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# ***Generation of Aerothermal Databases for the Orion Multi-Purpose Crew Vehicle using Computational Fluid Dynamics***

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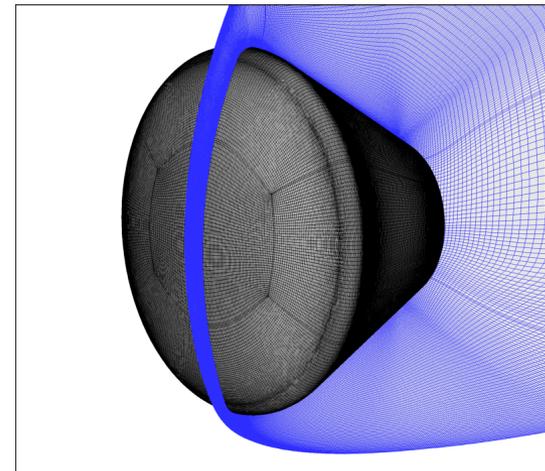
UC Davis NASA Orion Day  
April 29, 2015



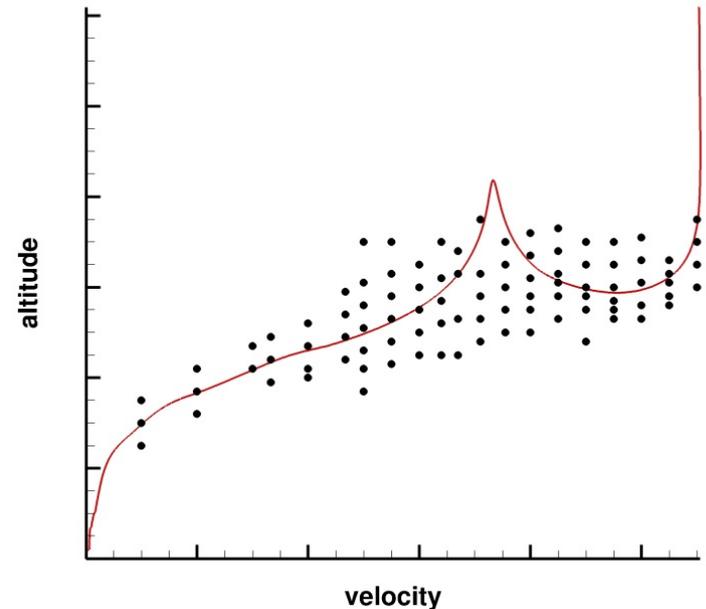
# *What is Computational Fluid Dynamics?*



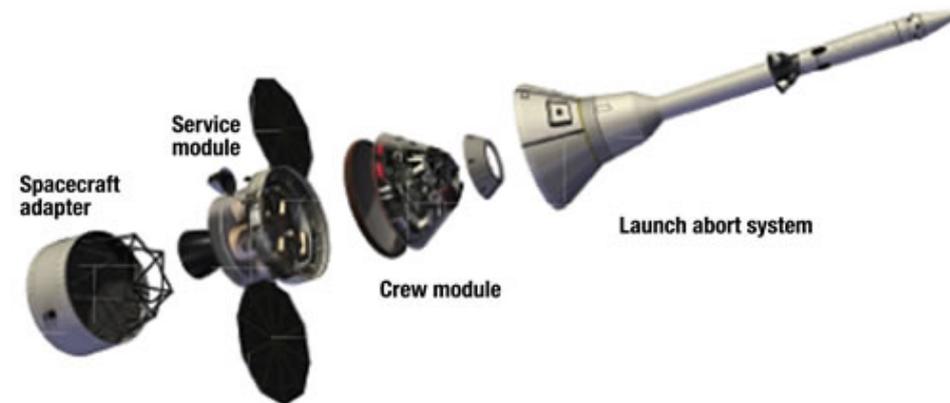
- **Computational Fluid Dynamics (CFD) uses numerical methods to analyze problems involving fluid flow and heat transfer**
- **Supercomputers are used to simulate the interaction of fluid flowing over an object**
- **Simulation solves the conservation laws (mass, momentum, and energy) on a discretized domain**
- **Numerical solutions complement ground-based and flight tests**



