Maintenance, Training, & Safety

June 29, 2021

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NACFE NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

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More info at www.runonless.com

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Join us for the 10th anniversary of the leading clean transportation event!

August 30 to September 2, 2021

Bootcamp Attendees Discount Code: **BOOTCAMP50**

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Electric Truck Bootcamp

- 4/20 – What's Driving e-Trucks
- 5/5 – Charging Planning & Buildout
- 5/18 – Charging Power Management
- 6/1 – Working with Your Utility
- 6/15 – Incentives for Electrification
- **6/29 – Maintenance, Training, Safety**
- 7/13 – Financing the Transition
- 7/27 – Sustainable Value Chains
- 8/10 – Global Perspectives
- 8/24 – Driver Behavior & Experience

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Bootcamp Updates

Resources for each training now linked on website!

Resources

- Funding Finder Tool (CALSTART)
- Advanced Transportation Funding Programs (ACT News)
- New Jersey Zero-Emission Incentive Program (NJEDA)
- National Zero-Emission Truck Coalition (CALSTART)
- Zero Emission Vehicle Awareness Initiative (NRCAN)
- Zero Emission Vehicle Infrastructure Program (NRCAN)
- Federal and State Laws and Incentives (Alternative Fuels Data Center)

Successfully complete all 10 Bootcamp quizzes to earn free Run on Less – Electric hat!

Before we get started:

Q&A

Submit your questions to the host using the Q&A box in the upper right-hand corner.

Presentations

A recording of today's webinar will be available on the ACT News website, and you will be emailed a link by early next week.

Survey

There will be a 30-second survey shown at the end. We appreciate your feedback!

Technical Issues

Contact Benjamin Chan at:
benjamin.chan@gladstein.org
or call 310-573-8545 for assistance.

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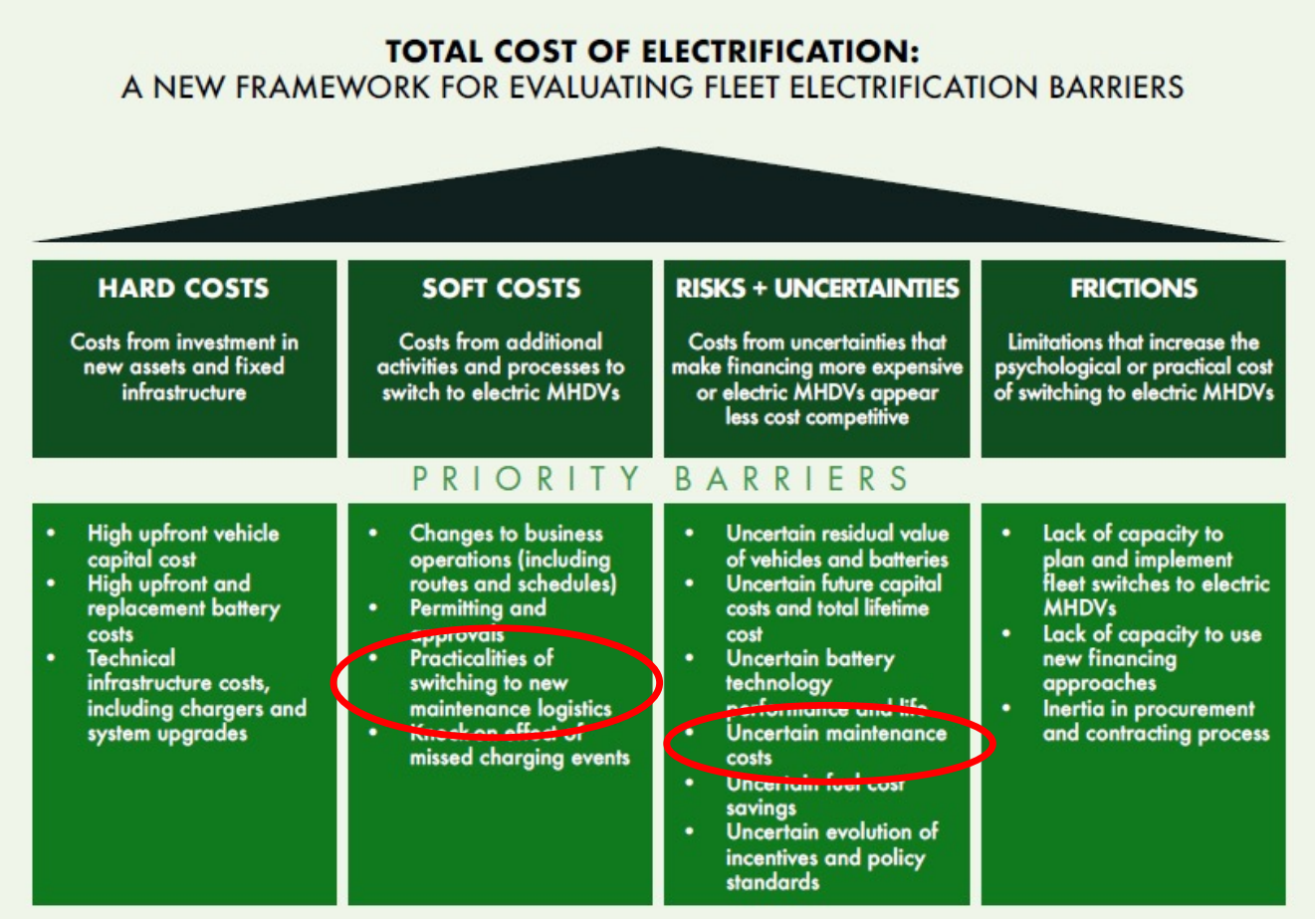
Thank you to today's sponsor!

Maintenance, Training, & Safety



Many questions remain

Source: EDF & GNA

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Today's Speakers:

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Vice-President of North American Truck Sales
The Lion Electric Co.

