## UT teams up with EPA on $1M hybrid hydraulics project

**By DAVID PATCH**
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Walter Olson, left, a mechanical engineering professor, and University of Toledo colleague Mohammed Elahinia are working on hybrid hydraulic propulsion systems for large vehicles.

While hybrid cars are making inroads with auto manufacturers and consumers, a team of researchers at the University of Toledo is thinking bigger.

Much bigger.

Garbage and delivery trucks, school buses, and other heavy vehicles that start and stop often could benefit the most from research into hybrid hydraulic propulsion systems being furthered under a $1 million partnership between the University of Toledo and the U.S. Environmental Protection Agency.

The research could double truck and bus engines' fuel efficiency while significantly cutting pollution - and could someday eliminate noisy engine brakes, the professor leading the research told The Blade.

"This is a very important technology, and we've been working on it for several years," Walter Olson, a mechanical engineering professor, said yesterday.

The hybrid hydraulic propulsion system stores braking energy by using it to compress gas in a reservoir instead of releasing the energy as waste heat.

Mr. Olson said it can work on many vehicle types, but has the greatest potential benefit for delivery trucks, school buses, and other heavy vehicles that start and stop often.

A three-year cooperative agreement between University of Toledo and the federal EPA to continue the research will be formally announced today at a ceremony at UT's Nitschke Hall.

The cooperative agreement involves Mr. Olson and two University of Toledo colleagues: Mohammed Elahinia, an assistant mechanical engineering professor, and Thomas Stuart, an electrical engineering professor.

The federal agency will contribute up to $449,998 toward the program's budgeted $997,528 cost, with the university providing the balance, said Nagi G. Naganathan, the dean of UT's engineering college.

The EPA funding, won in a peer-reviewed, competitive environment, "demonstrates the professional expertise of our faculty," Mr. Naganathan said.

The research will be "done with a clear understanding of what's needed out there in technology commercialization," Mr. Naganathan said.

Electric hybrid systems, increasingly popular for cars and light trucks as a way to cut gasoline consumption, aren't particularly useful for heavier vehicles because their batteries cannot be charged or discharged quickly enough to take full advantage of the available energy, Mr. Olson said.

"A battery is destroyed if you charge it too fast, or discharge it too fast," he said.
In a hydraulic hybrid system, power produced by braking that would otherwise be dissipated as heat operates a pump that forces hydraulic fluid from one reservoir to another.

In the receiving reservoir, called a high-pressure accumulator, the in-flow of hydraulic fluid compresses nitrogen gas in a flexible bladder - essentially, a balloon.

When the driver accelerates, the system reverses itself, releasing compression from the nitrogen to force the hydraulic fluid back into the first reservoir, called a low-pressure accumulator.

The hydraulic fluid flowing from one reservoir to the other now powers a motor that supplements the torque from the vehicle's engine.

For a typical full-size, four-wheel-drive sport-utility truck, fuel economy increases from 17.2 miles per gallon to 34.6 miles per gallon, but the vehicle's initial cost increases by between $500 and $3,500, according to Mr. Olson's research.

Fuel savings over such a vehicle's lifetime, however, is projected at $5,000.
The savings are even greater for heavier vehicles that make lots of stops, which is why that market will be targeted first, Mr. Olson said.

Eventually the regenerative braking system that hydraulic hybrid vehicles use could eliminate noisy engine brakes.

A main target of the continuing research will be reducing or eliminating a whining noise that the hydraulic system makes, especially during braking, Mr. Olson said.
Researchers also want to develop ways to improve the systems' energy density - the amount of energy that can be stored in a given amount of space - and to improve system controls, he said.

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