EXPERT WITNESS REPORT OF C A MacCarley, Ph.D., PE.

On behalf of Barrett Lyon (Plaintiff)
Represented by
Kemnitzer, Anderson, Barron, Ogilvie & Brewer, LLP.
445 Bush Street 6th Floor
San Francisco, CA 94108

November 5, 2009

1. Purpose and Conclusions

I was asked by counsel for the plaintiffs to provide an expert technical assessment of a 2008 LiV Surge ® Battery-Electric Vehicle Manufactured by EV Innovations Inc. aka Hybrid Technologies Inc. The subject vehicle is actually a modified 2008 DaimlerChrysler PT Cruiser ® identified by VIN 3A8FY68848T107401 and Hybrid Technologies Order No. 200868. My assignment was to examine the vehicle and related technical documentation, and render expert opinion regarding specific and general defects, safety and quality of engineering related to the vehicle.

I determined that the converted vehicle may best be characterized as an engineering prototype or work-in-progress conversion, containing multiple deficiencies and defects introduced by the modification to battery-electric propulsion. These deficiencies and defects affect vehicle function, features and safety, and could be expected to limit reliability. Overall, the subject vehicle fails to meet the manufacturer's representations and reasonable owner expectations of engineering quality.

The subject vehicle is shown in the photograph below.

2008 EV Innovations "LiV Surge"

2. Documents and Sources of Information Supporting the Opinion

Printed documents provided by Plaintiff's Counsel.

a. Case documents:

Plaintiff's Mediation Statement, CIV 481807, August 12, 2009

First Amended Complaint for Damages Breach of Warranties, CIV 481807

Original vehicle purchase order

Repair Options offer letter from Hybrid Technologies to Barrett Lyon, Order No. 200868, undated

FedEx Bill of Lading for replacement batteries

b. Manufacturer Publications and Manuals:

Hybrid Technologies LiV Surge Manufacturer's Specification Sheet.

Hybrid Technologies Electric PT Cruiser Users / Maintenance Manual

EV Innovations LiV Surge Electric Vehicle Operators / Maintenance Manual

Web URLs:

EV Innovations Web Site http://www.hybridtechnologies.com/

EVII | changing the world by reinventing power http://www.hybridtechnologies.com/products

LiV™ SURGE | EVII Product Web Page: http://www.hybridtechnologies.com/products/cars/surge

Product Reservation/Order Web Page http://www.hybridtechnologies.com/reserve_surge?id=Surge

Federal Motor Vehicle Safety Standards (FMVSS) http://www.nhtsa.dot.gov/cars/rules/import/fmvss/index.html

NHTSA complaint procedures http://www-odi.nhtsa.dot.gov/ivoq/ .

Comparable EV FMVSS certification example: Tesla Motors http://www.rpmgo.com/tesla-roadster-passes-fmvss-crash-tests

3. Vehicle History Prior to Inspection

Recited here are only those elements of the vehicle history directly relevant to the technical assessment of the vehicle.

Based upon an interview with Mr. Lyon:

The vehicle was delivered in December 2008, approximately three months later than promised at the time of purchase June 24, 2008 (ref: original vehicle purchase order). The vehicle was delivered non-operative, and Mr. Lyon noted a number of significant quality issues. Initial repairs were made by the manufacturer's representative, sufficient to allow basic operation of the vehicle. Mr. Lyon immediately noted that the vehicle maximum range was approximately 70 miles, not "120+ miles" as claimed by the manufacturer on the vehicle sales data sheet (Appendix b.1). This range limitation was demonstrated to the manufacturer's representative after the vehicle had been made operational.

As of October 2009, web-based information published by EV Innovations indicates (at least) two vehicle range specifications:

"100-120 miles" http://www.hybridtechnologies.com/reserve_surge?id=Surge
"up to 120 miles" http://www.hybridtechnologies.com/products/cars/surge

As confirmed by supporting documents (Repair Options offer letter from Hybrid Technologies to Barrett Lyon, Order No. 200868; FedEx Bill of Lading for replacement batteries), the vehicle battery system failed shortly after delivery. The vehicle information system was never fully operational. Two modules from the original battery were replaced by a manufacturer's representative, and a significant but undetermined number major electrical modifications were made to the vehicle, including major rewiring observed by Mr. Lyon. The vehicle was made operational, although not to the level of operation inferred by sales literature and verbal promises by the manufacturer, as noted in the following section.

The 30A vehicle charging locking connector overheated during the first complete battery charging cycle, causing the connector to melt due to excessive heat. Below is a photograph of the connector taken by Mr. Lyon using a cell phone camera. While blurred, the photograph clearly shows the partial melting of the upper connector input. The reason for this failure remains unverified, although excessive current is the most logical explanation. Such a failure has the potential to cause a vehicle fire. The connector was subsequently replaced by the manufacturer.

Original 220 VAC Charging Connector, Vehicle Side

Mr. Lyon noted excessively loud noise from under the hood of the vehicle, and was advised by the manufacturer that this noise could only be mitigated by disabling the power steering of the vehicle.

Concerned about the excessively heavy feel of the vehicle, exacerbated by the resultant lack of power steering, he had the vehicle weighed at a commercial truck scale with the following unladen weights measured for the front and rear axles independently, as well as overall:

Total chassis weight: 3850
Front weight: 1990
Rear weight: 1860

The vehicle traction battery would not accept a full charge. The vehicle 12V accessory battery did not charge from the main traction battery as it should. Mr. Lyon was instructed by the manufacturer to use a master disconnect switch located on the dashboard to completely disable the vehicle electrical systems, to prevent total discharge of these system.

