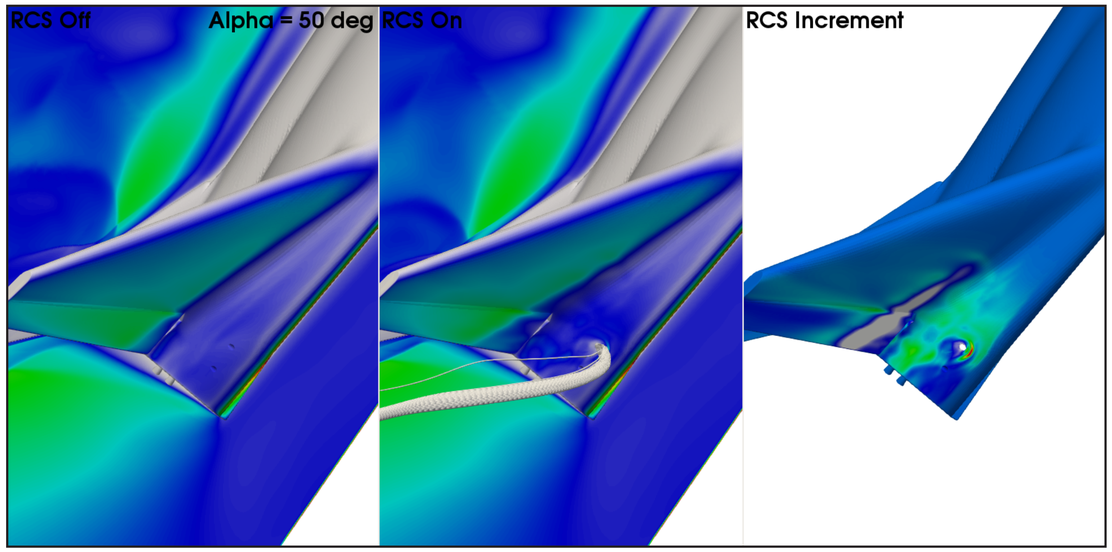
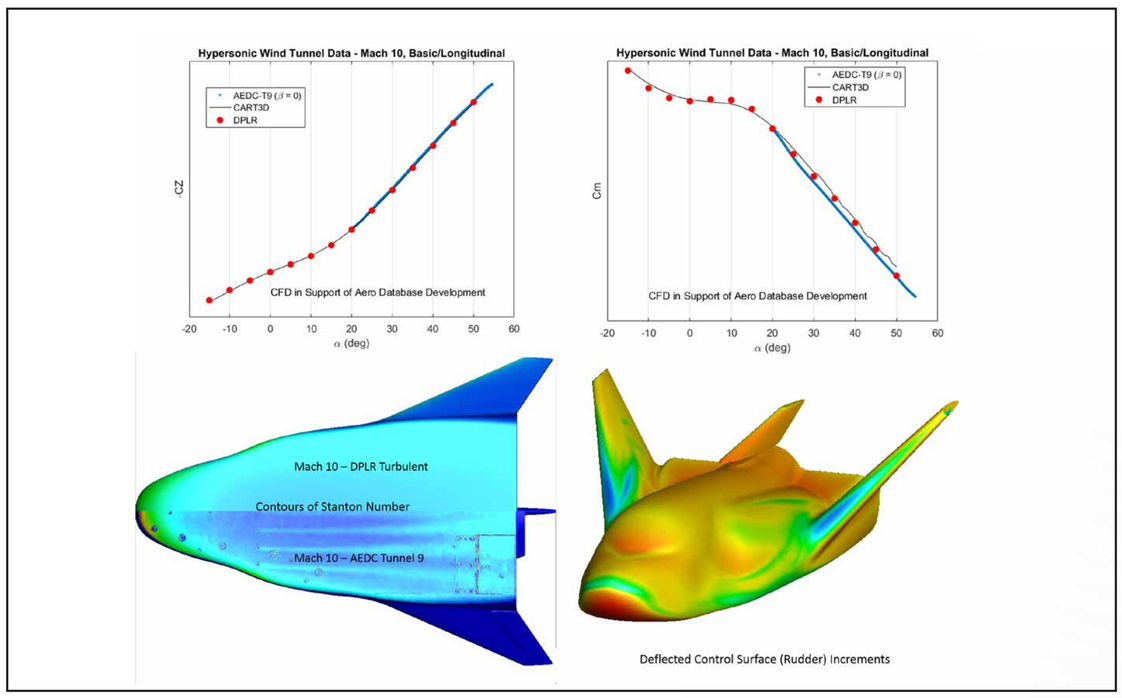
National Aeronautics and
Space Administration

NASA EXPLORES HUMAN SPACE FLIGHT



Visualization of the Reaction Control System thruster firing at hypersonic velocities during entry, descent, and landing at various angles of attack of the Dream Chaser spacecraft. As the angle of attack increases, the plume of the thruster impinges on the wing, changing the pressure distribution and therefore changing the vehicle's aerodynamics. *Matt Opgenorth, Sierra Nevada Corporation*

Simulating Dream Chaser® Spacecraft Aerodynamics: Subsonic through Hypersonic



Extensive computational fluid dynamics simulations were run utilizing supercomputers at the NASA Advanced Supercomputing facility at NASA's Ames Research Center to build an aerodynamic database for the Dream Chaser spacecraft, including control surface increments and aerothermal loads. *Michael Jeffries, Sierra Nevada Corporation*

Sierra Nevada Corporation's reusable Dream Chaser spacecraft will transport cargo to the International Space Station starting in fall 2021, as part of NASA's Commercial Resupply Services missions. During entry, descent, and landing, Dream Chaser will fly through Mach numbers ranging from above 20 to less than 0.4—about 15,224 miles per hour to roughly 304 mph—as it lands on a runway. Vital to its success is the accurate characterization of aerodynamic forces on the airframe and control surfaces during atmospheric flight. Additional aerodynamic interactions occur at hypersonic velocities due to Reaction Control System (RCS) firings. Predictions of aerodynamic forces and RCS aerodynamic increments were modeled with extensive use of computational fluid dynamics.

Matt Opgenorth, Sierra Nevada Corporation
Michael Jeffries, Sierra Nevada Corporation

www.nasa.gov

HUMAN EXPLORATION AND
OPERATIONS MISSION DIRECTORATE