

# Good Connection

How Turck's quick disconnect connectivity products helped the University of Wisconsin-Madison's Electric Ford F150 research vehicle come to life

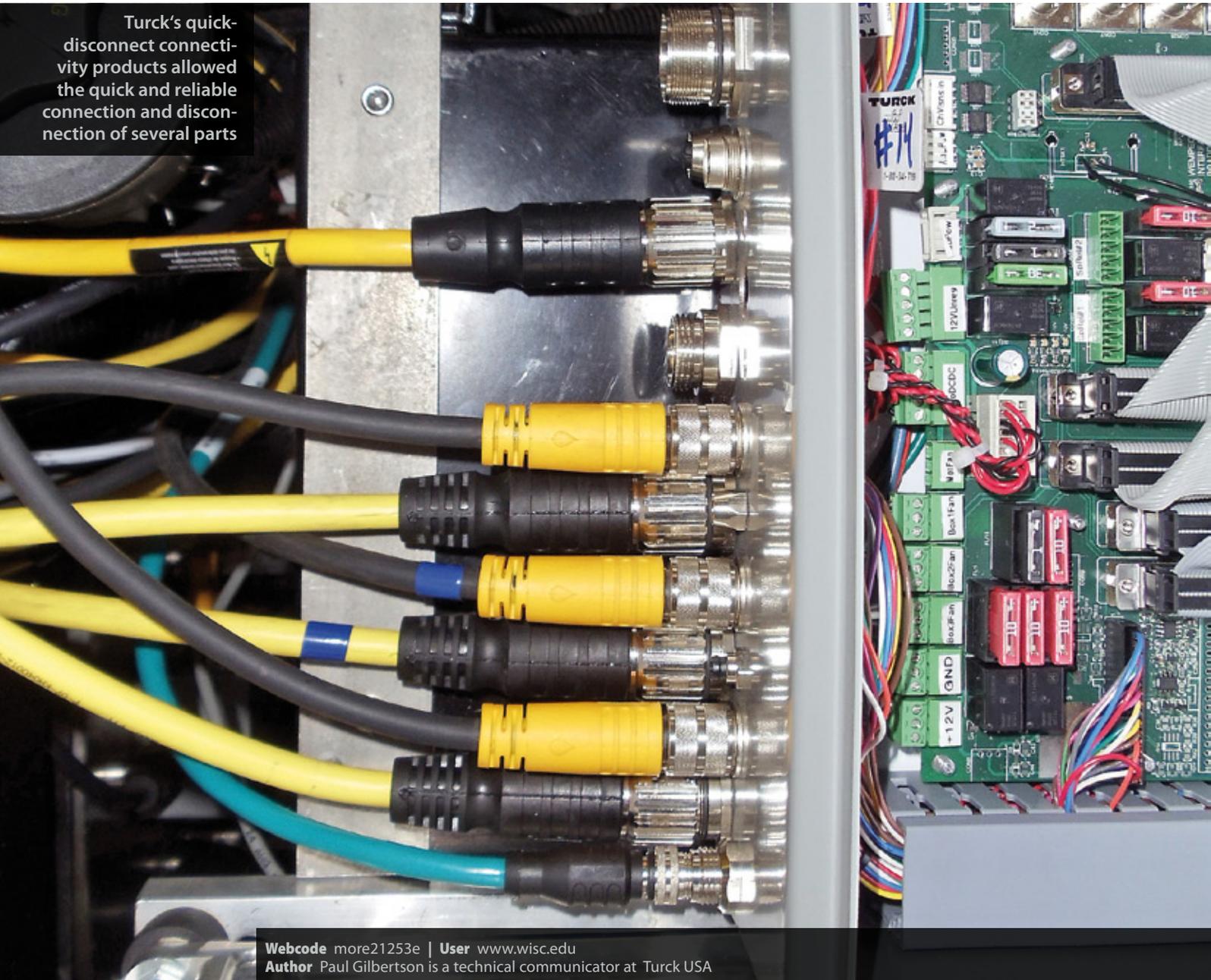
**P**hillip Kollmeyer has long been interested in building a research vehicle. He wrote his master's thesis on the electromechanical modeling of a Corbin Sparrow, a red, three-wheeled single seater electric car manufactured in California a few years ago in 2001.