Kevin Otto
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NACFE

Gregory Bowen
eMobility Trainer/Developer
Daimler Trucks North America

John Frala
Professor, Alternative Fuels/Electric & Fuel Cell Vehicles
Rio Hondo College

Mike Steiner
Customer Engineering Support
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ELECTRIC TRUCK MAINTENANCE

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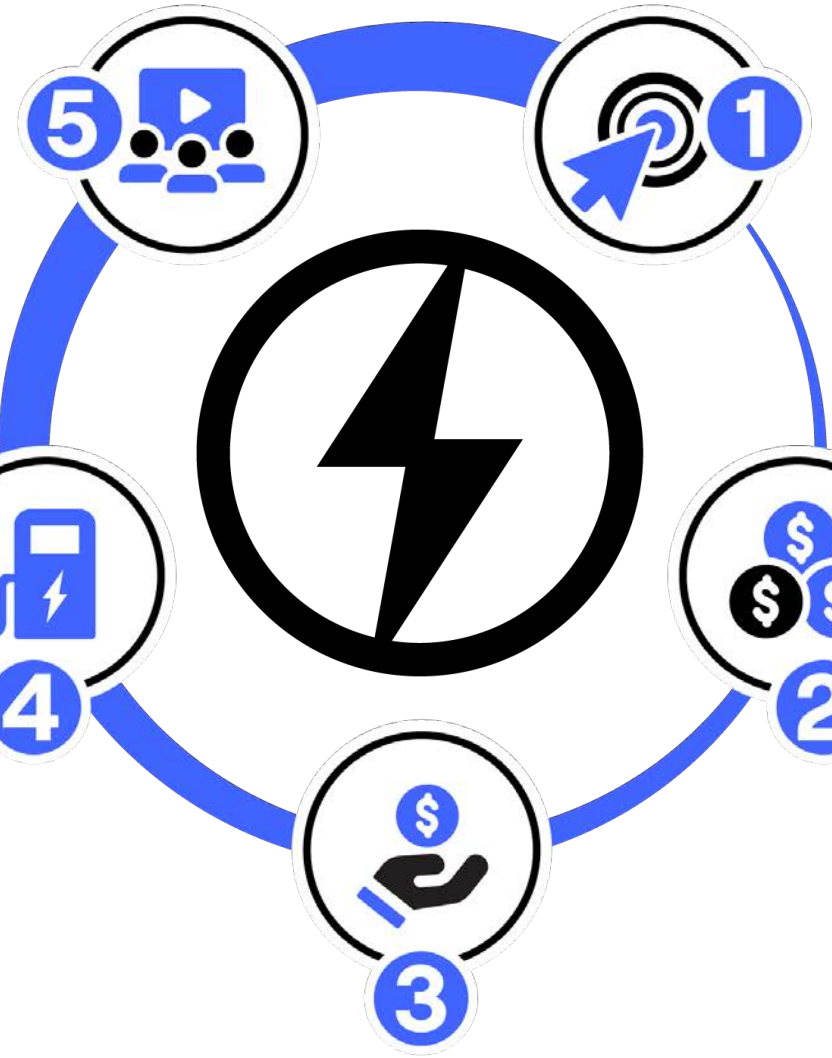
5 steps to electrify your fleet.



Provide the right EV training to your crew

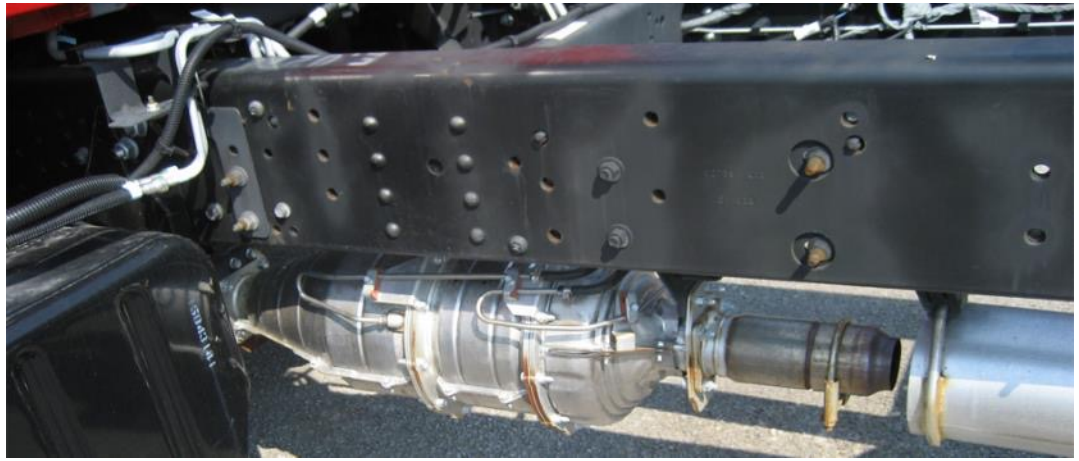
Make sure electric fits your needs

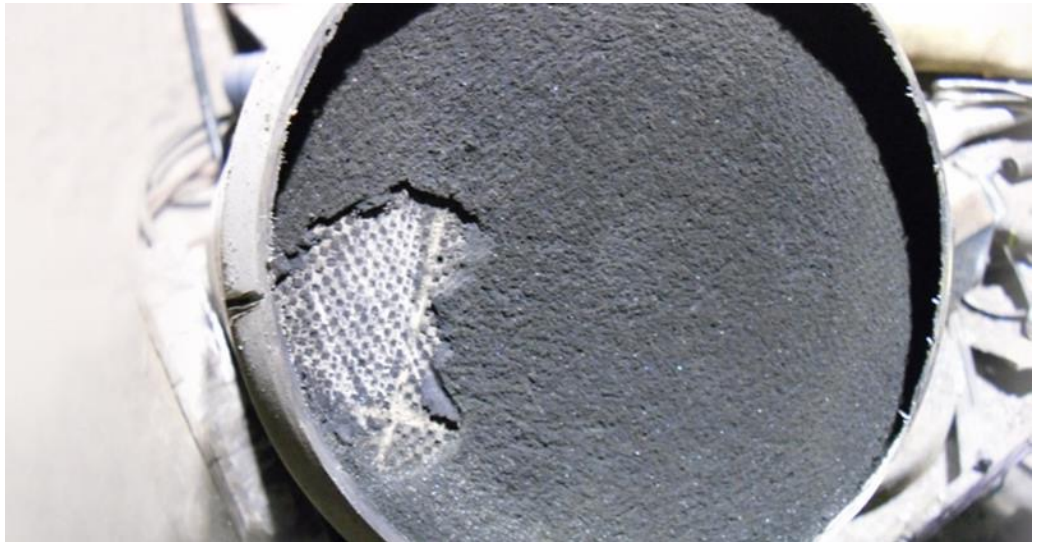
Get the right infrastructure evaluation

Consider the Total Cost of Ownership

Discover all financing options possible

I will be brief: No DPF – No DEF





Maintenance

- NO OIL
  - There's no engine oil in an electric vehicle, the only oil you will find is in the differential and is replaced after 100k miles
- A LOT LESS MOVING PARTS
  - The EV motor contains 20 components, an ICE contains more than 2000 components.
- LONG LASTING BRAKES
  - The use of regenerative braking allows the brake system to be use at least 5 times less than a conventional vehicle.
- BUILT TO LAST
  - The components are built to last at least for the life cycle of the vehicle.

