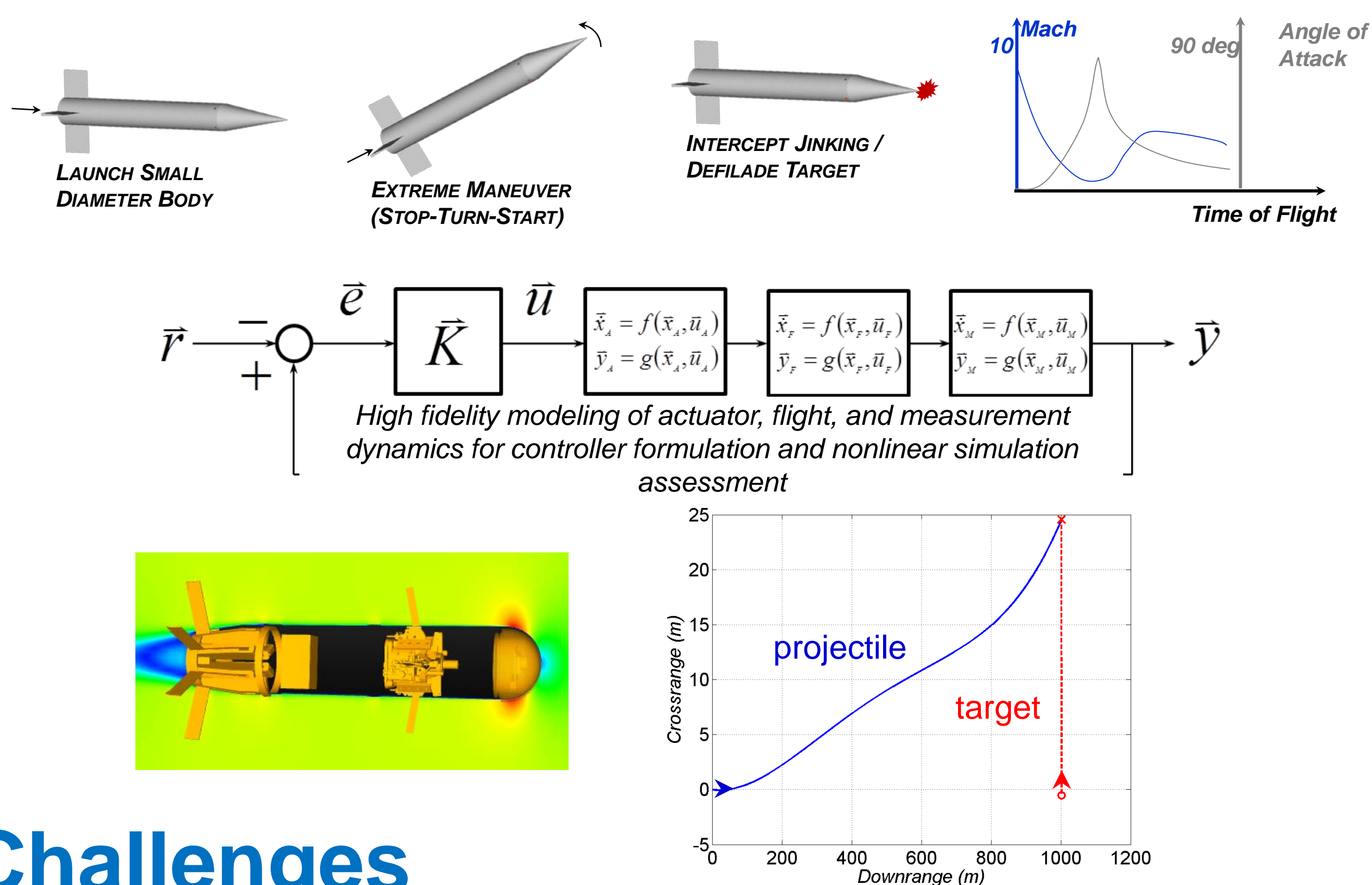


S&T Campaign: Sciences for Lethality and Protection  
*Kinetic Lethality*  
*Flight, Guidance, Navigation, and Control*

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## Research Objective

- Understanding and controlling flight behaviors of novel atmospheric flight vehicles across omnisonic speeds
- Discovering control mechanisms to overcome scientific barriers to maneuverability (e.g., aerodynamic lift-to-drag, guidance components, jet limitations) for extended lethal range, intercepting agile targets, and engaging defilade targets

