Innovative Research/Educational Outreach Program

LEADS TO BREAKTHROUGHS IN THE APPLICATION OF HYDRAULIC HYBRID TECHNOLOGY

A project to develop a hydraulic hybrid retrofit of a school bus, led by Dr. Michael Leamy at the Georgia Institute of Technology and his team of undergraduate and graduate engineering students, is yielding impressive results. Not only is their work realizing the potential of new fuel efficiencies for school buses, but it also is providing a model for effectively engaging college and pre-college students in hands-on learning about eco-friendly fluid power.

Over the last two years, Dr. Leamy and his students have designed, built, and begun testing a hydraulic hybrid propulsion system retrofit and biofuel conversion of a public school bus donated by the Atlanta public schools in Georgia. Much of the design and fabrication work to date has been carried out by undergraduates in Georgia Tech's mechanical-engineering program; graduate students have taken on leadership roles in the project. Their work, originally funded by a grant from the Ford Motor Company Fund, has been further enabled through donations of components as well as guidance from engineers at Eaton Corporation, Evonik RohMax, Linde Corporation, and Poclain Hydraulics—all industry affiliate members of the Engineering Research Center for Compact and Efficient Fluid Power (CCEFP). The CCEFP will provide funding for work during the project's third year.

A school bus is ideal for hydraulic hybrid power due to its large mass and stop-and-go drive cycle. The hydraulic retrofit captures braking energy using a pump-motor, which first pumps hydraulic fluid into a high-pressure accumulator (thereby storing energy) and then releases this energy to the drivetrain through the motoring capability of the pump-motor. A microcontroller-based system developed at Georgia Tech controls the mode of operation of the pump-motor, its displacement, and various valve components. Next steps involve incorporating complementary technologies using a clean-start technology in which the diesel engine is shut down at bus stops and restarted using a hydraulic motor, saving children from harmful emissions.

The hybrid retrofit has moved from the lab to the street, and tests are underway aimed at verifying predicted gains of over 20% in fuel economy. Considering that more than 700,000 gallons of diesel fuel are used by school buses each year in Atlanta alone, a 20% gain in efficiency could significantly lower both fuel costs and emissions through widespread adoption.

The impact of the project's education and outreach effort grows, too, as more undergraduates and graduate students get involved, some even taking on the role of teachers as they use the bus to show pre-college students not only how hydraulic systems operate but also why the work of engineers is so important.

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The Engineering Research Center for Compact and Efficient Fluid Power (CCEFP) was established in 2006 by the National Science Foundation as one of the nation's select engineering research centers. The CCEFP is comprised of a network of engineering faculty and their students from seven universities (University of Minnesota, also the site of CCEFP headquarters; Georgia Institute of Technology; University of Illinois at Urbana-Champaign; Purdue University; Vanderbilt University; North Carolina A&T; and the Milwaukee School of Engineering (MSOE) along with more than 50 hydraulic and pneumatic manufacturers, distributors, and industry organizations. Visit www.ccefp.org.