4. Vehicle Inspection Observations

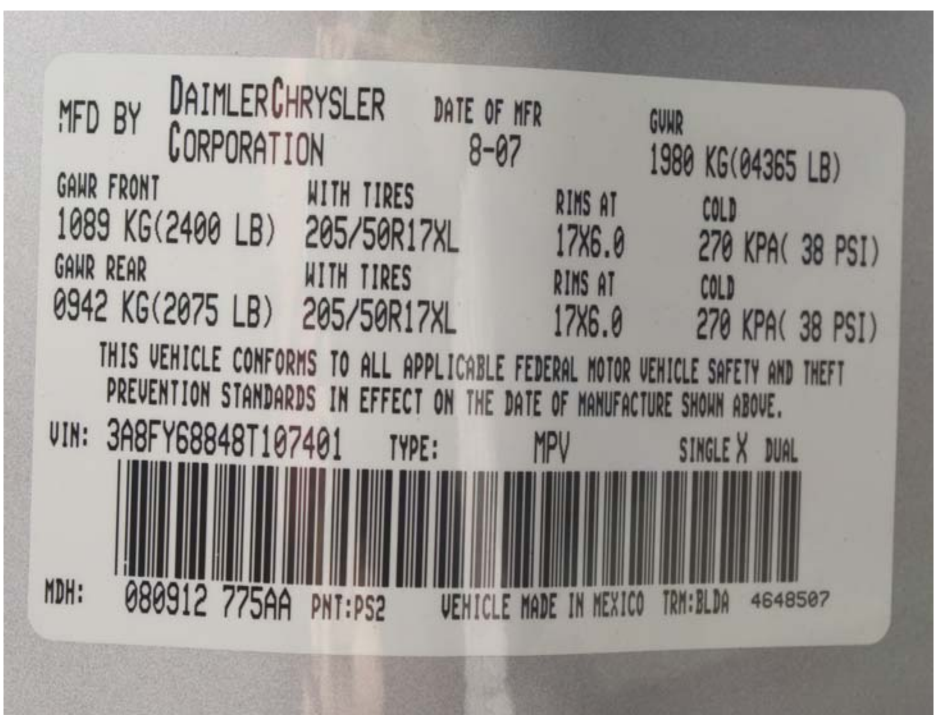
I inspected the vehicle at Mr. Lyon's home on October 22, 2009. According to Mr. Lyon, the vehicle had not been touched for approximately two weeks. The "emergency disable" switch The 12V vehicle accessory battery was completely dead, preventing any vehicle systems, including the OEM (Original Equipment Manufacturer) keyless door-locking system, from operating. The vehicle was manually moved to a safe inspection area and the accessory battery was charged.

In this vehicle, the 12V accessory battery is charged via a DC-DC converter from the main traction battery. Since the traction battery state of charge was low but not dead, it was unclear if the DC-DC converter was operating as intended.

Vehicle Weight and Payload

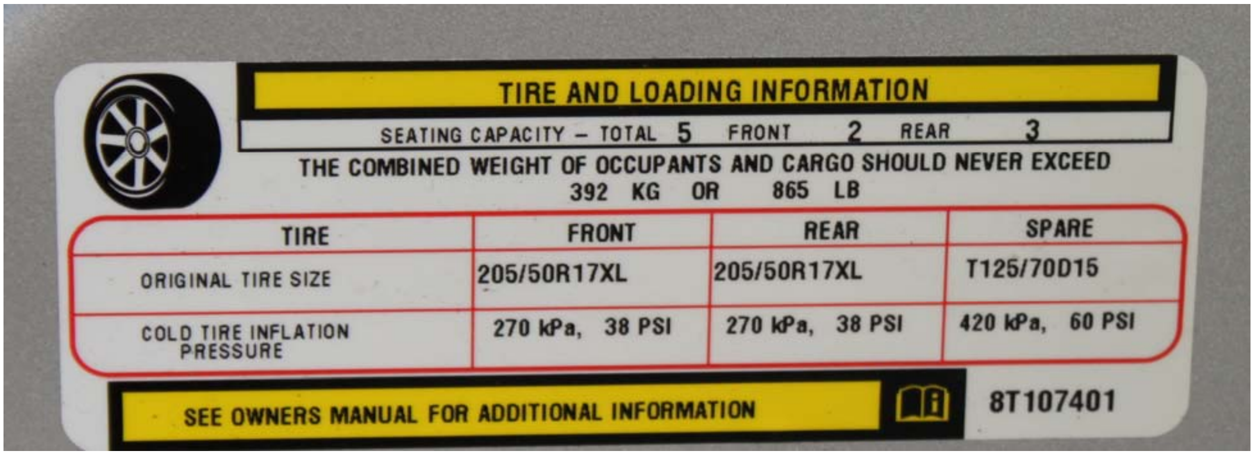
The vehicle was inspected externally in all accessible areas, including underneath the vehicle. Photographs were taken when appropriate.

A copy of the vehicle certification label from the drivers-side door jamb is shown below.



The GVWR of 4365 lbs is the highest loaded vehicle weight for which the vehicle was certified under FMVSS (Federal Motor Vehicle Safety Standards) http://www.nhtsa.dot.gov/cars/rules/import/fmvss/index.html .

A photograph of the OEM manufacturer's weight and loading information is shown below.



It indicates a maximum payload (combined weight of occupants and cargo) of 850 lbs. The difference between the GVWR and the payload is the unladen weight of the OEM vehicle (prior to modification), 3515 lbs.

From the OEM manufacturer's web site for the 2008 Chrysler PT Cruiser LX Wagon: "Weights: gross vehicle weight rating (lbs) 3,935, curb weight (lbs) 3,070, gross trailer weight braked (lbs) 1,000 and max payload, (lbs) 865"

According to EVii/Hybrid Technologies specifications http://www.hybridtechnologies.com/products/cars/surge the advertised unladen weight of the LiV™ SURGE LiV is 3376 lbs. The actual measured unladen weight of Mr. Lyon's LiV™ SURGE was 3850 lbs., 474 lbs greater than specified. Using the higher of the two GVWRs stated by the manufacturer, the subject vehicle had a safe payload capacity of 4365 – 3850 = 515 lbs, significantly less that the 850 lb manufacturer rating and below a reasonably anticipated loading of four adult passengers plus modest luggage 4x180 + 50 lbs = 770 lbs.