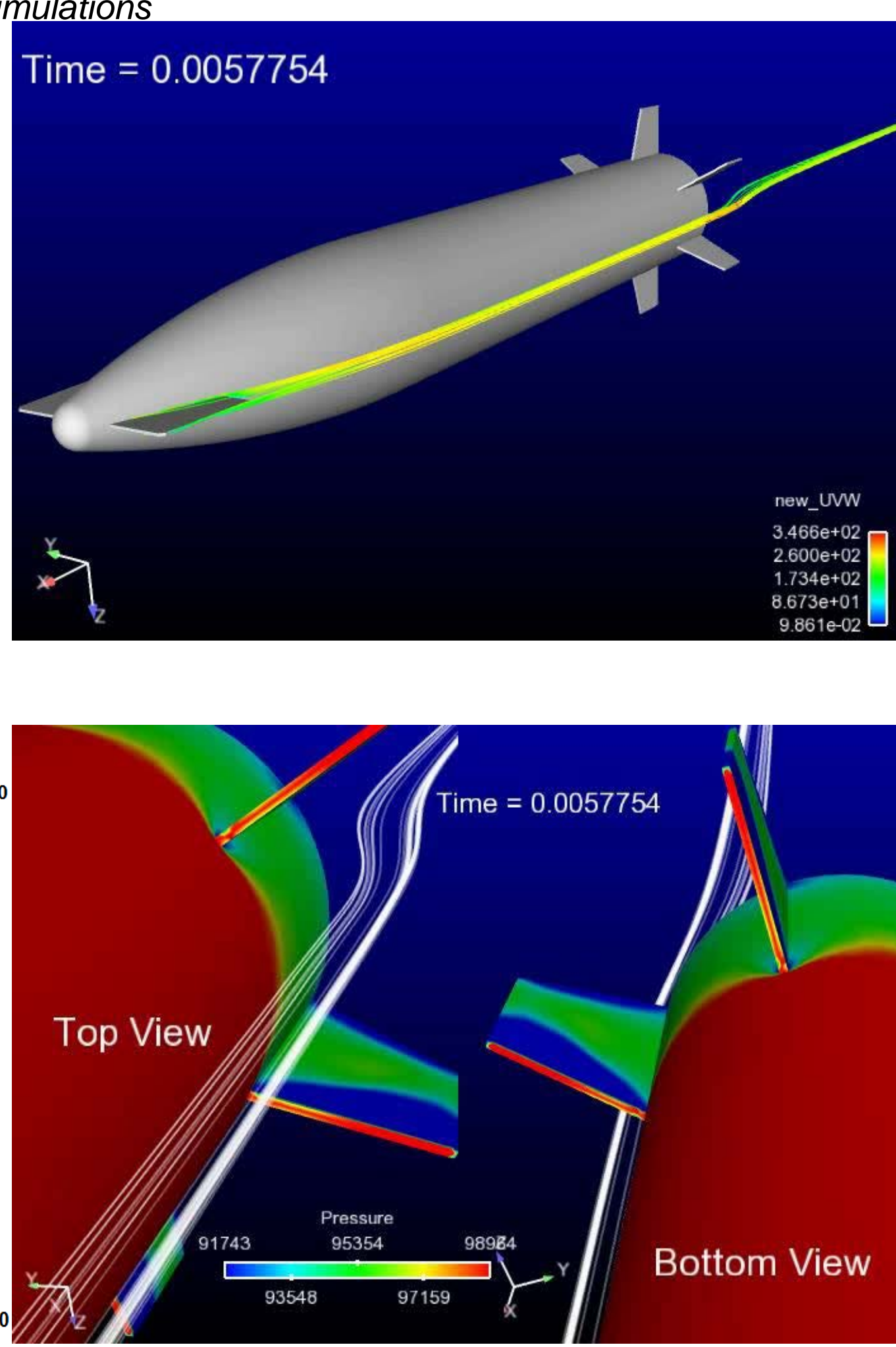