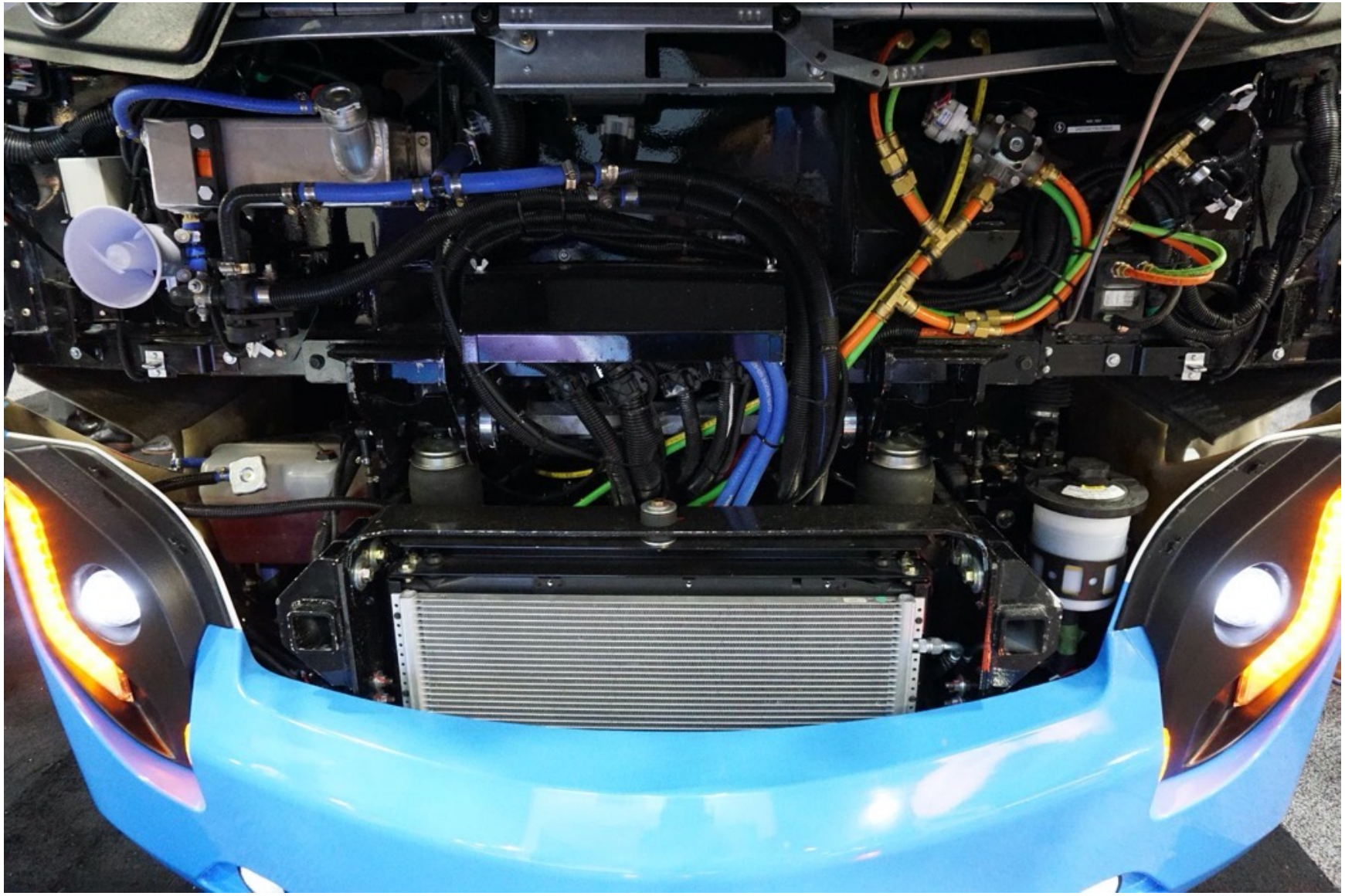
Purpose-Built to be Electric

Electric motor: **20 parts**
vs. **Diesel engine: 2,000 parts**

TOTAL BODY PARTS
Electric parts: 7,000
vs. Diesel parts: 30,000

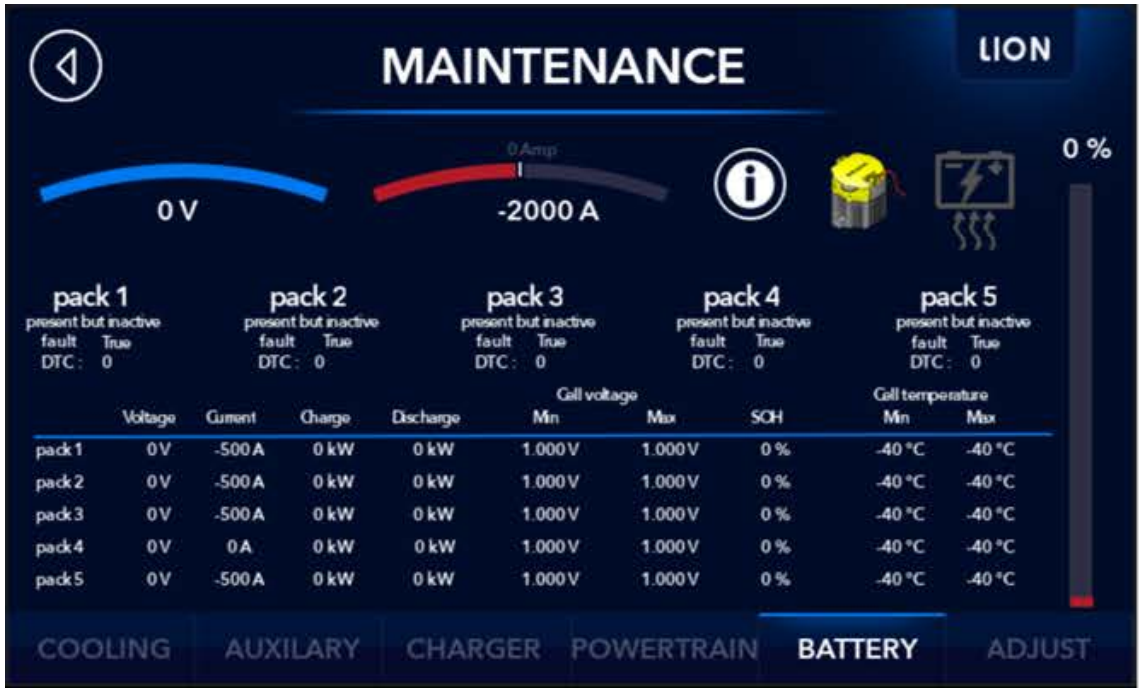
- We build our own chassis and body
- We assemble our own battery packs
- More kWh available than any other OEM on the market
- Composite body – no rust, no corrosion, no paint, no down time
- Regenerative braking system – brakes last 3x longer
- Our vehicles are not retrofitted diesel, they are born to be 100% electric
- Custom-built driver information center & clusters

Purpose-Built to be Electric