Limited production electric vehicle conversions are typically allowed exemptions by the NHTSA (National Highway Transportation Safety Administration) provided they comply with the OEM vehicle manufacturer's FMVSS certification, eliminating the costly process Federal vehicle certification process which includes crash testing of multiple sample vehicles. The exemption procedure is specified under FMVSS Part 555 http://www.nhtsa.dot.gov/cars/rules/import/fmvss/index.html

The excess vehicle weight, in addition to the significant operational modifications made to the OEM vehicle clearly invalidated the DaimlerChrysler OEM Certification. I did not see an exemption certificate, required under FMVSS Part 567. This situation may warrant a safety-related inquiry by the NHTSA http://www-odi.nhtsa.dot.gov/ivoq/ . While it is unclear if the vehicle would actually be unsafe with a full complement of adult passengers, it would certainly exceed design and certification specifications, such that the relative safety would depend upon the safety margins used by the manufacturer in the design and testing of the vehicle brake, steering, suspension, ABS, active handling, and traction control systems. In addition to the excess weight of the battery, the redistribution of the vehicle weight would invalidate the OEM vehicle crash test results.

For reference, comparable marketers of high-end EV conversions generally do comply with FMVSS requirements, e.g., the Tesla Roadster manufactured by Tesla Motors of San Carlos, California http://www.rpmgo.com/tesla-roadster-passes-fmvss-crash-tests . The Tesla Roadster is actually a converted Lotus Elise.

Battery Charge Time

According to EVii http://www.hybridtechnologies.com/products/cars/surge the time to complete a full charge for the LiV™ SURGE is "Charge Time: 8 hours (110-120V or 220-240V)"

The actual full charge time of the vehicle, reported by Mr. Lyons was over 12 hours from a 220-240 VAC source, and probably twice this (never completed a full charge) from a 110-120 VAC source. While I could not fairly ascertain the actual battery charge time during the inspection, due to time limitations and the probably presence of defective battery cells, it is important to note that the manufacturer's specifications did not distinguish the different charge times between the different voltage sources. This is critical information for an EV owner expecting to be able to charge a vehicle from their home, in which a 220-240 VAC source may not be readily available (as was the case for Mr. Lyon).

Vehicle Performance

According to EVii http://www.hybridtechnologies.com/products/cars/surge the LiV™ SURGE is capable of "Speed: Up to 80 mph", "Acceleration: 0-60 mph in 9.9 seconds". Mr. Lyon reported the maximum possible speed ever achieved with this vehicle with a full charge to be 70 mph. During the inspection of the vehicle, the maximum attainable speed was 30 mph, although the battery was in a partial state of charge and it is probable that defective individual cells were present.

Vehicle Range

The actual vehicle range as observed by Mr. Lyon, and it's inconsistency with the manufacturer's specifications, are discussed above. During the inspection, it was not possible to ascertain the actual vehicle range. However, the multiple range specifications for the same vehicle stated by the manufacturer suggest that these values were estimates, and were probably optimistic. Vague range promises were typical for early electric vehicles, e.g., those sold in the 1980's through 1990's, but values for recently manufactured EV's are generally more conservative and accurate. The lack of any delimiter in the specification such as "vehicle range may depend upon many factors, including speed, terrain, battery state of charge and condition, …" has the potential to mislead a potential buyer that may depend on this specification in their purchase decision.

Engineering Quality and Safety

As shown in the two photographs that follow, the front trim panels for both front seats had been removed as part of the vehicle conversion. This exposes the legs of the driver and passenger to potentially sharp metal edges, which could pose a safety hazard, especially in a collision. The black plastic box shown in the first photograph is an enclosure for the converted vehicle's control and diagnostics system. Its proximity to the driver's feet made it vulnerable to repeated light impact, potentially resulting in vibration-induced damage to the internal electronics.

As shown in the photograph below, a supplemental data display had been installed as part of the vehicle conversion. The position of the display made it difficult to read in the glare of ambient daylight. The display did not provide any mechanism for backlight dimming, so that it was excessively bright during night time driving, to the point of possibly interfering with driver road awareness and therefore potentially hazardous. The display provided a number of driver-selectable display screens, including a battery monitoring function. This function revealed the presence of two, sometimes four, failed cells in the battery pack. The vehicle energy flow and estimated battery capacity display showed a graphic similar to that found on a Toyota Prius, but the animated data display features were non-functional. During a driving test, roadside vibration occasionally caused blanking or intermittency of the display.

