



QUARTERLY COW

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An update from the University of Wisconsin-Madison FutureTruck Team

The Heart of a Champion

By: Eric Fox

Since its introduction in 1991, Ford has deemed the Explorer a beast; a master of the road and a conquistador once the road ends. The Explorer, though not as large as some of its counterparts, still has a sizable heart. Yet this is not an ordinary heart. Oh no. This heart bleeds black. Not because it is a prime evil machine forged at the hands of Satan himself for the sole purpose of hate and suffering. No. It bleeds black because its heart is an engine producing a couple hundred horsepower with equally impressive torque numbers. It bleeds black simply because the lifeblood of the Ford Explorer has a multi-viscosity rating of SAE 10W-30.

The University of Wisconsin is going to be performing quite a bit of amateur truck surgery, however. The rules state that we may not use the engine that comes with the 2002 Explorer. So every year the team has set out on a quest to find the lightest most powerful engine to replace the behemoth (both figuratively and numerically) lurking under the hood of the vehicle. Every year the team has selected a diesel replacement and this year will be no exception. Although the diesel engines seem undersized in horsepower, they are quite adequate when it comes to torque, and torque is what matters in the end.

For the Future Truck 2001-2002 competition, the University of Wisconsin explored three engines. The first was the Land Rover Td5 that had been used in the Chevrolet Suburban in the previous competition. The Td5 is a strong engine. It is a 2.5 liter inline five cylinder that makes about 125 horsepower and 225 foot-pounds of torque. Land

Rover uses this engine in their Defender series sold overseas. The Td5 has great power and is familiar to the team but it is very physically large both in weight and shape. Another engine is the overhauled Ford Lynx. The Lynx is a 1.8 liter inline four cylinder making roughly 120 horsepower and 185 foot-pounds of torque. What makes this engine so desirable is its common rail fuel injection that allows the engine to be very powerful but very small. The only drawback is that the Lynx is such a great engine that everybody in Europe wants one so Ford is putting all of them into vehicles as fast as they are made. The last engine the team seriously looked at was the Land Rover Td4. This is the "little brother" to the Td5. It is basically a Td5 minus one cylinder. It makes comparable torque and horsepower to the Lynx and like the Lynx is

not readily available to the United States.

So which is the best engine for the job? All three are turbo diesels and have similar power to weight numbers. The Lynx is the smallest but the Td5 is the only one designed to be longitudinally mounted. Get to the point already! Which is the best engine? In a hybrid electric drivetrain, the Lynx is best suited for the Explorer. However, the Lynx is not immediately available. By the time the team could get a Lynx it would be too late to fit it into the vehicle. Although the installation of the Td5 will challenge our engineering abilities, the impressive torque curve will guarantee success.

Whatever heart this beast has, be it a screaming V6 or a roaring diesel, it will always be a champion.



This is the Landrover Td5 that will be placed in our 2002 Explorer.

Aluminum Association Convention

By: Eric Schroeder

I had the opportunity to attend the 22nd Annual Automotive Aluminum Design and Fabrication Seminar in beautiful metropolitan Detroit, Michigan on October 24 with six other team members and our advisor.

The day-long conference focused on emerging aluminum technology and design trends in the automotive industry and attracted several hundred attendees. The seminar included information on new aluminum technology, coordinated technical research, design trends and success stories concerning the use of aluminum in automotive manufacturing.

After a long drive straight from Madison to metropolitan Detroit, we arrived at our hotel around midnight. The next morning proved to be an early one, as we had to get our display set up before everyone else arrived.

As the day progressed, I was amazed at what some of the companies had done with aluminum. One presentation that I attended was the use of aluminum in Harley Davidson's new V-rod motorcycle to reduce the weight of the vehicle and give a contrast between the bright luster of natural aluminum and Harley's mirrored chrome-plated finish. Our advisor, Dr. Glenn Bower, gave a presentation on the implementation of aluminum in our 2001 FutureTruck frame and the design considerations that had to be taken into account.

Other displays at the convention included an



The Moollennium was on display at the 22nd Annual Automotive Aluminum Design and Fabrication Seminar in Novi, Michigan.

electric mail truck with aluminum body panels, a complete aluminum space frame for an Audi A3, an aluminum tailgate for a truck, and sliding door for a minivan.

