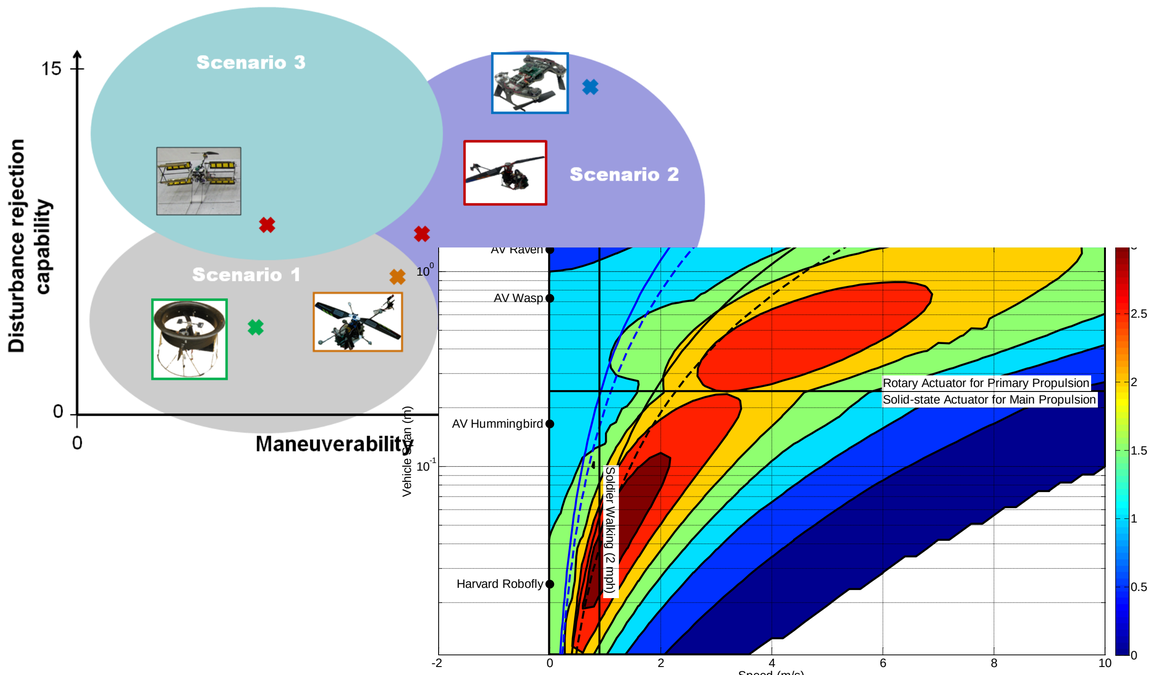
Mechanics of Handheld Aerial Mobility

S&T Campaign: Sciences for Maneuver
Platform Mechanics

Chris Kroninger, (410) 278-5690, christopher.m.kroninger.civ@mail.mil
John Hrynuk, Ph.D., (410) 306-4402, john.t.hrynuk.ctr@mail.mil

Research Objective

Address the needs for highly efficient and agile flight in handheld and man portable aircraft

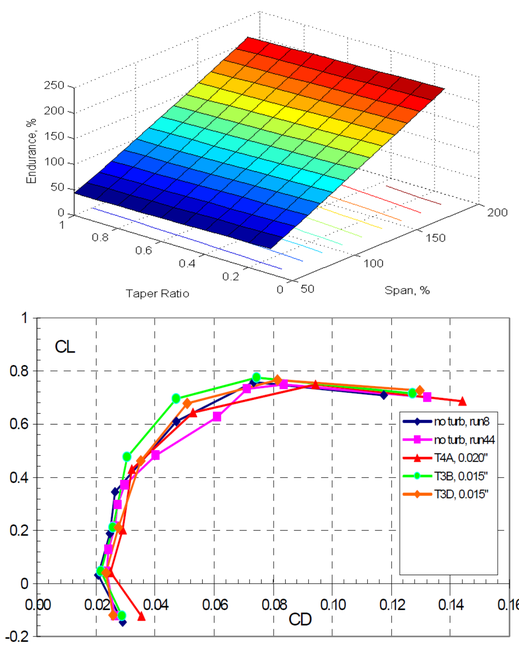


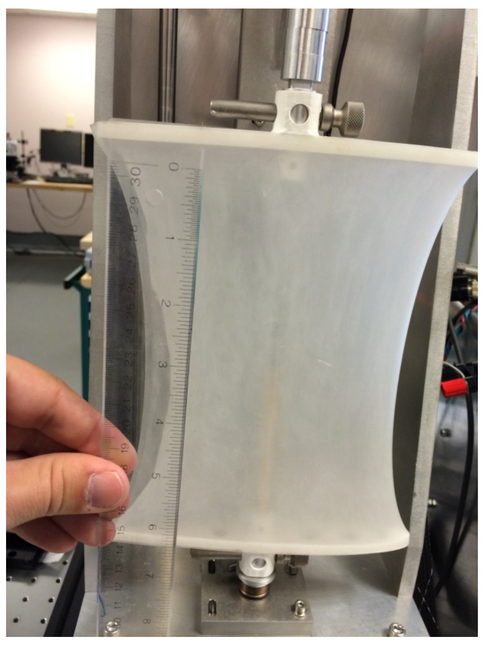
Assessment of Performance: Agility & Maneuverability and Efficiency Bounds of Various Flight Configurations

Reference: Gardner, Renee C.; Humbert, J. Sean, "Comparative Framework for Maneuverability and Gust Tolerance of Microhelicopters," Journal of Aircraft, Volume 51, Issue 5, pp. 1546-1553, Sep-Oct 14.

