CER Technology Fellowship Program –2008

Project Team: Charles Meneveau, Professor, Mechanical Engineering, Whiting School of Engineering; Jordon Raddick, Staff, Physics & Astronomy, Krieger School of Arts & Sciences; Raphael Krut-Landau, Undergraduate Student, Physics & Astronomy, Krieger School of Arts & Sciences

Project Title: Eddy: An Online Database-Enabled Lab for Fluid Dynamics

Audience: The initial audience will be the graduate students in the *530.625 Turbulence* course and the undergraduate students in the *530.328 Fluid Mechanics II* course, both to be taught spring 2009. It is envisioned that Eddy will also be used by other mechanical engineering courses at JHU that cover fluid dynamics, or in environmental engineering courses. The collaborative lab notebook model could be used with online resources in a wide variety of science courses at JHU and elsewhere.

Pedagogical Issue: Undergraduate engineering and science courses at JHU and other universities are frequently based on problem sets and lab activities; what is often missing is experience with the practice of modern science and engineering.

Solution: As a way to get students working at the frontiers of science, we propose to develop Eddy, a new web application designed from the beginning to provide an interface to allow students to work on collaborative lab activities, thus allowing them to experience the nature of modern science and technology.

Technologies Used: C/C++, Graphic Design, HTML/Web Design, JavaScript, Macromedia Flash, MySQL

Project Abstract: What is often missing in college science classes is the experience of doing science, as it is pursued at its frontiers. To provide this experience of modern science, we propose to create a web application in which engineering students explore data from the JHU Turbulence Database Cluster, an enormous (multi-Terabyte) database generated by a computer simulation of turbulent fluids. The software has three components that work in tandem: (1) A visual interface to the database that is easy-to-use and quick to respond to user actions; the interface will allow users to trace test particles to see how they move in the turbulent fluid, and will include analytical tools for measuring particle velocities and modeling the motion based on physical laws. (2) A collaborative forum for a lab group to work together to explore features of the data; the technology enabling this will be an online collaborative lab notebook where students can record methods and results of their investigations, with features modeled on successful online communities like *Facebook* and *Wikipedia*. (3) Assessment: Students can challenge themselves with a range of puzzles that require them to apply physics equations to the real-world data. Instructors will be able to upload questions and review students' progress and success.

We will use ASP.NET (C#), web technologies (HTML, XML, CSS, Javascript, Ajax), and responsible web design practices as defined by the W3C, including accessibility and platform neutrality. In all of this, our key mission will be to bridge the gap between the classroom and the cutting edge by allowing students to explore the same data that working scientists use, and to promote community, conversation and collaboration among students.