CCSF Lunch Summary – January 28, 2009

Institute for sustainable mechanical designs

Paul Dawson and Matt Miller, Sibley School of Mechanical Engineering

Abstract
Design and production practices for the manufacture of mechanical systems are constantly evolving. New versions of successful products appear on the market each year with greater utility, improved performance and reduced price. Economic and social drivers linked to renewable resources and sustainability are beginning to appear on the product development horizon. New design challenges will accompany a move towards more sustainable systems. In an emerging area such as this one, it is difficult to identify the associated research issues and which ones of these can be addressed as university research topics. The overall goal of this institute is the exploration of possible research issues that will accompany a move towards more sustainable mechanical systems. Through a series of topical studies, which will incorporate fact-gathering workshops and will produce a white paper, we will outline research opportunities for enabling technologies. Further, we will proactively disseminate the findings to appropriate policy and funding agencies.

General topic areas include;

- Material selection considering sustainability. (Most existing products employ nearly 100% non-renewable materials.)
- Product life cycle: cradle to grave design (cradle to cradle)
- Energy usage: production, service and disposal
- Cost considerations: sustainable designs must be affordable and profitable
- Development of new performance metrics for sustainability

Attendees:

Host - Paul Dawson, MAE
Host - Matt Miller, MAE
Mark Campbell, MAE
Jack Booker, MAE
Leigh Phoenix, TAM/MAE
Alan Zehnder, TAM/MAE
Wilson Aquino, CEE
Tony Ingraffea, CEE
Steve Koutsourelakis, CEE
Derek Warner, CEE
Mircea Grigoriu, CEE
Frank DiSalvo, CCSF
Helene Schember, CCSF
Paula Euvard, CCSF
Steve Beyers, ECS
Megan McDonald, CS
Gwen Wilcox, CCSF
David Dietrich, CCSF
Mark Lawrence, CCSF
Dean Koyanagi, ECS

Discussion Summary:
The meeting began with short presentations by Miller and Dawson to outline their vision for the institute. As described in the abstract, the "pre-research" nature of the institute and the structure of the proposed workshops were explained. The focus on determination of research needs was demonstrated using two examples: hydrogen storage and wind turbine design. The goals of this meeting were:

i. to explore topics for an pilot workshop
ii. to better understand what role university research can play in the general area of sustainable mechanical designs and
iii. to gauge the interest in submitting a proposal to CCSF for support of the pilot workshop.

Comments were made that were specific to the two examples and to the institute concept more generally. These include:

1) The example of pressure vessel design was used as an application where the world is not necessarily waiting for your particular design but very specific work is needed to improve their safety.
2) There is (may be) an availability of funds from the NRC for these types of topics.
3) The wind turbine gearbox was discussed as a structural element that may well be replaceable, but the basic funding for investigating alternatives currently doesn't exist. There is a need for "new" money
4) The Biochar topical lunch (Nov. 19) contained examples for obtaining new money
5) Some specific "first topics" were suggested. These included:
    a. Harvesting low temperature, low efficiency energy sources
        i. CHESS has 140° "waste" water – is there a use on campus?
    b. Storage devices
        i. Hydraulic storage
        ii. Flywheels – mechanical storage devices
    c. Small turbines
    d. Converting plant matter into energy
    e. HVAC – possibly involving the architecture school
6) Smaller companies – many who may be involved in "one off" type design might be in a good position to offer examples and to collaborate with.
7) It was pointed out that M.I.T. is well-known for such "think tank" experiences – not because they necessarily have the expertise themselves but because they hosted the workshops and invited the experts.
8) The business model for the institute must be considered and the recent DOE workshop format should be considered.