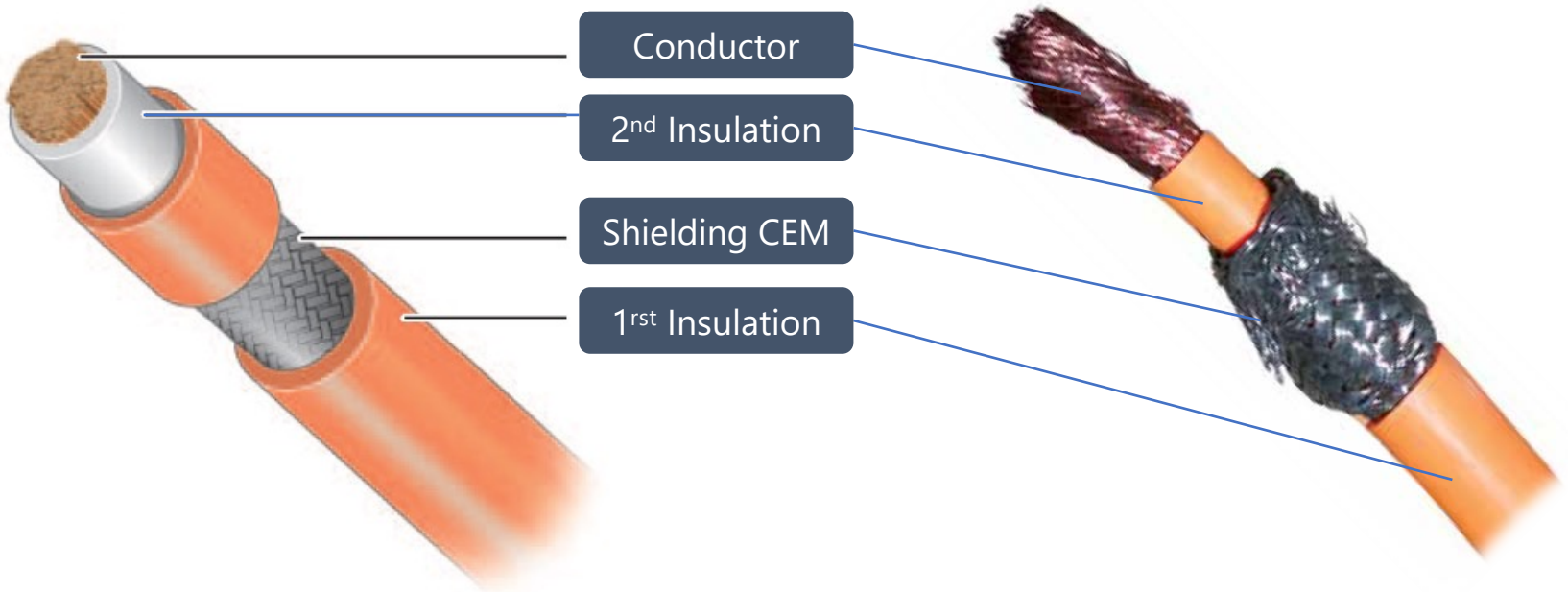
Maintenance & Diagnostic

→ 80% of maintenance can be done remotely



High-Voltage Cables

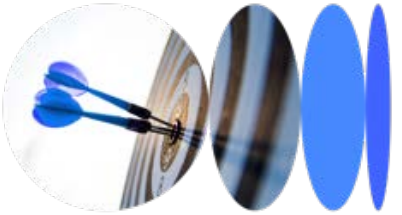
- WHAT IS A HIGH-VOLTAGE CABLE?
  At Lion, any voltage above 60V is considered high voltage. The 208V, 400V and 750V are therefore voltages identified as high voltage.
- THE COLOR CODE
  - ORANGE : The orange wiring on the bus is high voltage. When working on high voltage components or high voltage wiring, you must disable high voltage.
  - NOIR : A black cable is associated with the negative of the 12V accessory batteries.



It’s Business as Usual!

