

**DOCKETED**

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# Fuels & Transportation Technology Merit Review Workshop

## Manufacturing and Workforce Development



**EFFICIENT DRIVETRAINS®**

**August 6<sup>th</sup>, 2018**

# The EDI Journey...

*From start-up to successful acquisition by Fortune 500 company*

2007



- Founded to turn a portfolio of patents from UC Davis Professor Andrew Frank into real-world products.
- \$150,000 loan from the City of Dixon and underwritten by the State of California.
- Five initial employees.
- One location in Dixon, CA.
- Start product development.

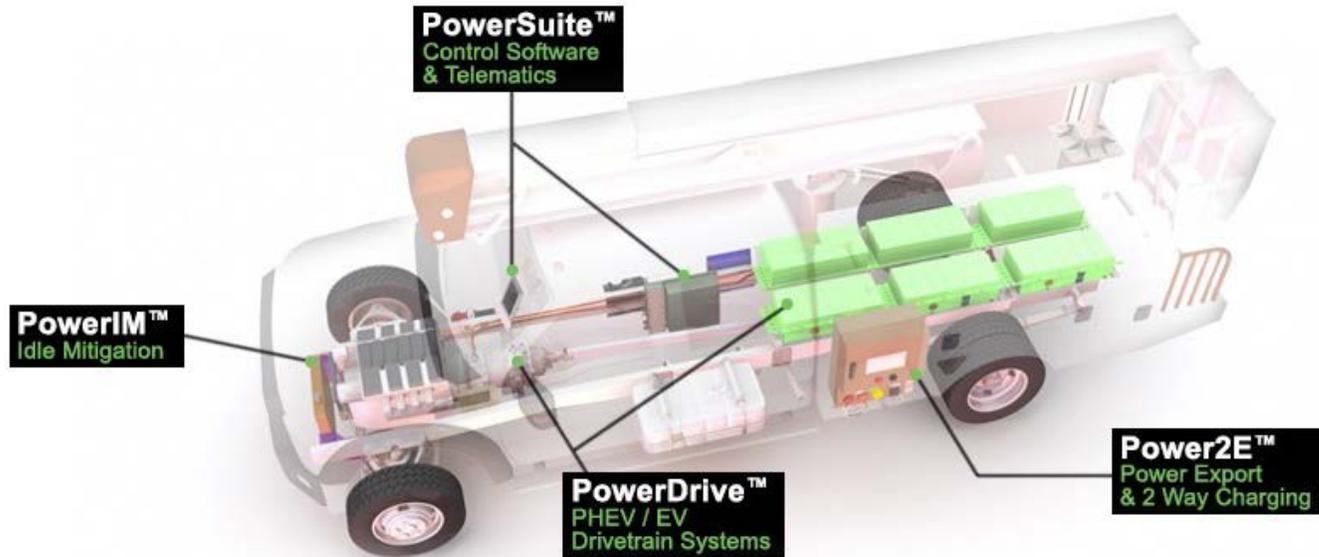
2018



- Over 50 employees and contractors (and growing).
- Multiple locations in Milpitas, CA, Dixon, CA, Shanghai and Beijing, China.
- Over 200 EV and PHEV drivetrains deployed or on order in the US, China and Taiwan (and growing).
- Several strategic partnerships with major OEMs (Blue Bird, Thomas Built Bus, Freightliner, FCCC,...).
- Acquired by Cummins, Inc. and part of its Electrified Power Business Unit.

# EDI's Technology Offering

*PHEV and EV drivetrain, control software and export power solutions*



- **EDI PowerDrive™ PHEV**

- INDUSTRY FIRST zero emissions PHEV drivetrain solution
- 4 modes of operation: EV, EV+, Parallel HEV, Series HEV

- **EDI PowerDrive™ EV**

- FULL POWER ELECTRIC drivetrain and vehicle electrification solutions
- Same parts and components as PHEV product line for economy and ease of service and maintenance

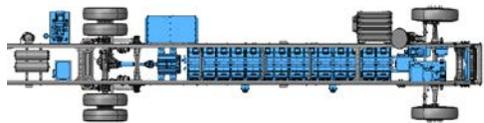
- **EDI PowerSuite™**

- Software for controlling complex drivetrain and battery system functions. Telematics for diagnostics, fault management, and communicating with operators