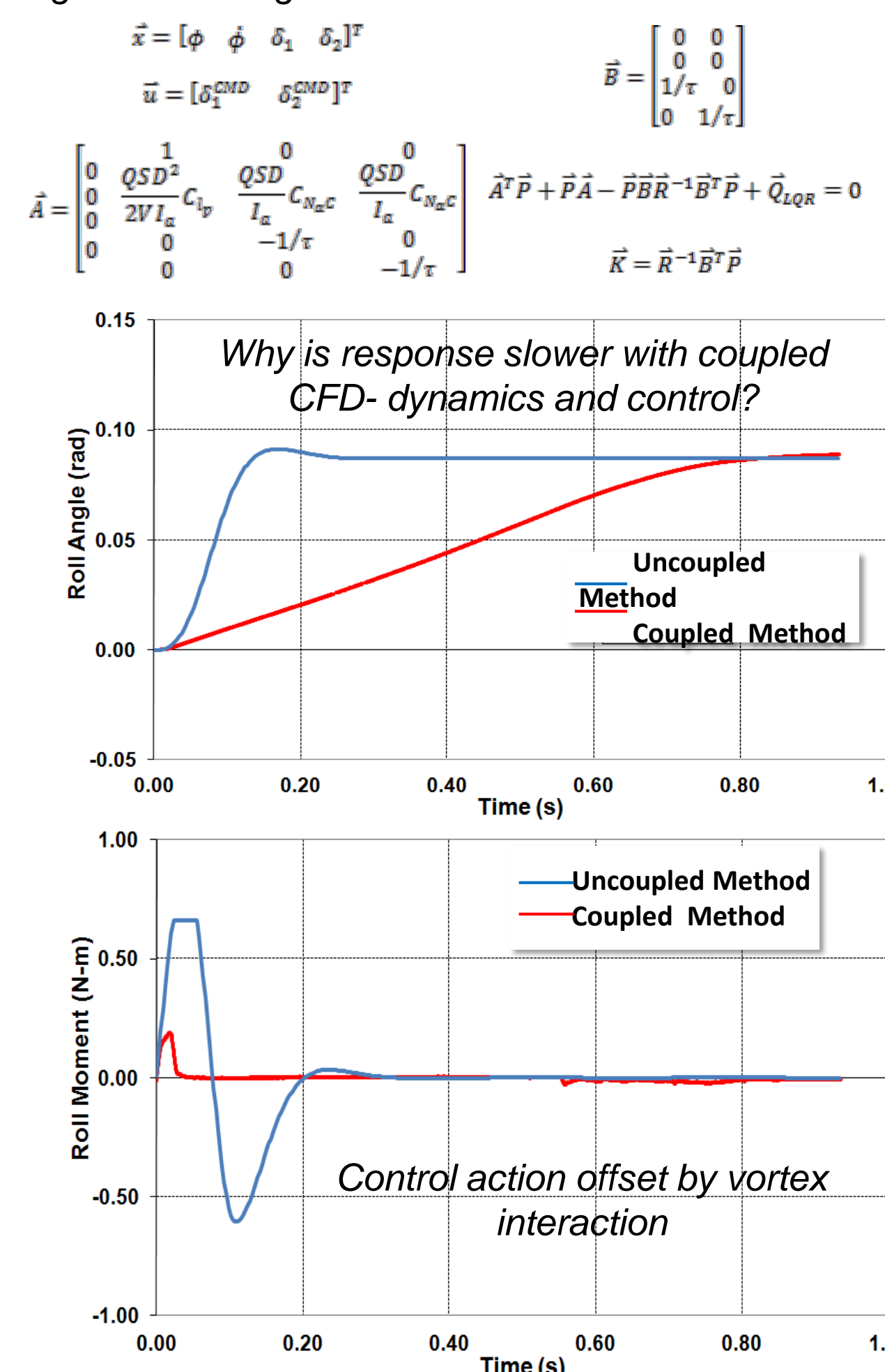