- Usual maintenance
- Brakes
- Suspension
- Tires
- Body, Lion as composite body easier to maintain

A Solution for Technician Shortage



- Smaller technician/trucks ratio
- Easy access to components
  - Quick repairs
- Cleaner and more attractive work environment
- Smaller and cheaper maintenance facilities required
- Simpler service network to establish

The bright moove

LION ELECTRIC

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NACFE Bootcamp #6 Maintenance, Training & Safety

Kevin M. Otto

Technical Advisor - NACFE

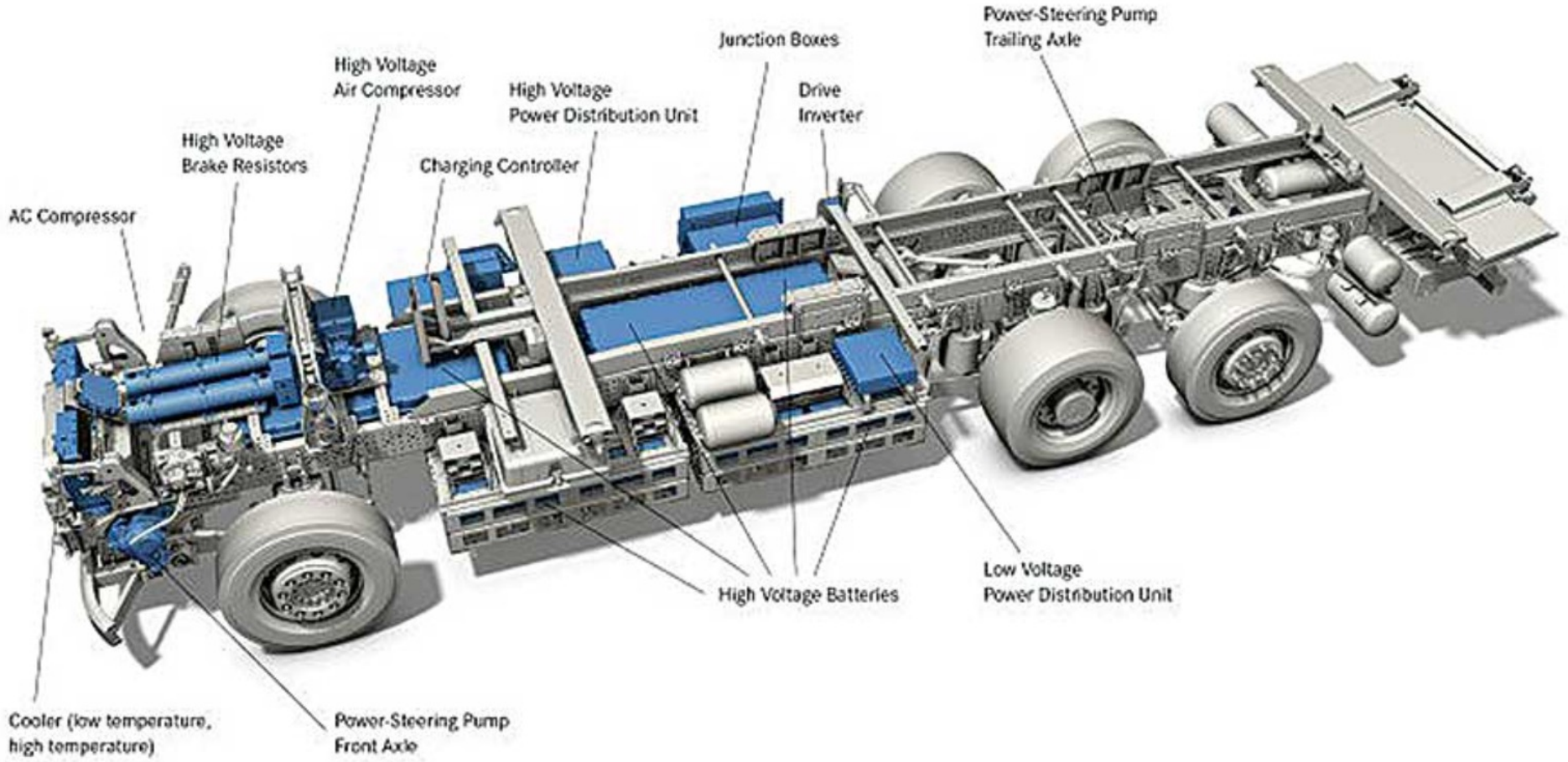
June 29, 2021

Training for Electrified Vehicles

- Some key questions:
  - How are EVs different than today's vehicles?
  - What new skills are necessary for Maintenance Management, Technicians and will some kind of certification be necessary?
  - Are there training programs in development to address the needs above?
    - OEMs and Suppliers
    - Technical Schools
    - Service Providers
  - What kind of required tools will there be?
  - Will there be technical support (information and expert assistance)?

Electric Trucks Get Ready to Roll

- How are EVs different?



Many truck manufacturers are developing all-electric power trains. Illustration courtesy Daimler AG

ELECTRIC TRUCK BOOTCAMP

What new skills are necessary for Technician and Maintenance Management?

- Key items:
  - Understand the new product ‘architecture’
    - What components does it have
    - How do they combine to do all the functions required of the vehicle
  - Knowledge of Basic Electrical
    - Not just DC 12V any more
    - Trucks will have multiple voltages and some of the systems will be AC and at least 3 phase
    - Some voltages will be very high – 400+ volts which will require new equipment, insulated tools, Personal Protective Equipment (PPE), etc.
  - Accessory systems will change significantly
    - Brakes, Power Steering, HVAC, Power Take Offs,
  - Technician Certification will be necessary at least for high voltage systems – OEMs may require more
- TMC has a task force working on a Recommended Practice for the industry on Technician Training for EVs

Are Training Programs in Development?

- Yes, but this area is still in development
- All entities will need to review training plans and classes to determine what will be required
  - This could become quite costly (resources as well as expense)
- OEMs should be expected to provide support for early vehicles
- Expect Training Classes/Certification to be on multiple levels
  - Basic, Intermediate, Expert
- I am predicting there will be exceptionally high demand for the resources with these new skills, so plan appropriately

Level 1 Vehicle Electrification Certification

Vehicle Electrification High Voltage System Architectures

a. Vehicle Level System Architecture Acronyms and Definitions
b. System Architecture - all EVs
c. Powertrain Systems Operation - all EVs

High Voltage Safety and Personal Protective Equipment

a. Hybrid and Electric Vehicle Terminology
b. High Voltage Wire and Cable
c. High Voltage Components: Labels and Identification
d. High Voltage Electrical Measurement Equipment
e. High Voltage Electrical Gloves: In-Service Care and Inspection

High Voltage Vehicle Safety

a. Introduction to High Voltage Vehicle Safety Systems
b. High Voltage Manual/Service Disconnect Systems
c. High Voltage Interlock Systems
d. High Voltage Bus Discharge Systems
e. High Voltage Isolation Fault Detection Systems