- During re-entry, the heating on the Orion MPCV depends on: vehicle geometry, vehicle orientation, entry conditions, ...
- Hundreds of *DPLR* simulations are computed to estimate the aerothermal environment for a wide range of flight conditions
- These high fidelity solutions are used by the *CBAERO* code to create aerothermal databases
- Databases are used to select the type of Thermal Protection System (TPS) material and thickness of TPS

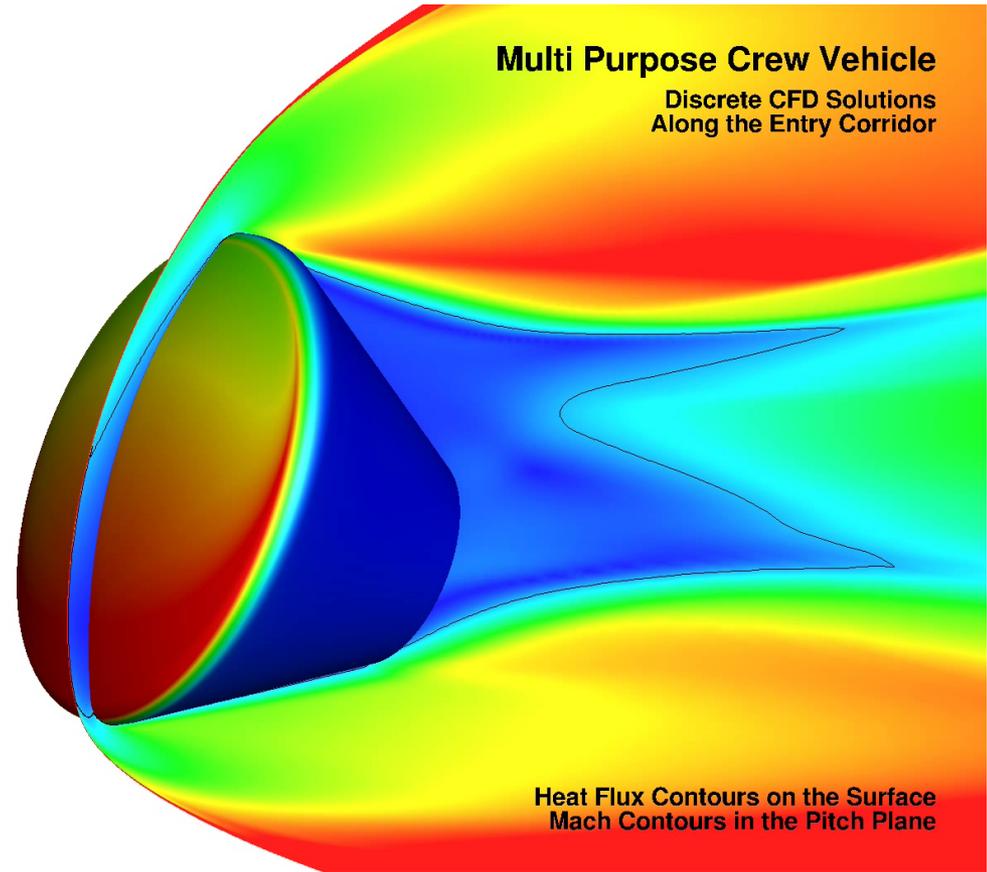


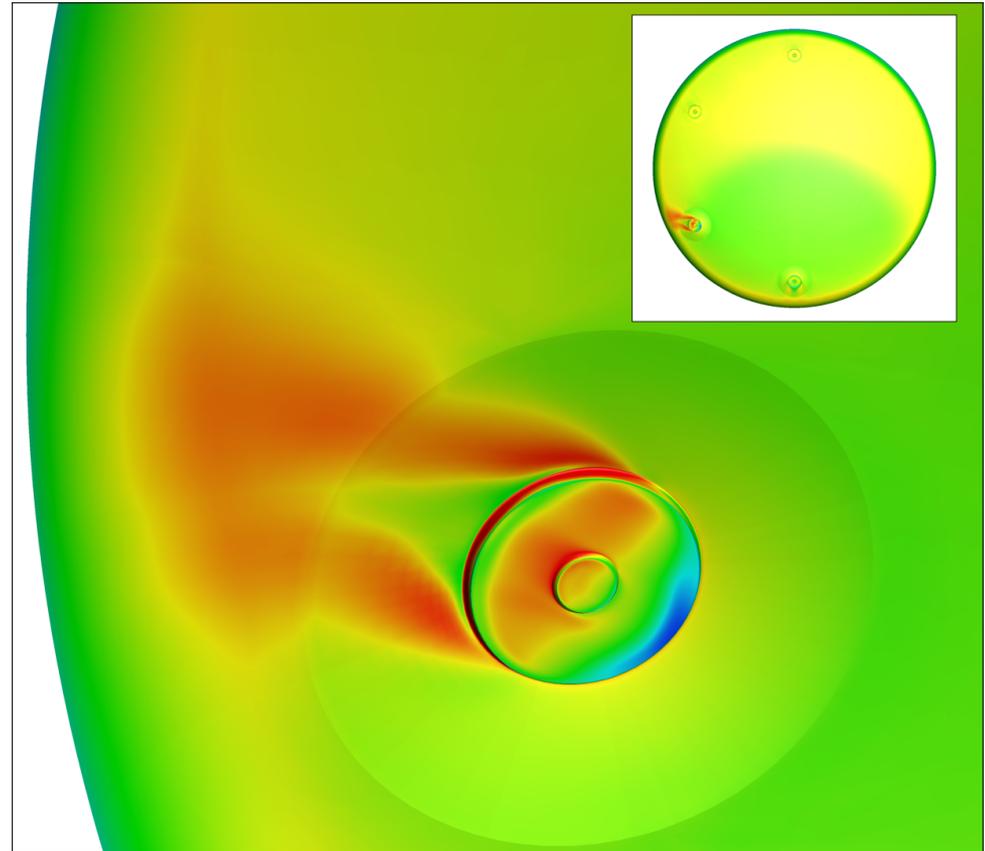
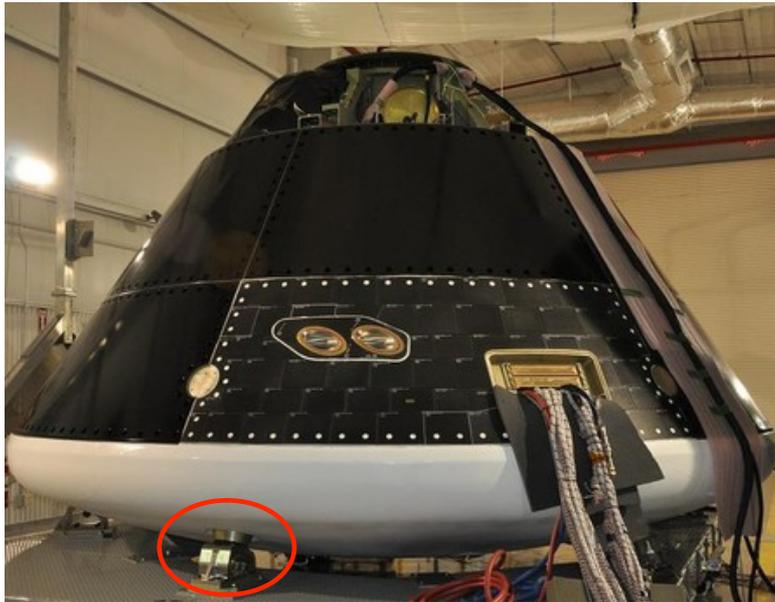
Sample trajectory and database cases