## Challenges

- Rapid, accurate prediction of maneuvering flight physics and experimental validation
- Nonlinear control laws with limited feedback and simple actuators
- High angle-of-attack, unsteady and separated flows, turbulence, wakes, shock-shock, shock-boundary layer and vortex interactions, nonlinear dynamics and stability

Roll Control Investigation using Coupled Computational Fluid Dynamics and Flight Dynamics and Control Simulations

Flight Control Algorithm based on Aeromechanics



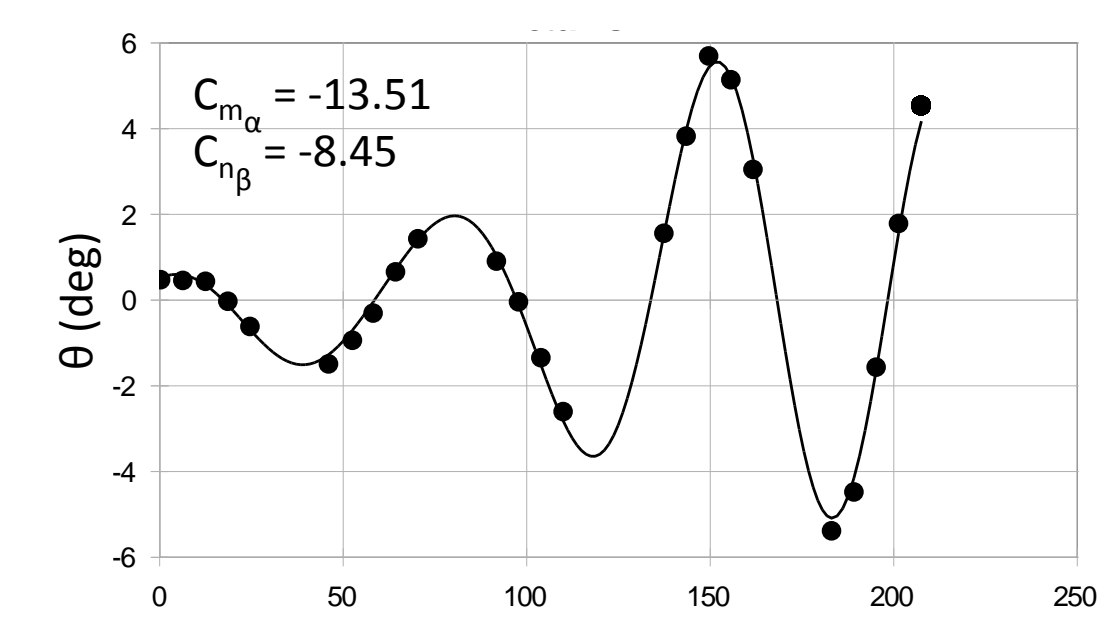
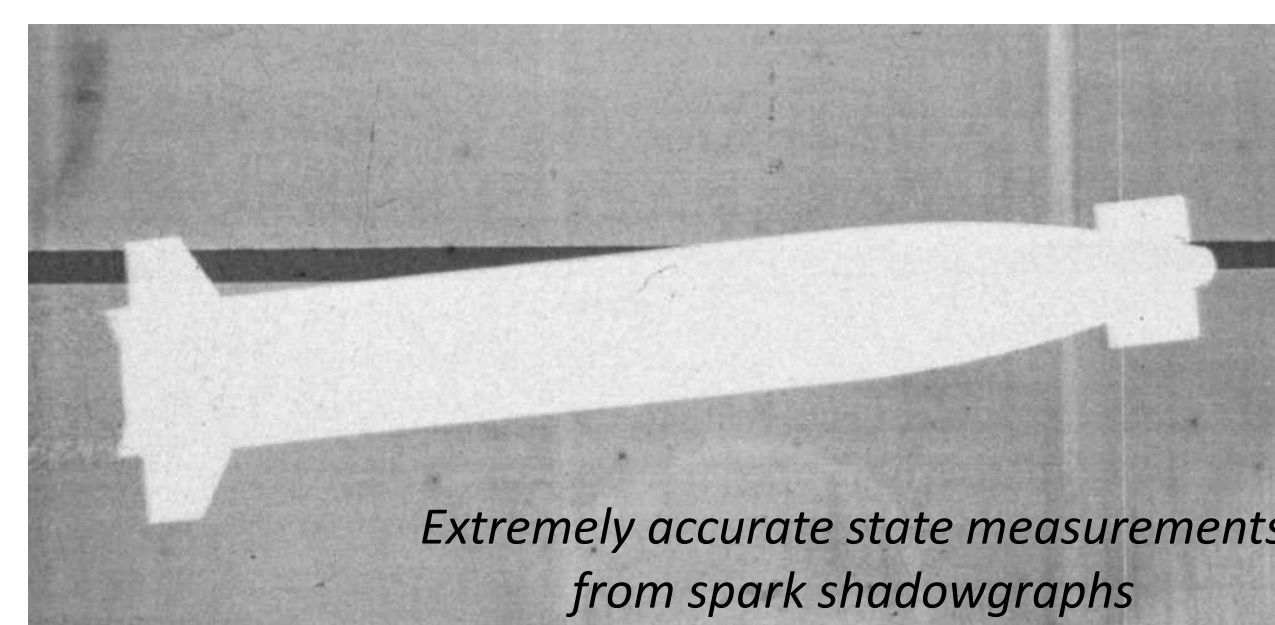
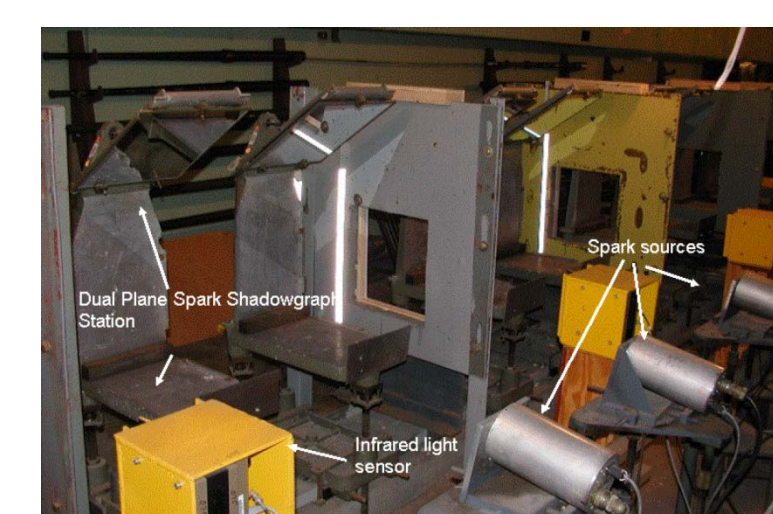
## ARL Facilities and Capabilities Available to Support Collaborative Research