Required Tools and Technical/Expert Support

- Required Tools Examples:
  - Scan tool – enhanced from today's for additional capabilities
  - High Voltage/Current Capable DVOM
  - DC and 3 Phase AC current clamps
  - Shielded/insulated tools
  - Insulated Gloves and overgloves
  - Experts may need protocol analyzers and oscilloscopes
- Technical Support
  - Repair and Diagnostic documentation – delivered in user friendly way and compatible with 'Right to Repair' requirements
  - Available expert help on demand to evaluate fault codes/symptoms
  - This will be initially supplied by OEMs and Service Providers, but portions will eventually trickle down to fleets

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Electric Vehicle Training at Daimler Trucks North America

Greg Bowen, eMobility Developer / Trainer

High Voltage Safety Training for Electrical Vehicles

DTNA's high voltage training program was adapted from DGUV-I 200-006, which is the product of a collaboration between all German auto manufacturers.

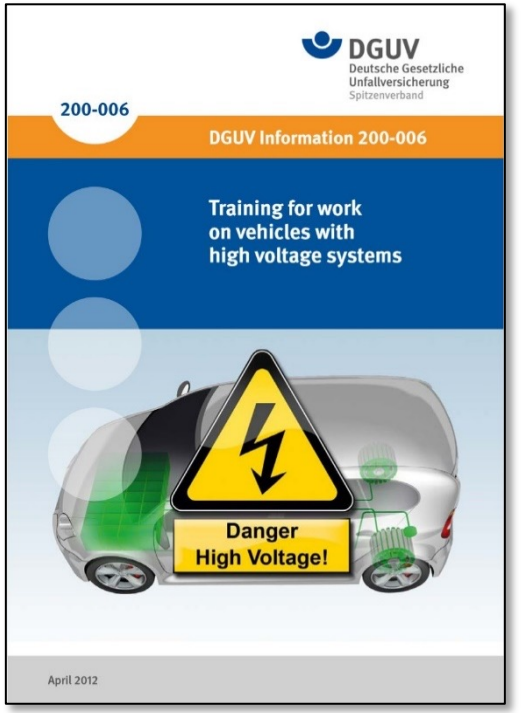
It is also the basis of Mercedes-Benz US technician training for hybrids and EVs.

This book available in supplemental materials. HV3 course follows *Annex 4* outline.

We currently offer three levels of electrical safety training, based upon job responsibilities.

HV1 & HV2 are online courses. HV2 allows a technician to work safely on non-HV systems, such as mechanical and 12V systems.

HV3 is 3-day instructor-led course that covers the fundamentals of an electric drive system, and how to be 100% sure that the HV system is locked-out / tagged-out and de-powered before working on it.



Technician Safety Roles

Employee Task	NONE	HV1	HV2	HV3
Drive a series production vehicle. This is the scenario for a customer driver.	X	X	X	X
Drive a prototype vehicle with an HV system.		X	X	X
Conduct Low-Voltage system testing and repair.			X	X
Drive a vehicle containing a HV system in a test drive.			X	X
Perform work on non-HV systems.			X	X
Perform any work on automotive HV system.				X
Decommissioning and recommissioning of a vehicle HV system.				X
Perform HV system modifications and trou-bleshooting without an approved procedure.				

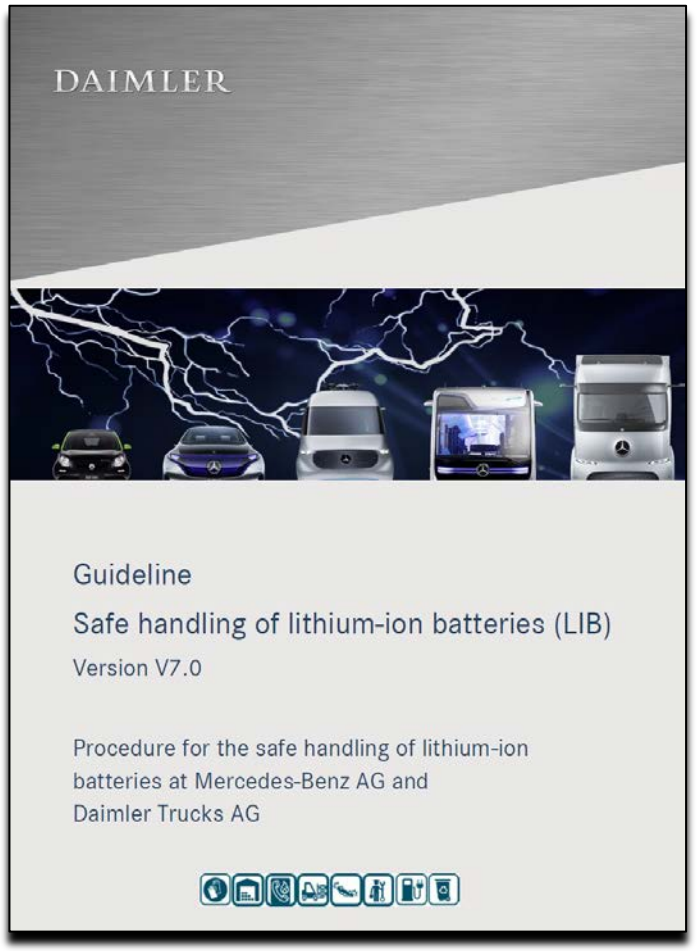
Battery Safety Training

The battery safety training syllabus was written by Daimler AG similarly to high voltage safety training with three levels; Battery Handler, Battery Specialist, & Battery Expert.