- Complete range of **technical services** including:

- Vehicle electrification and integration of EDI's solutions
- Telematics data analysis and reporting
- Low volume production of initial vehicles

# Highly Scalable Business Model



**Builds & Tests PD7000ev Modules**

**Fabricates & Tests Harnesses & Cables**

**Programs PowerSuite Software**



**Builds School Bus Chassis**

**Installs PD7000ev Kit onto School Bus Chassis**

**Test EV-powered School Bus Chassis**



**Builds School Bus Body & Interior**

**Installs Body & Connect Subsystems**

**Finishes School Bus**

**Complete Final End-of-Line School Bus Test**



# Advanced Vehicle Manufacturing Facility (ARV-14-047)

- ARFVTP Solicitation PON-14-604
- Awarded in February 2015
- Contract Executed in April 2015
  - Energy Commission Funds: \$2,990,900 / EDI Cost Share: \$3,858,702
- Amendment #1 executed in January 2017; Amendment #2 approved in July 2018
  - No-cost time extension
  - Equipment list changes to better answer company evolution in a fast-changing market
- Project will be completed by March 2019

# Lessons Learned

- In a fast-changing market, companies need to change and adapt to survive
  - EDI's original focus was on CVT, PHEV drivetrains and vehicle control software. Prototype demonstration vehicles. Lengthy design/build cycles. Limited OEM interaction. Demand driven by end-users.
  - EDI's current focus on formal and expansive EV/PHEV drivetrain product offering. Low volume vehicle production. Modularized system for fast time to market. Strategic relationships with major OEMs. Demand driven by truck OEMs and Tier 1 suppliers.
  - Fast-developing technology industry requires a more stream-lined Public/Private Partnership process
- Contracting process can delay/exacerbate project progress
  - Time from approval to contract, and approval of necessary amendments, put stress on the individual project partners, and can disrupt project teams
- Requirements for data collection and analysis task remain hard to define
  - Boilerplate contractual language is not well adapted to manufacturing facility projects
  - Nominal six months data collection requirement is not well-suited for the development of a California manufacturing facility
- Current equipment/materials list changes require amendment
  - Equipment/materials costs vary from \$680,000 to less than \$100 per item.

# Suggestions for Future Manufacturing Grants

- Manufacturing grant projects should be anticipated to change
  - The end point is the same but alteration to the pathway is some times needed
- Contracting/amendment process should be expedited
  - Assurance of a maximum of 3 months between initiation and execution of the contract, and for necessary amendments
- Data collection and analysis task should be re-evaluated/modified
  - How do we best measure that the project goals were met and the manufacturing facility is operating as planned? Is 'data collection' the answer?
- Equipment/materials budget should be more flexible
  - Modifications should be allowed without triggering the formal amendment process

# Project's Success

- Allowed EDI to attract investors and secure lines of financing
  - Partnership with Energy Commission made EDI more attractive to investors
- Solidified EDI's presence in California
  - Created 50+ jobs, paid \$16 million in salaries and benefits, paid patent royalties of over \$2 million to the UC System, attracted \$13 million of foreign investment
- Important piece of the fulfillment in Cummins' due diligence
  - Energy Commission grant review process provides valuable third-party evaluation
- Supports high quality job creation and retention in California
  - 18 engineers, 24 technicians, 7 administrative and support staff
- Training in specific skills targeted at advanced vehicles development
  - Vehicle control systems, high/low voltage electrical, Li-ion battery testing, drivetrain dynamometer testing, PEMS testing

# EDI's Advanced Vehicle Manufacturing Facility Today...



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# Manufacturing & Production Capabilities

*Production rate of up to 2,000 drive system kits per year*

- PowerDrive™ System Engineering & Design
- Component / Subsystem Development & Validation
  - Battery Test Lab, Metrology Lab, Development Test Lab
  - Validation Test Lab Equipment (Quality, Reliability, Durability)
  - Drivetrain Dynamometer
  - Emissions Measurement System
- PowerDrive™ System Production
  - Ramping up to reach production rate of up to 2,000 drive systems per year in 2019
  - Targeting initial production rate of 1 drive system per day in June 2018
  - Technicians trained and added as needed



## Contact

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