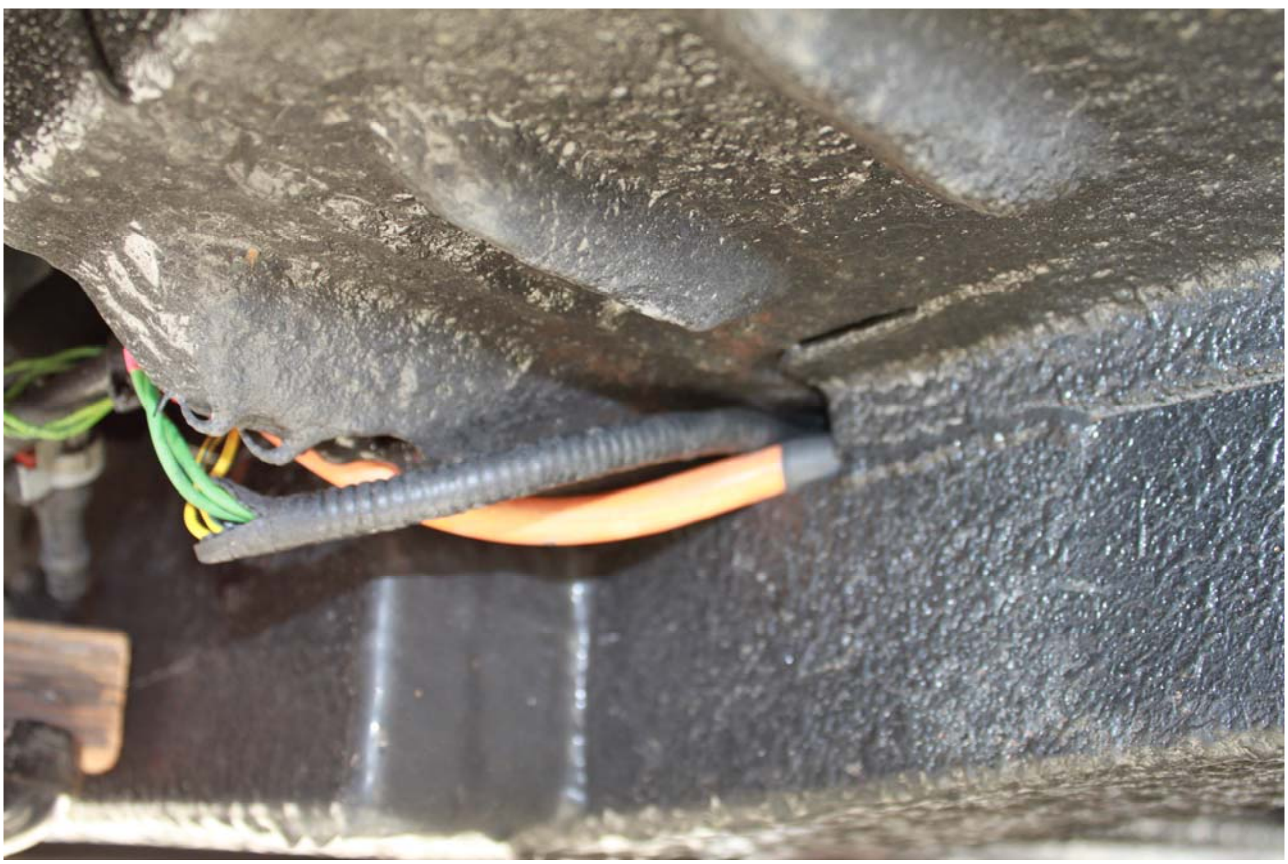
The general quality of other interior modifications appeared to be appropriate for the level of a good home conversion, but not that of a high-end production vehicle in the price class of the LiV SURGE. One example is the dash-mounted switch and indicator lights shown in the photograph below.

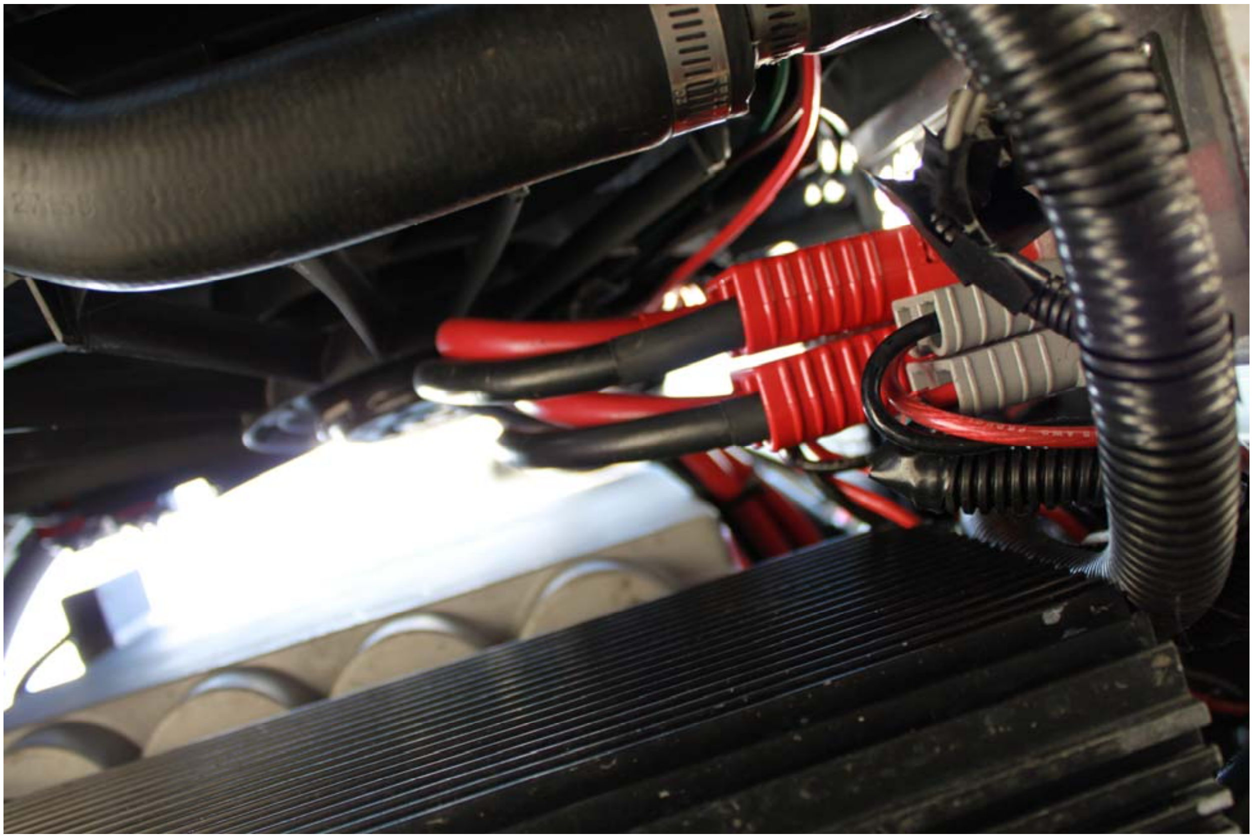
The floor pan of the vehicle had been approximately 75% removed and replaced to provide room for the large 328 Volt (nominal) lithium-ion battery pack. The entire assembly had then been heavily undercoated. Additional wiring, for traction power, battery charging and instrumentation/control had been added to the underside and under-hood areas of the vehicle.

