

**Center for Fluid Mechanics, Division of Applied Mathematics
Fluids and Thermal Systems Group, School of Engineering
Joint Seminar Series**

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Hydrodynamics of Manta Ray Swimming

Aquatic animals propel themselves using a wide variety of mechanisms. In manta rays, propulsion is achieved by combining oscillating and undulatory motions of flexible surfaces. We are interested in studying the unsteady hydrodynamics of such motions to understand and model the wake structure. Experiments have been conducted on flapping flexible membranes, flapping rigid plates, and mechanical models of manta rays. Preliminary observations suggest a rich set of phenomena exist, depending on the non-dimensional frequency of flapping, the wavelength of the excitation, and the aspect ratio of the fin. Under certain conditions, simple wake structures are observed that bear a strong resemblance to the structure of co-flowing jets and wakes. In other cases, bifurcating wakes are seen, which appear to correspond to a decrease in efficiency. The performance of active and passive actuation methods is also explored.



**TUESDAY – OCTOBER 4, 2011
3:00 PM
Barus & Holley, Room 190**