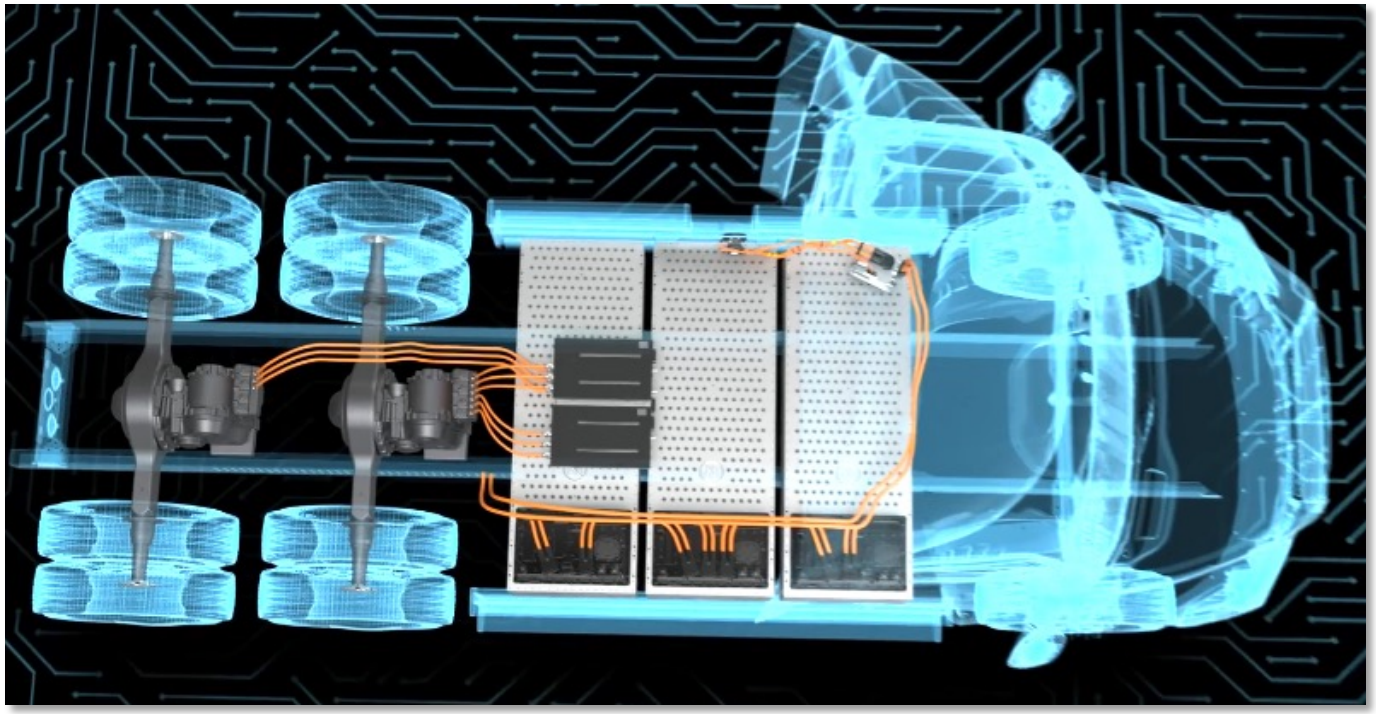
The German Battery Handler training “covered the bases” of European safety training requirements for personnel working around Li-Ion batteries. This original Daimler AG training will be augmented to meet the additional US regulations: OSHA 29 CFR 1910.1200 and DOT 49 CFR 172.704.

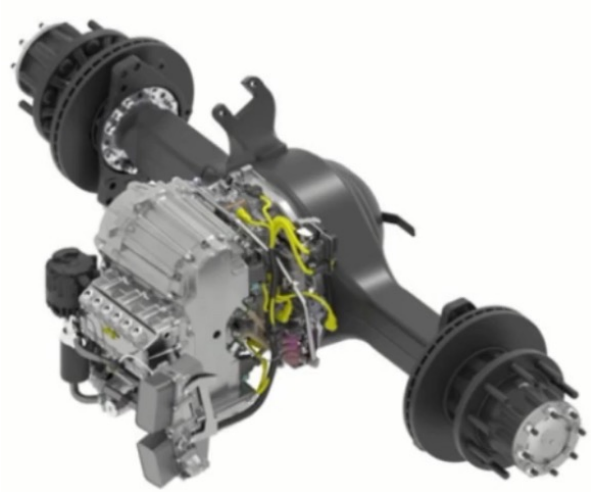
The Battery Specialist is additionally trained to conduct the manufacturer’s battery inspection form, and certify that a battery is safe to ship per DOT regulations. Battery Specialists also direct immediate actions at a facility.

The Battery Expert may not be present in the field. This person is responsible for determining whether a damaged battery is safe to ship, or how to make it so. DTNA may take a one-size approach and have crash-damaged batteries, for example, ship in vented steel box.



Technical Training





This will be the first qualification to require two sequential instructor-led courses; HV3 and the vehicle technical course.

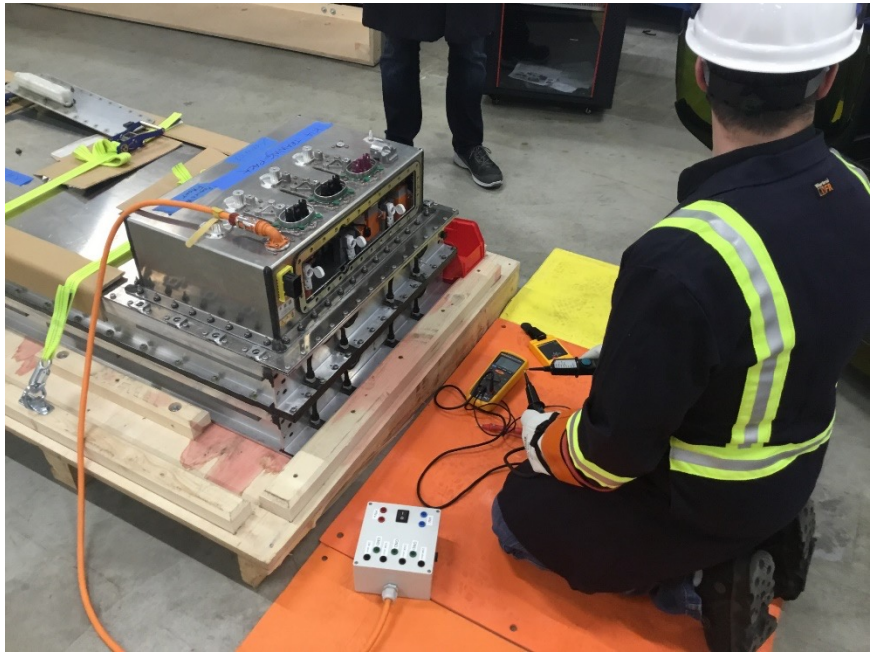
Pre-series trucks will be supported by web-based technical training. These courses will become prerequisites for an instructor-led course released at the start of series production.