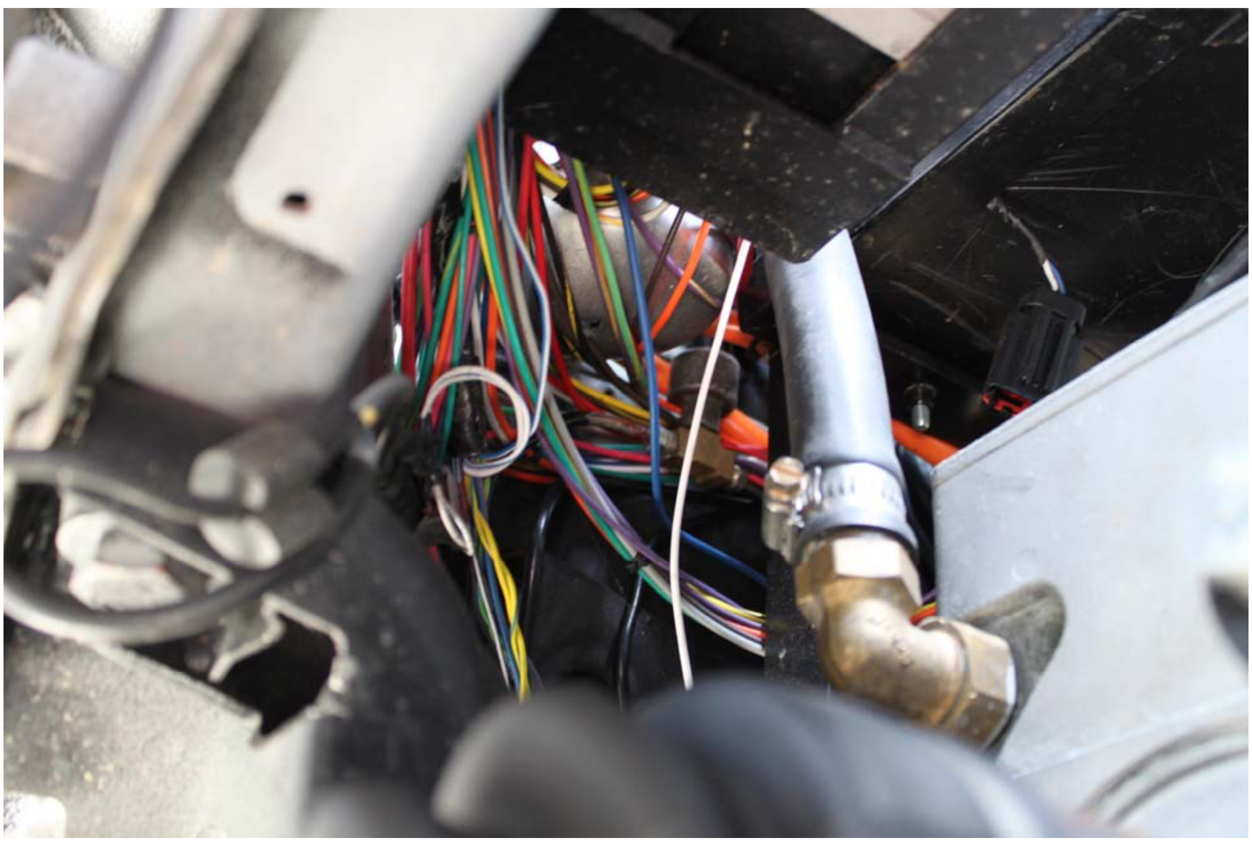
As shown in the photographs below, almost all added wiring was exposed to the elements, and most had been routed without adequate concern for abrasion against metal surfaces. This is a significant safety concern, especially for the power conductors, since the vibration of normal driving can eventually cause sharp metal edges to penetrate the insulation of the wiring and potentially cause a short circuit to the vehicle chassis. The ramifications of a short circuit in the power conductors of an electric vehicle can be extreme: massive arcing, fire or explosion of the battery or conductors, potential exposure of a person to lethal voltages and currents, and destruction of power handling components and instrumentation.