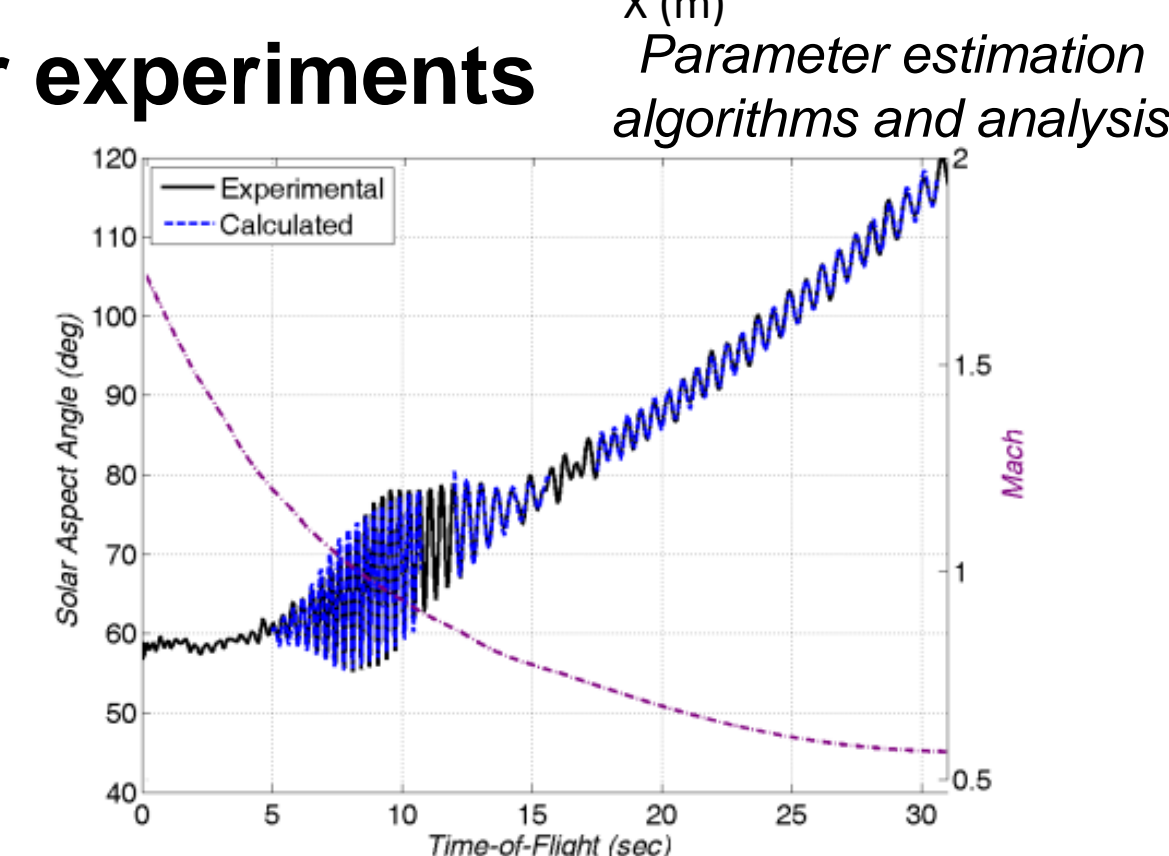
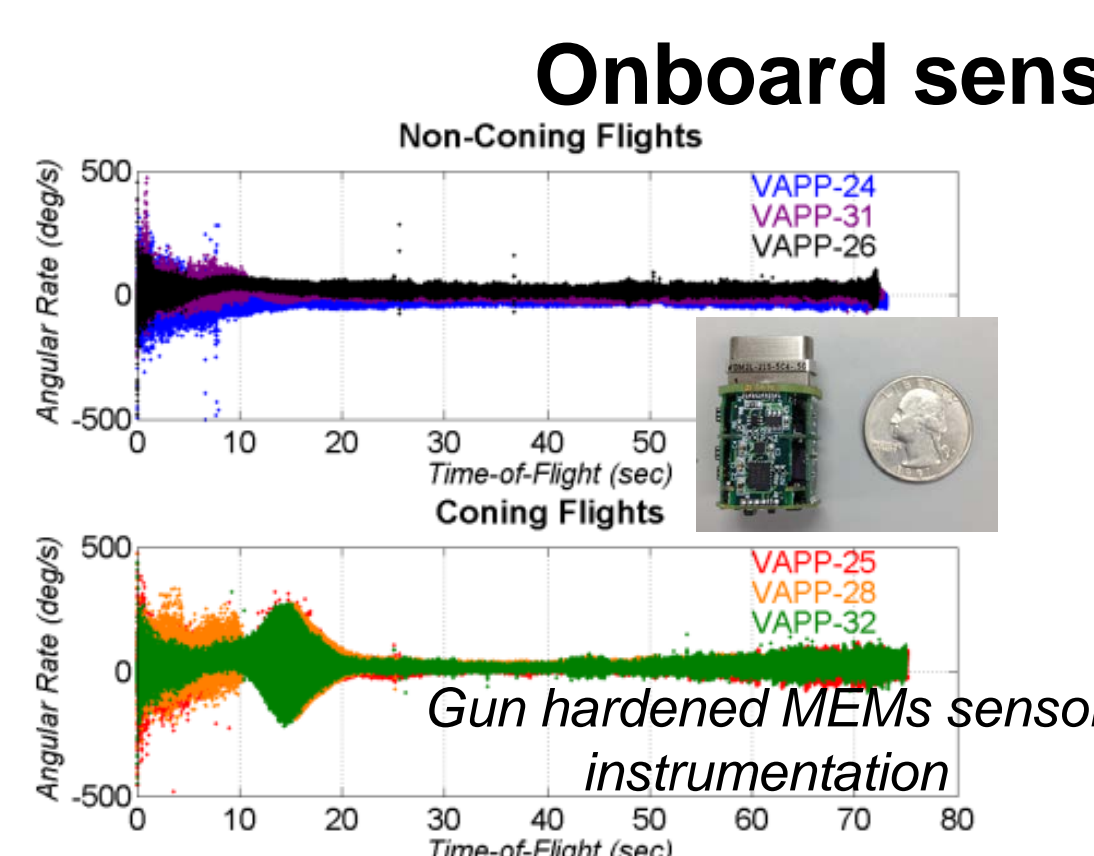
Unique launch and flight range facilities