# Orion Capsule Simulations

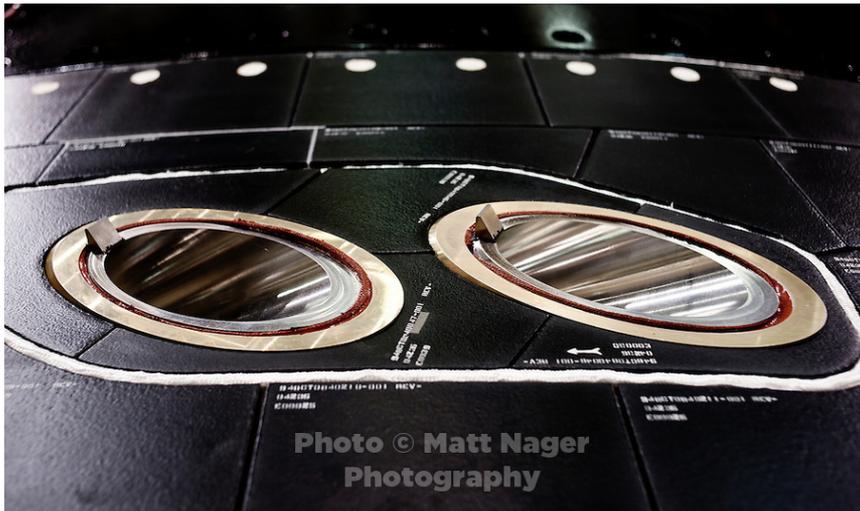
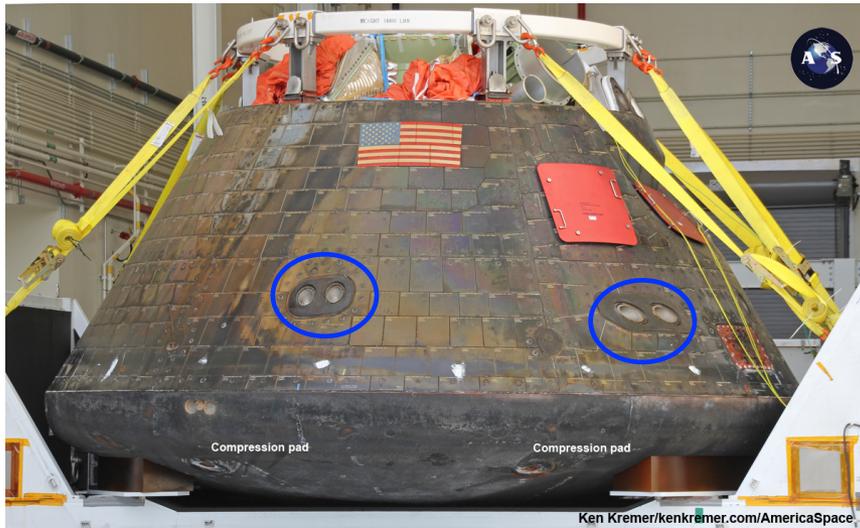




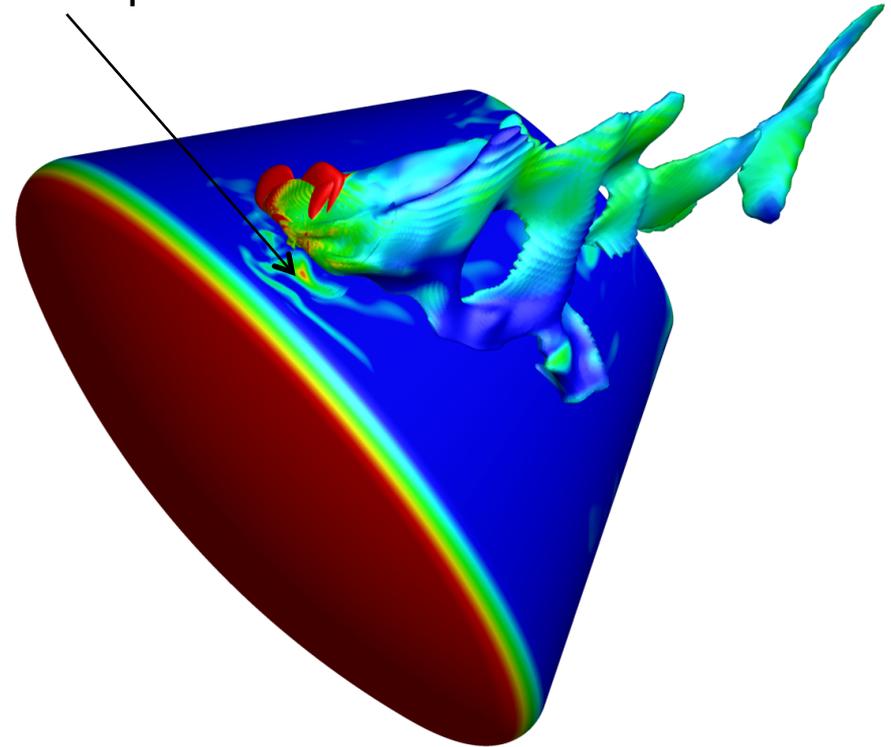
*DPLR* simulation showing the temperature contours near a compression pad



# Reaction Control System (RCS) Jet Interactions



Hot spot on backshell



DPLR simulation showing temperature contours on the Orion capsule and RCS plumes



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Questions?