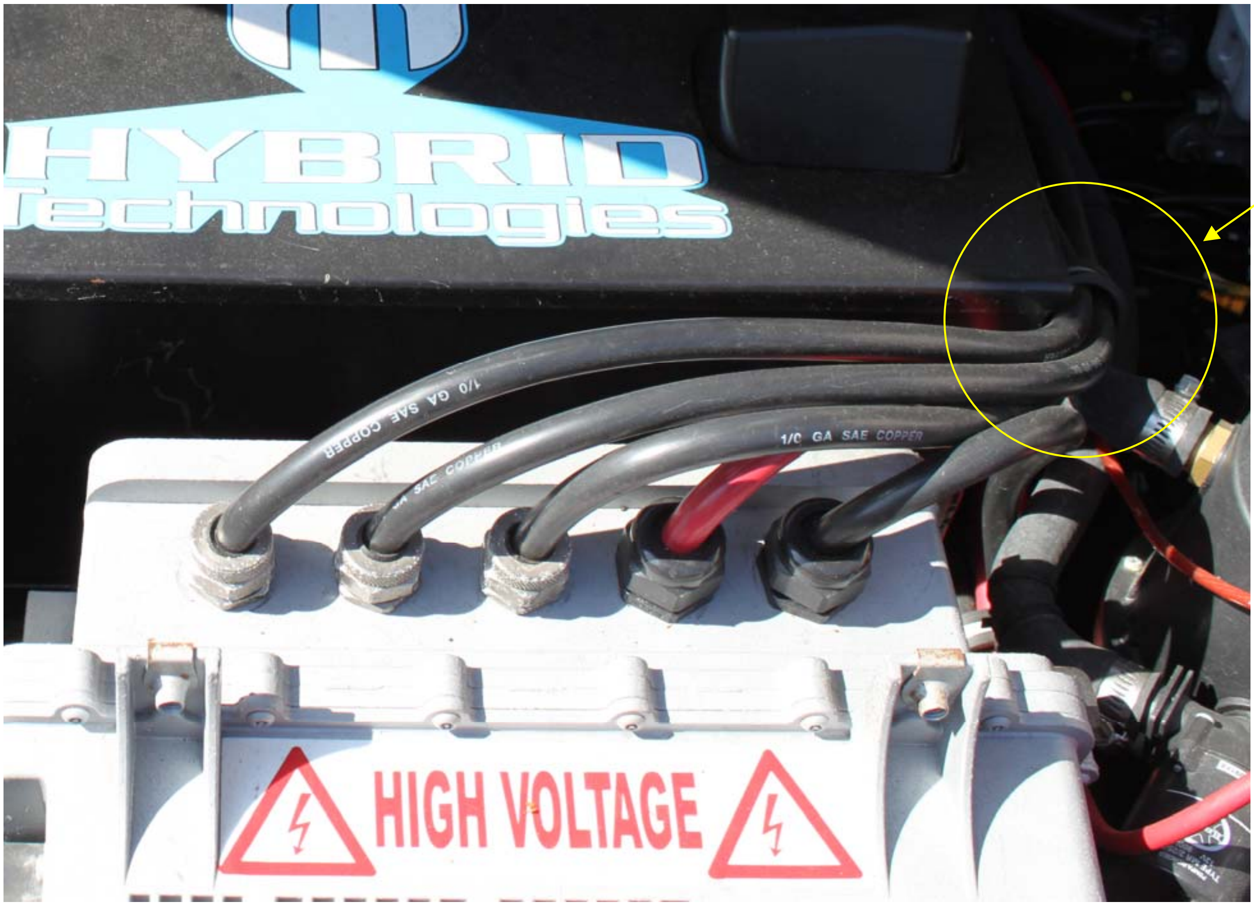
An orange 3-conductor power cable (typical outdoor extension cord) was employed in the vehicle conversion to route 110 or 220 VAC power from the charging connector in the vehicle rear to the battery charge controller under the hood. The stranded wire gauge appeared to be either 12 or 14 AWG, which would be marginal given the 30 Amp 220 VAC rating of the charge connector.

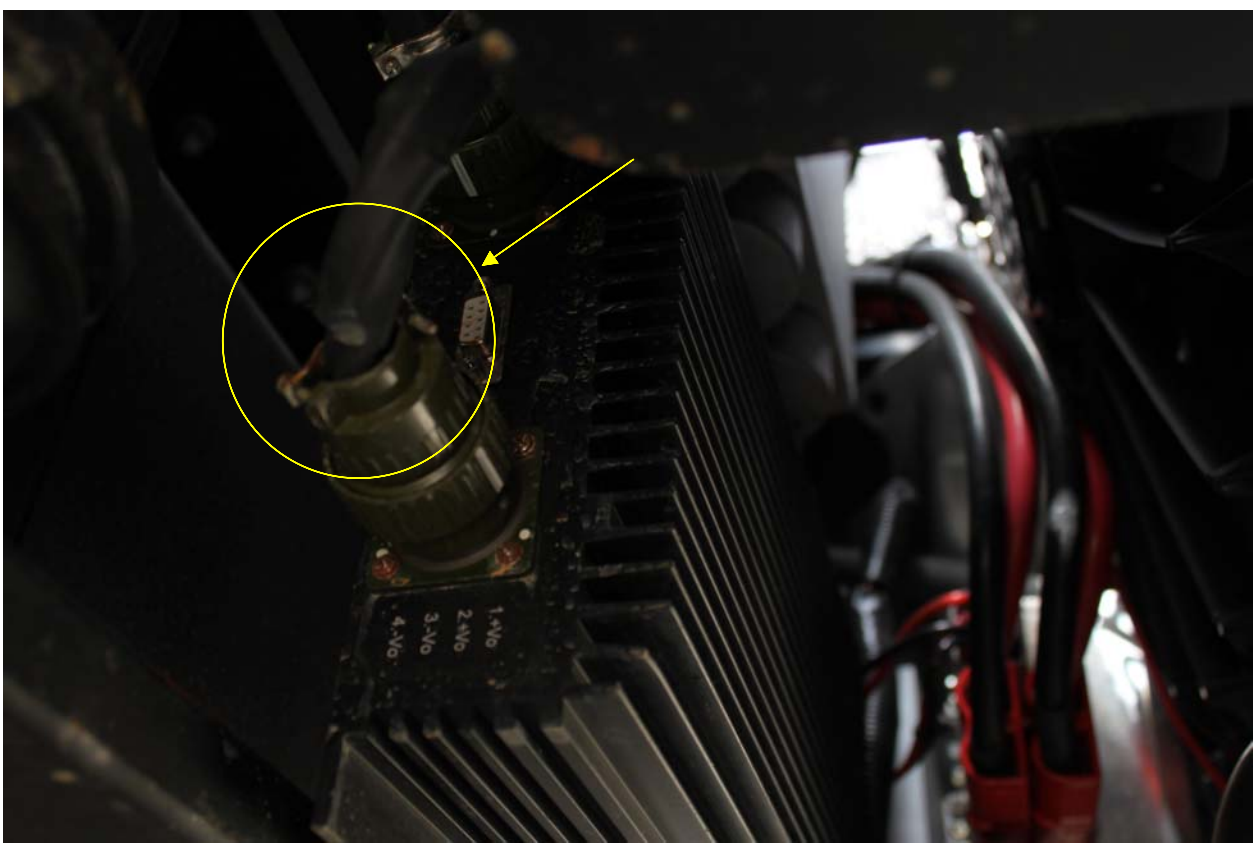
Some wire spices were not weather-tight, and cable/harness bend radii were in some cases too extreme for reliability.