Challenges

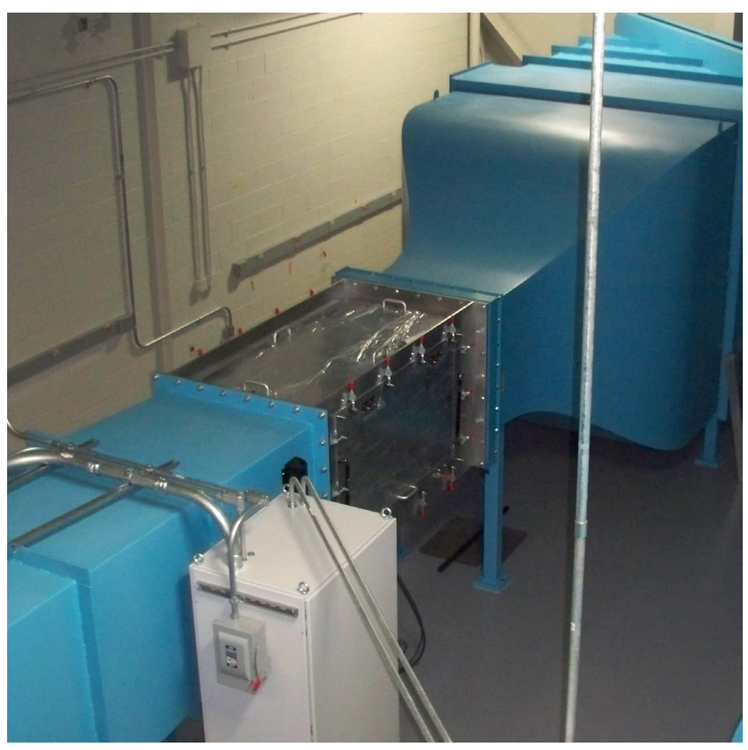
- **Low Reynolds number airfoils typically have poor efficiency and are very receptivity to disturbances such as geometric imperfection, deformation and turbulence**
- **Large motions and gross changes in material stiffness are desired to adapt to the environment and mission**
- **Implementation of flight control is not straightforward for highly nonlinear, time-variant systems, particularly responding to large discrete perturbations and deviation from steady state**



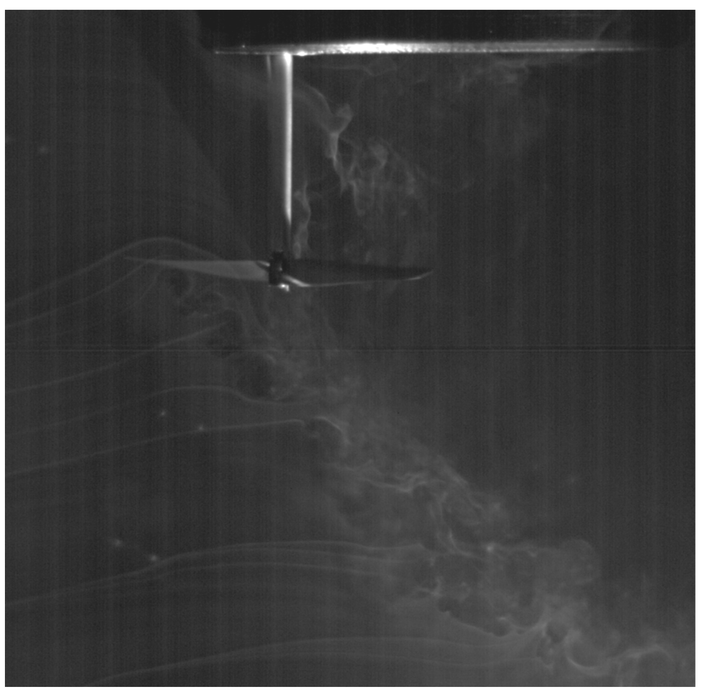


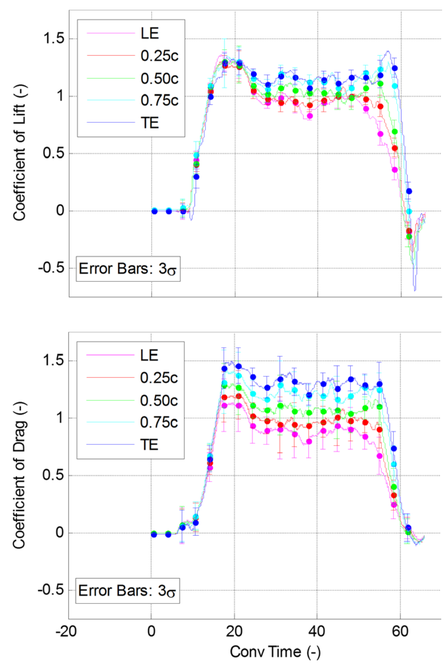
Adaptive Aircraft: Exploring the Utilization of Elastic Material for Wing Span Adaptive Aircraft

ARL Facilities and Capabilities Available to Support Collaborative Research



Testing Facilities for Low Reynolds Numbers





Recent Experiments

Complementary Expertise/Facilities/ Capabilities Sought in Collaboration

- **Unsteady and low Reynolds number aerodynamics**
- **Novel actuation for constrained size, weight and power**
- **Approaches to stability and control of nonlinear, time-varying systems**
- **Novel manufacturing/integration capabilities**
- **Biomechanics of animals**