Aluminum was not the only metal that was discussed at the convention. An interesting presentation was given on the process of injection molding magnesium for applications such as steering wheels, camcorder housings, and laptop shells. This process is currently being researched with aluminum as a cheaper and stronger alternative to traditional aluminum castings.

After an exciting day in Detroit, it was back to Madison, a little bit wiser.



Team Paradigm Alumni Scholarship Awarded

The first annual Team Paradigm Alumni Scholarship was awarded to Katie Orgish this fall. Katie, a junior in mechanical engineering, has been in the mechanical group for three years. She was business group leader last spring and will resume the position once again this spring. She is RADAR for 2001-2002.



FutureTruck

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Small Pack Packs Big Punch

By: John Welter

Why was the battery pack from a tiny car, the Toyota Prius, ever chosen by Team Paradigm to power a large hybrid SUV, the Ford Explorer? Actually, there are several reasons why the Prius battery pack will work well in powering the Explorer.

The electric motor in a parallel hybrid-electric vehicle is used mostly to aid in acceleration. It also stores electrical energy in the batteries while most of the power for actual driving will come from a parallel diesel engine. Compared to a totally electric vehicle like the EV1, our hybrid only needs a small battery pack. The battery pack for our Explorer only needs to supply short bursts of energy during acceleration and store energy during braking. The Prius, however, is not an electric vehicle, and despite the extra small size of its pack, it still holds a lot of power.

The Prius pack utilizes specially designed prismatic batteries that have more surface area that allow it to deliver more power than a typical battery of its size. The prismatic shape of the batteries also allows them to be packed tightly together, minimizing the amount of space required for installation. This is a very important consideration when



You might be surprised that the battery pack in the tiny Toyota Prius is ideal for our comparatively enormous Explorer. (Note: Vehicles not shown at same scale.)

designing a vehicle. With all the different components used in a hybrid vehicle careful consideration needs to be taken to make sure that all of the additional equipment will fit. Not only is the packaging of the Prius pack small, but because it is a mass produced item, many tests have been done to maximize its strength as well as safety of construction.

The battery pack also matches well with the motor size that will be used to provide extra power to the Explorer this year. The amount of power supplied by the battery pack is almost equal to the power that can be used

by the electric motor. This ensures that no extra weight is carried on the vehicle, because any extra energy stored means extra batteries were used.

This brings up another important point-weight. The Prius pack is approximately half the weight of the custom battery pack that was built the year before. This reduction in weight improves fuel economy and acceleration, and reduces emissions, all of which are goals of the Future Truck competition.

Careful consideration was used when selecting the Prius pack to power the hybrid Explorer. It is an excellent choice due to its size, shape, and weight, as well as its power capabilities. Like a lightning bolt, the Prius battery pack will deliver huge bursts of power.



This Prius battery pack (shown with cover removed) will be used in parallel with our Landrover Td5 diesel engine.

New Group Leaders for 2002

Mechanical: Eric Schroeder

Engine: Eric Fox

Controls: Mitchell Pederson

Electrical: John Welter

Business: Katie Orgish

Information: Dan Kenan

Road Trip

By: Glenn Bower

Faith or Fate? Driving a student-built prototype hybrid Suburban from Madison to Dearborn – 450 miles. A true test of the vehicle and the advisor's faith in the students! It was only the first phase of a two-week crusade: testing new control code and the integrity of the Moollennium's powertrain.

First, participating at the GM Tech World (October 17-19) as part of the Alcoa display. Glenn Bower and Julie Marshaus represented the university while talking to hundreds of GM engineers about the FutureTruck program and our success with an aluminum frame.

Second, Monday morning, October 22, Julie pilots the Moollennium to The Budd Company to discuss the vehicle and possible cooperative research in the near future.

Next, on to Laurel Manor in Novi, MI for the Aluminum Association's Automotive Seminar for two days. Again, excited engineers wishing the bean counters (accounts and business managers) would allow them to integrate more aluminum into their vehicles.

Wednesday evening included a 250-mile venture past the Michigan International Speedway in a treacherous down pour. Lodging in Kokomo – no Indiana! Thursday, October 25, was the culmination of the Road Trip with a visit to Delphi Automotive. We discussed the integration of starter/alternators into our hybrid powertrain.

Finally, 310 miles back to Madison and to our garage!!! Averaging over 25 miles per gallon at 75 mph and logging over 1100 miles – a huge success!!!



Future Truck - Quarterly Cow
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