

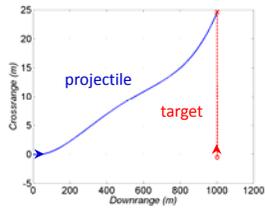
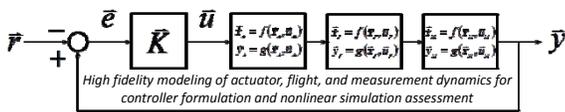
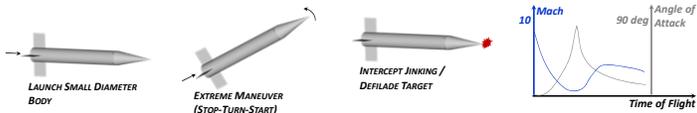


S&T Campaign: Sciences for Lethality & Protection Ballistics and Blast

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Research Objective

- Understanding and controlling flight behaviors of novel atmospheric flight vehicles across omnisonic speeds
Discovery of 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



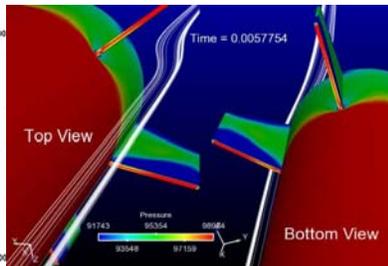
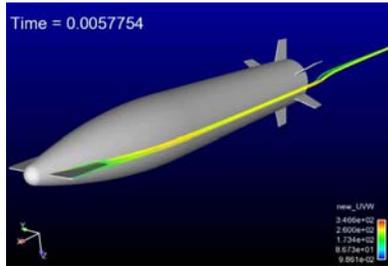
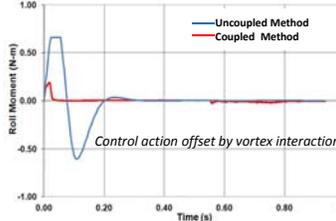
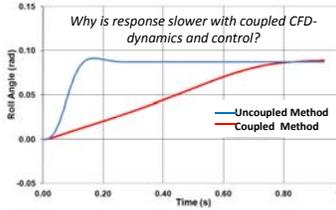
Challenges

- 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

Mathematical equations for roll control algorithm based on aeromechanics, including state vector x and control input u.



ARL Facilities and Capabilities Available to Support Collaborative Research



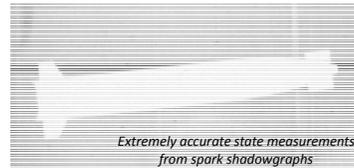
Unique launch and flight range facilities



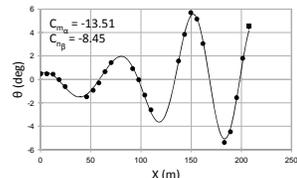
Spark range experiments



Onboard sensor experiments

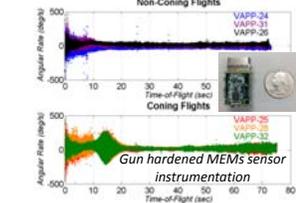


Extremely accurate state measurements from spark shadowgraphs

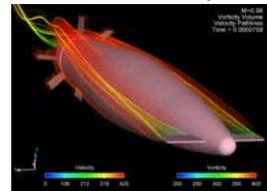


Parameter estimation algorithms and analysis

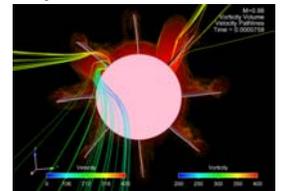
Capabilities for Understanding Flight Behaviors



Computational fluid dynamics



Three-dimensional, time-resolved access to complex flow fields through High Performance Computing resources



Recent Journal Publications

List of recent journal publications including 'Flight Performance of a Small Diameter Munition with a Rotating Wing Actuator', 'Flight Control of a Small Diameter Spin-Stabilized Projectile Using Imager Feedback', etc.

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