For his doctoral thesis at the University of Wisconsin-Madison Kollmeyer took it one step further: he strived to build a state of the art electric research vehicle, with a modern battery pack, electric motor, and motor drive. Kollmeyer's dream vehicle included technology on par to commercialized vehicles along with a hefty

budget for advanced sensing and control hardware. The electrical engineer found support for his ambitious project at Orchid International, a metal stamping and manufacturing company, Orchid had been involved in building a prototype electric motor for a startup electric vehicle (EV) company, and expressed an interest in sponsoring a project with the university.

Orchid provided the foundation for the project – it designed and built a prototype electric motor, mounted the drivetrain, and also helped provide funds to ensure the extensive list of parts that were needed could be secured.

Turck's quick-disconnect connectivity products allowed the quick and reliable connection and disconnection of several parts



## Benefits of electric

One goal of electrifying a Ford F150 was to be able to better quantify the benefits of utilizing an electric powertrain versus the stock F150 powertrain.

The electrified vehicle has zero emissions; lower energy costs from about \$0.22 per mile to \$0.07 per mile, offers similar power to the stock vehicle while requiring a simpler, more efficient two speed gear box, and reduces brake wear through regenerative braking. If those benefits aren't enough, it is also exceptionally quiet, with the only noise coming from the battery, motor, and radiator cooling fans. As the project continues, modeling, control, and design projects will continue to explore further opportunities to improve the efficiency and reliability of the vehicle, as well as lower the cost of individual components.

## Strong support

Although Orchid provided strong support the postgraduate also took the project as an opportunity to collaborate with others. As Kollmeyer explained, "As the detailed plans were coming together, I realized I needed to find a way to connect all these systems together. At that time I remembered that Turck's range includes cabling"

Kollmeyer got in touch with Larry Jacob, Sr. Sales Engineer for Turck representative MTech, who was a key to the cabling and connectivity success of the project. As Kollmeyer describes, "I started out with an abstract block diagram of the whole vehicle, with lines connecting all the different components. Larry Jacob helped me get from the block diagram, to an actual specification for each cable in the vehicle. I really started out unfamiliar to the world of industrial cabling, and Mr. Jacobs met me personally, suggesting specific specialty cables for certain applications including Ethernet cable and power cables where they fit. Then I spent a long time with the big Turck connectivity catalog, and ended up with 34 cables providing interconnection between more than a dozen vehicle systems."

## Quick disconnect

One of the most convenient features of Turck's cables is their quick disconnect feature – basically a few minutes is all that is needed to disconnect or reconnect a set of cables. With the research vehicle continuously having components and different systems worked on, there is a need to constantly remove and reinstall parts of the system. Turck's quick disconnect connectors made what would otherwise be a major undertaking, one which for a vehicle typically involves a maze of hand assembled wire harnesses and comparatively fragile automotive connectors, a painless and easy part of the process.

Kollmeyer has taken full advantage of this feature to minimize the hours needed to complete the project. He explained the benefits as follows: "Many of the connections in our research vehicle are sensitive signal level cables, requiring shielded cabling. If I had to build



**Research vehicle: With support from Orchid and Turck Phillip Kollmeyer developed an Electric Ford F150**

all these cables by hand, it would have taken weeks, and I wouldn't be nearly as confident in their performance. And a further benefit of the Turck solution is the receptacles, which are populated with color coded flying leads making populating connectors quick and easy compared to traditional methods."

## Conclusion

With the exception of the high current battery cable, Turck provided all the cabling in the vehicle. Compared to a production electric vehicle there is an exorbitant amount of cabling, which is due to one of the research features of the vehicle – extensive measurements of component efficiency and power consumption. As Kollmeyer puts it, "Turck's quick disconnect connectors really made it possible for me to develop a reliable, water proof, prototype electric vehicle." The vehicle is now being shown at events across the country, including the 26th annual International Electric Vehicle Symposium in Los Angeles and the 1st annual International Transportation Electrification Conference in Detroit. Each show requires the vehicle to be in show worthy condition, which means many long days leading up to the show preparing the vehicle for tech savvy crowds eager to see the vehicle which Kollmeyer is proud to show. ■



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**Phillip Kollmeyer,**  
University of  
Wisconsin-Madison

### ▶ Quick read

For his doctoral thesis in electrical engineering at the University of Wisconsin-Madison Phillip Kollmeyer developed and built an electric research vehicle. The postgraduate equipped a Ford F-150 with a modern battery pack, electric motor, and motor drive – including quick disconnect connectivity from Turck.