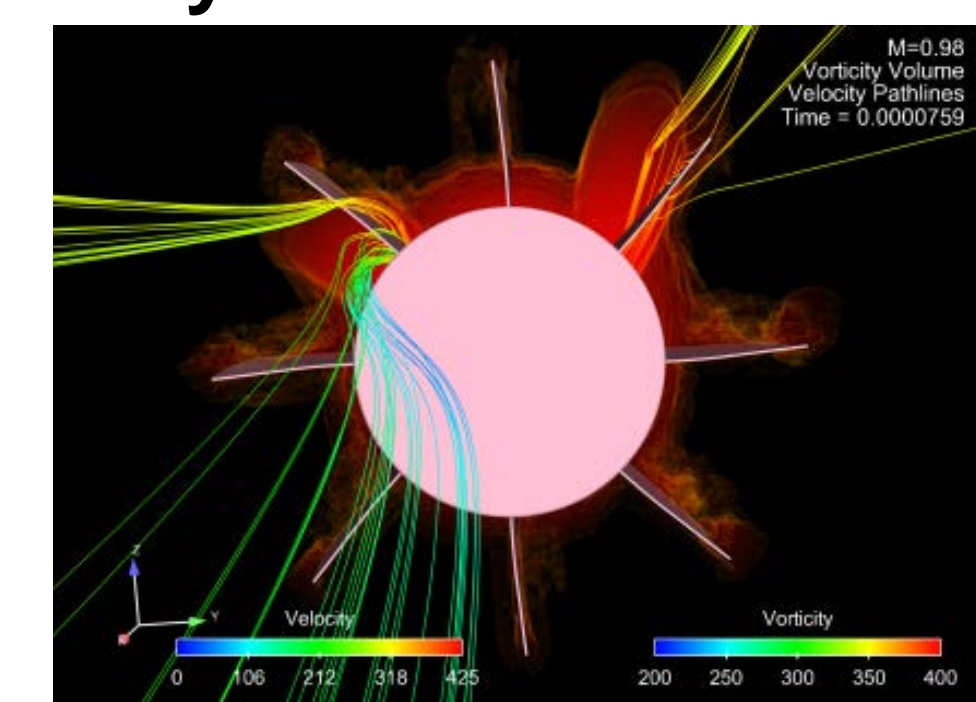
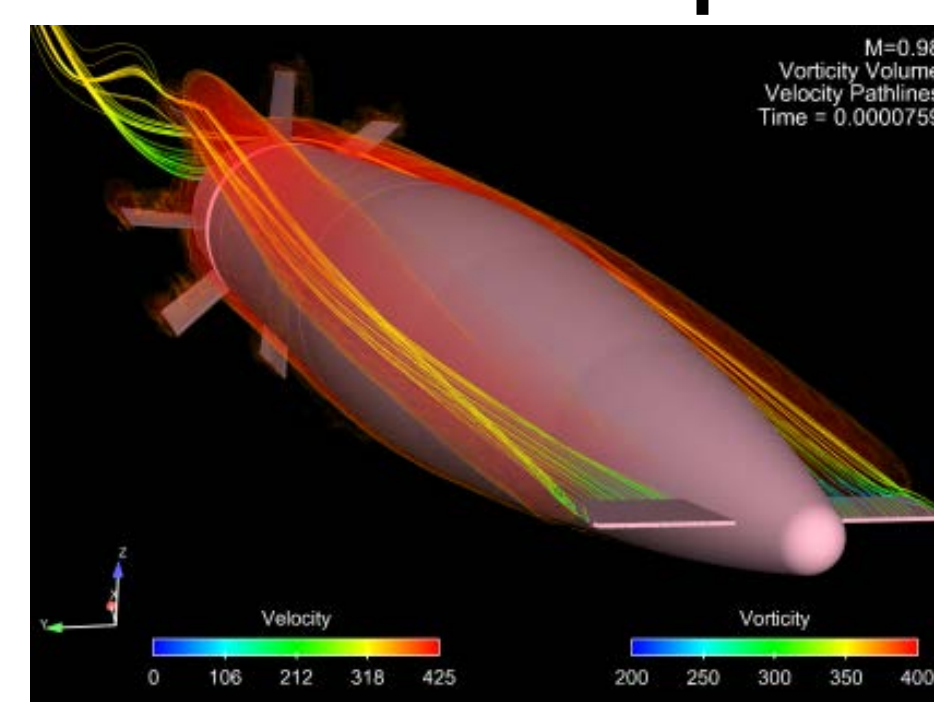
Spark range experiments



Capabilities for Understanding Flight Behaviors



## Computational fluid dynamics



## Complementary Expertise / Facilities / Capabilities Sought in Collaboration

- Control mechanisms, nonlinear control algorithms, and assessment tools for controlling high maneuverability flight bodies across omnisonic speeds
- Low cost/highly accurate experimental techniques for investigating maneuvering flight