The current intent is to require Cascadia certification as a prerequisite as the eCascadia technical training material will largely be presented as delta-style training. E.g. an eCPC controls the EV drive system.

Detroit will be offering component-level training, similar to their current offerings for Detroit-branded components such as e-axles, and batteries.

Additional Technical Training

Some Charger Maintenance and Repair procedures will be within the capabilities of charger owners and operators. Charger maintenance and repair training will be co-developed with dealership technical experts.



Live Work Training
As the industry becomes more accustomed to working with EVs, we will eventually reach the point where dealers will be replacing cells in a battery. Since opening a battery case involves exposing high voltage components that cannot be isolated, further training in the procedures for working on live voltages will be required.

Hydrogen Fuel Cells
When Fuel Cell Hybrids begin supplementing battery electric vehicles, there will be more to share!

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Maintenance, Training and Safety

Rio Hondo College
Alternative Fuels, Electric Vehicles
and Hydrogen Fuel Cell Training

June 29, 2021

Professor John Frala, Rio Hondo College Whittier, CA

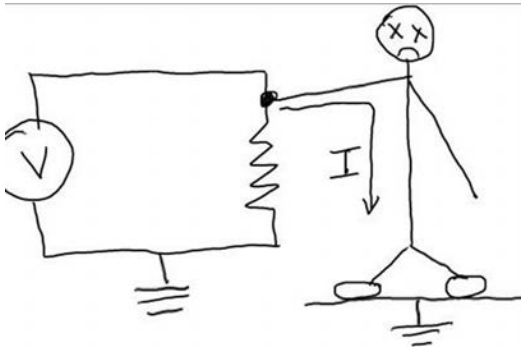
Coordinates the Alternative Fuels

- Co-PI for the NEVTEX NSF grant
- Associate of Science Advanced Alternative Fuels Transportation
- Associate of Science Electric and Fuel Cell Vehicle Technology
- Certificate of Achievement in Tesla Technology
- Volvo Lights Project, Electric Class 8 Trucks

What we found in our grant research,

Currently there are NO uniform Standards for technicians who are working with High Voltage or High-Pressure systems.

Several existing training formats that are available are outdated by technology changes.



This has been confirmed by the industry

SAE Society of Automotive Engineers

OSHA Occupational Safety Health Administration

Department of Transportation

Department of Energy

California Energy Commission

South Coast Air Quality Management District

California Air Resources Board

CSA Canadian Safety Administration

NFPA National Fire Protection Administration

Hoke/ CiCor

Swedgelock

Several meetings with the Alternative Energy Transportation Team at CSA Group

- Establish the need for Hydrogen fuel tank inspection standards
- Establish the need for high pressure piping certification
- Establish the need for technician high voltage certificate training
- Establish uniformed standards for this certification

This Project Grant has helped to build relationships with essential Advisory partners throughout the country. These members are truly representative of the vehicle electrification systems dealing with high-pressure storage and handling of fuels and high-voltage storage and creation.

A sample template and list of Advanced Standards categories have been established as we plan for refinement of the standards criteria.
An initial discussion has taken place as we select the first 10 test sites for the first 2 standards to be “proofed”.

This grant also opened the door for (In California) to establish the Volvo Lights training project on Class 8 Electric Truck at Rio Hondo College.

Second development was the formal MOU between the West Coast Center of Excellence and Rio Hondo College to develop training and certification participation for Transit fuel cell technicians and their managers.

Train the Trainer Level One Standards developed and now being delivered this year.
Train the Trainer Level Two Standards developed and now planning for delivering this year.

Level three is being finalized currently.

SAE/ITC certification on training to be delivered through the Prometric system.

For More Information

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(NSF ATE award #1700708)
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NACFE – Run on Less - Electric

Tire Considerations

Mike Steiner, Michelin Field Engineer

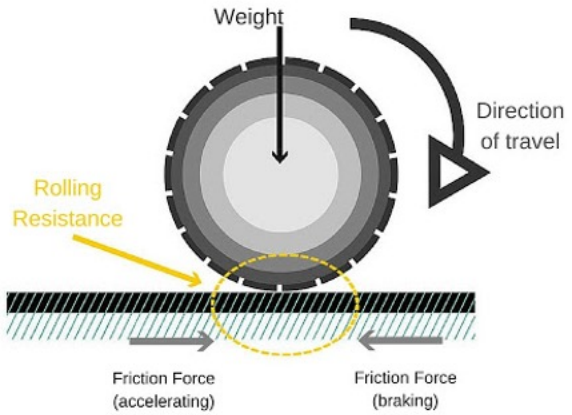
MICHELIN
A BETTER WAY FORWARD

NACFE – Run on Less - Electric
Tire Considerations

- Learnings
  - Tire performance
- Best practices
  - Tire choice and maintenance
- Next generation tires – Electric vehicle
  - Specific development

NACFE – Run on Less - Electric Tire Performance Learnings

- Rolling resistance – All axles
  - Higher importance for EVs due to range limitations



- Load carrying capacity
  - Regulation change

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

    - Natural Gas Vehicle (NGV) and Plug-In Electric Vehicle (PEV) weight exemption
      - 2000 pound increase for Class 8 gross vehicle weight
  - Steer axle is already close to tire load limits

- Wear – Drive axle
  - Accelerated wear rate compared to diesel equivalent

MICHELIN A BETTER WAY FORWARD

NACFE – Run on Less - Electric
Tire Choice and Maintenance Best Practices

- Appropriate tire selection for electric vehicle application
- Guidance on tire maintenance
- Driver and technician training

NACFE – Run on Less - Electric
Next Generation Electric Vehicle Tires

New breakthrough tire technologies needed for:

- Increased load carrying capacity, **and**
- Reduced rolling resistance, **and**
- Improved wear

MICHELIN
A BETTER WAY FORWARD

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Thank you!

Please complete the survey at https://subscribe.act-news.com/NACFE-RoL-E-Survey

For more information & to earn your Electric Truck Expert badge, please visit: www.RunOnLess.com

Our next training is **July 13** on **Finance & Innovative Business Models**

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