

OVERFLOW Simulations of Space Shuttle Orbiter Reentry Based on As-Built Geometry

Edward C Ma¹

Jabobs Technology, Houston, Texas, 77058

Darby J Vicker² and Charles H. Campbell³

NASA Johnson Space Center, Houston, Texas, 77058

Brad Wilson⁴ and Mike Pavsek⁵

United Space Alliance, Kennedy Space Center, Titusville, Florida 32780

Karen Berger⁶

NASA Langley Research Center, Hampton, Virginia, 23681

I. Abstract/Summary

The Space Shuttle Orbiters Discovery and Endeavor have been digitally scanned to obtain outer mold line surfaces. Using these scans, the existing overset computational fluid dynamics (CFD) grid system will be modified by projecting the grid points to the scanned geometry. Simulations will be performed using the OVERFLOW solver and the results compared to previous OVERFLOW results on the theoretical geometry and the aerodynamic databook. The “bent airframe” term will be compared between the aerodynamic databook and the computations over a range of reentry conditions.

¹ Aerospace Engineer, Applied Aeroscience and CFD Branch, M/C EG3, NASA Rd #1.

² Aerospace Engineer, Applied Aeroscience and CFD Branch, M/C EG3, NASA Rd #1, and AIAA Member.

³ Aerospace Engineer, Applied Aeroscience and CFD Branch, M/C EG3, NASA Rd #1, and Associate Fellow.

⁴ Aerospace Engineer, Aerothermodynamics Branch, MX 408A, 16 Victory Street, and Senior Member.

⁵ Precision Measurement Engineering Lead, Optical Alignment/Field Metrology, USK-C52, 1102 John Glen Blvd.

⁶ Aerospace Engineer, Aerothermodynamics Branch, MS 408A, and Senior Member.

II. Preliminary Orbiter Digital OML Surface Images

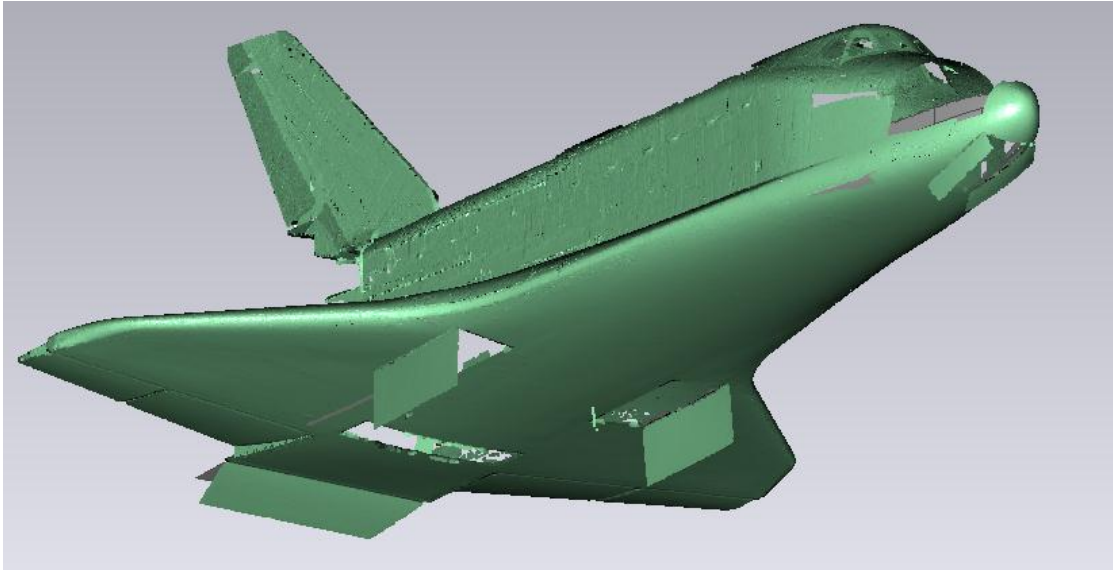
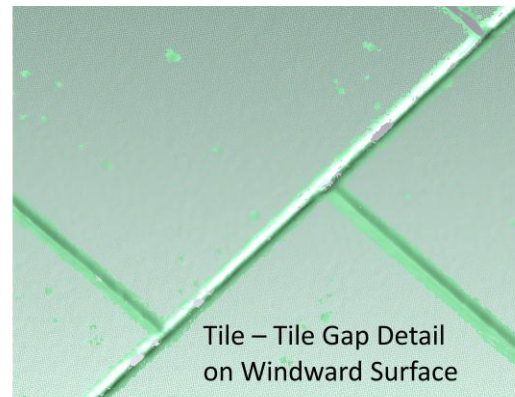


Figure 1. Digital Outer Mold Line surface isometric view of *Endeavor* with gear doors open.



Tile Detail on
Windward Surface



Tile - Tile Gap Detail
on Windward Surface

Figure 2. OML surface detail images depicting several tiles, and tile to tile step and gap region.

Acknowledgments

These activities have been the result of interactions between the Orbiter Boundary Layer Transition Flight Experiment team at United Space Alliance in Houston and Cape Canaveral, NASA personnel at Johnson Space Center and Langley Research Center and, individuals from Boeing in Houston, Cape Canaveral and Huntington Beach. Resources supporting this effort have been provided by the Space Shuttle Program, the Space Shuttle Transition and Retirement Project and the NASA Engineering & Safety Center. Complementary efforts by the Library of Congress to develop a historical reference for *Discovery* as a 'vehicle of record' have also facilitated dialogue to generate digital scans of Space Shuttle vehicle and ground processing facilities.