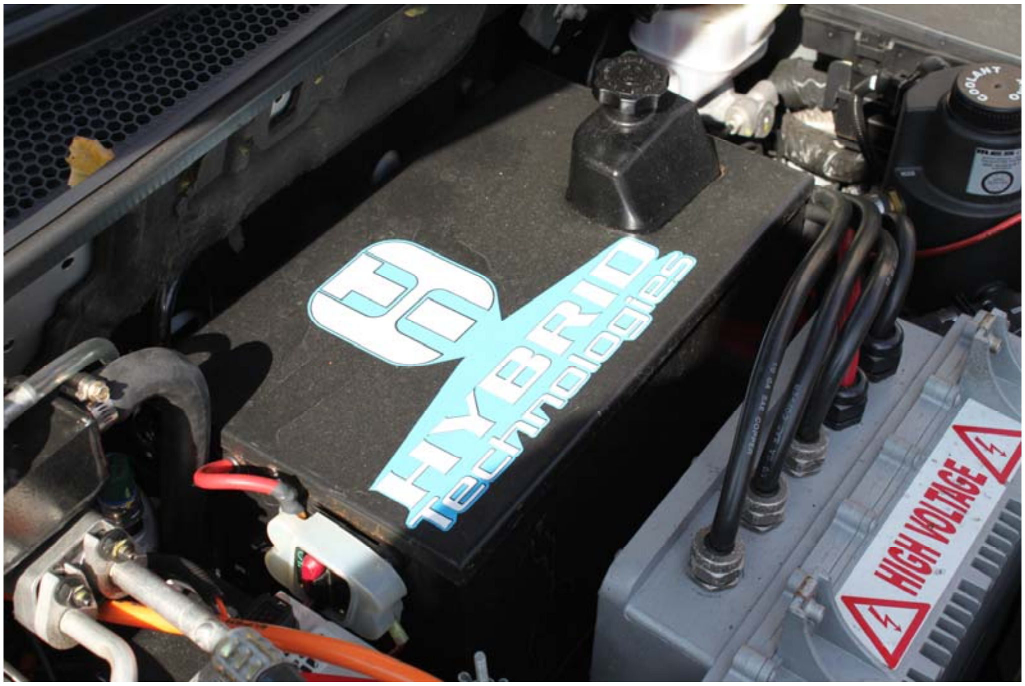



HYBRID
Technologies
1/0 GA SAE COPPER
HIGH VOLTAGE



Due to the installation of the traction battery underneath the vehicle, the rear brake hydraulic lines and the emergency brake cable had been re-routed as shown below. At the under-car location shown, the cables were in direct contact with the chassis sheet metal and battery pack enclosure, and were vulnerable to impact from road debris. This is a potential failure point that could result in partial or complete loss of braking capability, (depending on the OEM design of the hydraulic braking circuit).

Powering of OEM vehicle accessories such as power steering and brakes is always a challenge in converted vehicles. The OEM vehicle (2008 PT Cruiser) was equipped with power steering. This safety-related system requires the continuous operation of a high-pressure hydraulic pump. In the converted vehicle, this was implemented by the use of an accessory electric motor driving a small hydraulic pump at all times the vehicle key is “on”. The large black box shown below contains these components. In the second photo, the box is open and a brushed DC motor is shown connected to a small hydraulic pump. This system produced an annoyingly loud noise at all times, and drew considerable current, which reduced the vehicle range. Mr Lyon indicated that he had been advised by the manufacturer to shut the system off to restore some lost vehicle range, and been shown how to override it. Disabled, this would leave the vehicle without power assist or ABS. The use of a low-cost (Briggs and Stratton) DC motor typically used for electric lawn mowers was an unreliable design choice for this critical system, since it was not designed for continuous operation in a safety-critical application. A more reliable and much quieter implementation in modern electric vehicles is direct electric power-assisted steering.



The conversion of the vehicle ignored some of the OEM electronic features, for example, the dash display of estimated range shown below, and all of the normal diagnostic mechanisms normally provided by the vehicle body and powertrain electronic control systems. I connected an OBD-II diagnostic scanner to the OEM OBD-II diagnostic scanner connector, and as expected due to the removal of the internal combustion engine and drivetrain, it showed DTCs (Diagnostic Trouble Codes) for almost every system on the vehicle. While not critical to safety or daily function, it would be reasonable to expect that a professional vehicle conversion in this price range would include some modification of the OEM diagnostic system to be appropriate to the electric version of the vehicle.

I observed that the OEM tire pressure warning system was continuously on, and Mr. Lyon indicated that he could not disable it.

The cabin heating and window defrosting features had apparently been implemented with a resistive electric heating element. This is a low-cost solution, but is very energy inefficient, directly reducing the vehicle range with usage.

I also reviewed two versions of the “ELECTRIC PT CRUISER USERS / MAINTENANCE MANUAL” (App b.2). that had been provided to the owner. One was ten pages in length. The other was 16 pages in length and was apparently a newer version of the 10-page manual. It was not clear which was correct for the vehicle, and some information was contradictory. Both provided only basic information and electrical hazard warnings. A wiring diagram is included on page 8 of the 10-page manual but not the 16-page manual. This diagram identifies all major components as black boxes, and does not provide a means to identify the wires used in the vehicle conversion that were not already specified by the manufactures of purchased components. Section 5 on troubleshooting (both manuals) is limited to only fuse replacement and four basic failures. Figure 2 (10-page) or 6 (16 page) in this section, stated to be the fuse block, appears to be incorrect in both cases, showing unrelated photos of printed circuit boards.

Appendix

1. Copy of EVii specifications from http://www.hybridtechnologies.com/products/cars/surge

LiV™ SURGE

As functional as it is fun. Reaching speeds in excess of 80 mph and traveling up to 120 miles, our PT Cruiser conversion offers the green car connoisseur an eco-friendly alternative with comfort and style. (It's the iconic car chosen as the first lithium NY Taxi. Hail a healthy cab.)

Performance

Speed:
Up to 80 mph
Acceleration:
0-60 mph in 9.9 seconds
Range:
Up to 120 miles
Charge Time:
8 hours (110-120V or 220-240V)
Cycle Life:
2500+ full charges
LCD Touch Screen:
Vehicle operations monitor - miles remaining, power consumption, each cells' charge level, battery temperature, drive time, distance traveled, and average speed.

