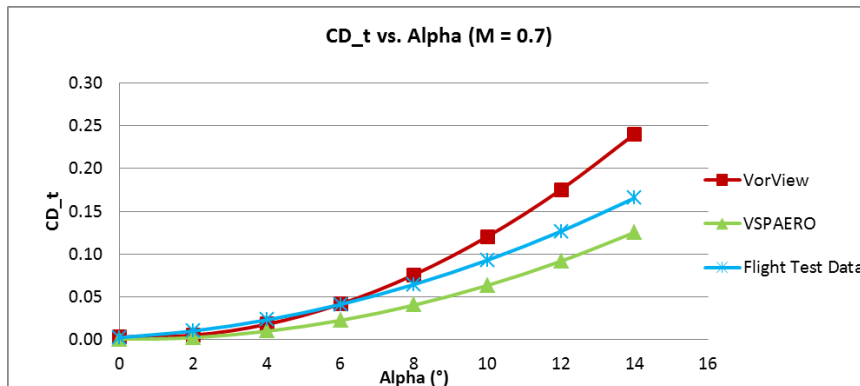
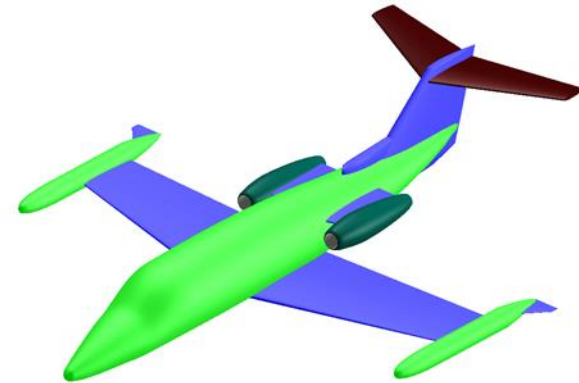
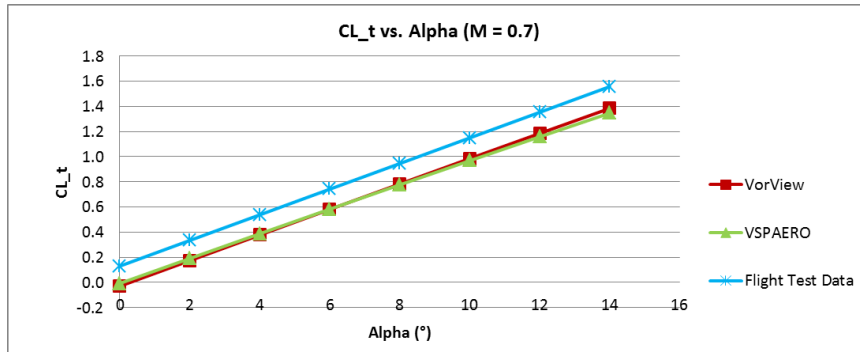
❖ Trefftz Plane Wake Integration



VorView and VSPaero Surface Pressure Integration Validation: Curtis' Learjet 24

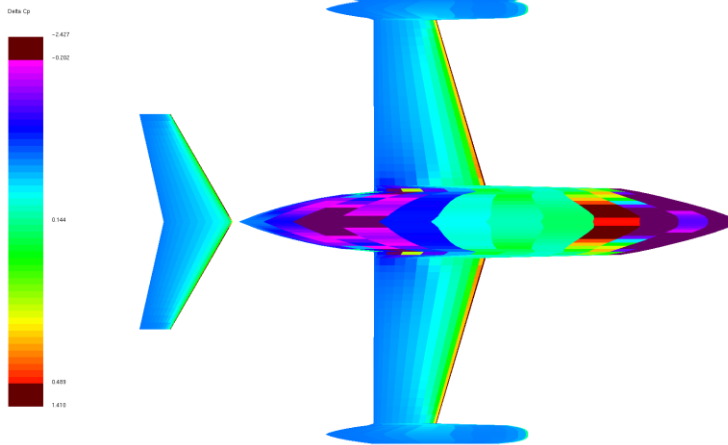


VorView and VSPaero Trefftz Plane Integration Validation: Curtis' Learjet 24

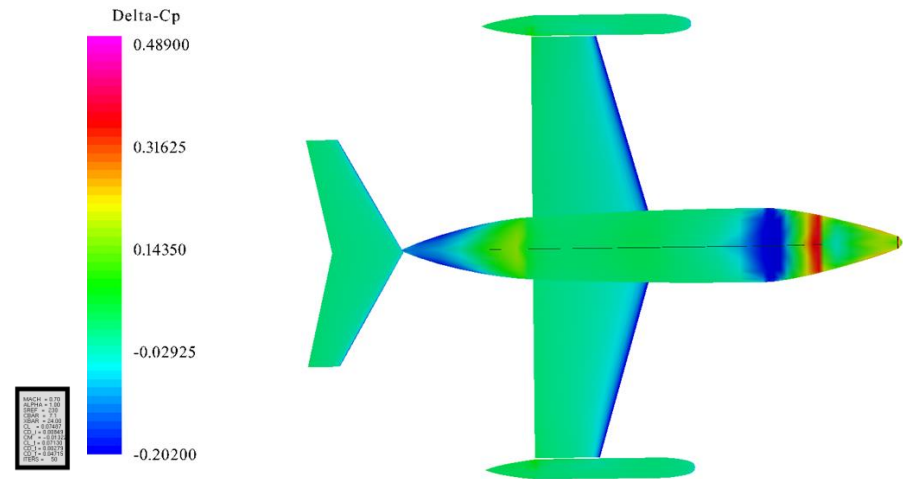


VorView and VSPaero Comparison: Curtis' Learjet 24

VorView



VSPaero



Mach: 0.700, Beta: 0.00000000, Alpha: 1.000

Final Thoughts

- ❖ This exercise provided an excellent learning experience for 6 summer students (modeling and analyzing 9 aircraft total).
- ❖ This exercise provided a base validation suite that we will eventually take through all of the computational aerodynamics tools that we can lay our hands on, through RANS.
- ❖ This exercise provided a stress test for VSPaero that definitely helped to improve it.
- ❖ I still need to review their work, cleaning up and correcting as necessary, but I want to put the end products up on the OpenVSP website to act as guides for the community.
- ❖ My organization needs to understand the cost-benefit ratio of these tools and this exercise was a great start.