Powertrain

Electric Motor:
3 phase, brushless A/C motor - 78 kW peak (105 hp)
Batteries:
10 (550 lbs / 250 kg) maintenance-free lithium ion packs
Charger:
Onboard 110 VAC or 220 VAC input
Battery Management System:
Proprietary HT design

Chassis

Brakes:
Front disc - rear drum

Suspension:
Strut front suspension, independent with stabilizer bar and coil springs
Steering:
Rack and pinion
Tires (Front):
195-65-15 mm
Tires (Rear):
195-65-15 mm

Weights & Measures

Weight:
3376 lbs (1531 kg)
Length:
168.9 inches (4290 mm)
Width:
67 inches (1705 mm)
Height:
63 inches (1600 mm)
Wheelbase:
103 inches (2616 mm)
Ground Clearance:
6 inches (152 mm)

2. Descriptions of Relevant FMVSS Sections:

Part 555 - Temporary Exemptions from Motor Vehicle Safety Standards (Effective 1-29-73)
This regulation provides a means by which manufacturers of motor vehicles may obtain temporary exemptions from specific safety standards on the grounds of substantial economic hardship, facilitation of the development of new motor vehicle safety or low-emission engine features, or existence of an equivalent overall level of motor vehicle safety

Part 567 - Certification Regulation (Effective 8-31-69)
This part specifies the content and location of and other requirements for the label or tag to be affixed to motor vehicles and items of motor vehicle equipment manufactured after August 31, 1969. This certificate will provide the consumer with information to assist him or her in determining which of the Federal Motor Vehicle Safety Standards are applicable to the vehicle or item of vehicle equipment, and its date of manufacture. An amendment effective January 1, 1972, required gross vehicle weight (GVWR) information on the certification label.

Part 573 - Defect and Noncompliance Reports (Effective 10-1-71)
This part specifies manufacturer requirements for reporting safety-related defects to the National Highway Traffic Safety Administration; for providing quarterly reports on defect notification campaigns; for providing copies of communications with dealers and purchasers concerning defects; and for maintaining owner lists.

Part 577 - Defect and Noncompliance Notification (Effective 3-26-73)
This part establishes requirements for the format and contents of manufacturer notification to the person who is the registered owner or to first purchasers of motor vehicles and motor vehicle equipment of a defect relating to motor vehicle safety or a noncompliance with a Federal motor vehicle safety standard.

The complete text of all Federal Motor Vehicle Safety Standards and other NHTSA regulations can be found in Title 49 of the Code of Federal Regulations (CFR). Title 49 of the CFR is published in seven volumes, the fifth volume (Parts 400-999) is where these regulations can be found. Copies of this volume can be obtained for a cost from U. S. Government Printing Office, Superintendent of Documents, Mail Stop: SSOP, Washington, DC 20402-9328.

3. 2008 DaimlerChrysler PT Cruiser Specifications, from http://www.motortrend.com/cars/2008/chrysler/pt_cruiser/specifications

2008 Chrysler PT Cruiser LX Wagon Performance & Efficiency Standard Features
- 2,429 cc 2.4 liters in-line 4 front engine with 87.5 mm bore, 101.0 mm stroke, 9.5 compression ratio, double overhead cam and four
valves per cylinder EDZ
- Unleaded fuel 87
- Multi-point injection fuel system
- 15.0 gallon main unleaded fuel tank 12.5
- Power: 112 kW , 150 HP SAE @ 5,100 rpm; 165 ft lb , 224 Nm @ 4,000 rpm

2008 Chrysler PT Cruiser LX Wagon Handling, Ride & Braking Standard Features
- 3.940:1 axle ratio
- Two disc brakes including two ventilated discs
- Immobilizer
- Spacesaver steel rim under body spare wheel
- Strut front suspension independent with stabilizer bar and coil springs, beam rear suspension rigid with coil springs

2008 Chrysler PT Cruiser LX Wagon Exterior & Aerodynamics Standard Features
- Body color front and rear bumpers
- Driver and passenger internally adjustable black door mirrors
- External dimensions: overall length (inches): 168.9, overall width (inches): 67.1, overall height (inches): 63.0, ground clearance
(inches): 5.5, wheelbase (inches): 103.0, front track (inches): 58.3, rear track (inches): 58.2 and curb to curb turning circle (feet):
36.7
- Complex surface lens halogen bulb headlights
- Luxury trim alloy look on dashboard
- Pearl paint
- Fixed rear window with defogger and intermittent
- Roof spoiler
- Tinted glass on cabin, rear and side
- Weights: gross vehicle weight rating (lbs) 3,935, curb weight (lbs) 3,070, gross trailer weight braked (lbs) 1,000 and max payload
(lbs) 865
- Windshield wipers with variable intermittent wipe

2008 Chrysler PT Cruiser LX Wagon Interior Standard Features
- 12v power outlet: front and 1
- Fixed mast antenna
- Audio system with AM/FM and CD player
- Cargo area light
- Cargo capacity: all seats in place (cu ft): 21.6 and all seats removed (cu ft): 62.7
- Clock
- Compass
- Computer with average fuel consumption and range for remaining fuel
- Full dashboard console with open storage box, full floor console with covered storage box
- Delayed/fade courtesy lights
- Front seats cup holders fixed, rear seats cup holders pop out
- Door ajar warning
- Door pockets/bins for driver seat, passenger seat and rear seats
- External temperature
- Driver front airbag with multi-stage deployment, passenger front airbag with occupant sensors and multi-stage deployment
- Bucket driver and passenger seat
- Height adjustable 3-point reel front seat belts on driver seat and passenger seat with pre-tensioners
- Front seat center armrest

- Two height adjustable head restraints on front seats and rear seats
- Illuminated entry system
- Internal dimensions: front headroom (inches): 39.2, rear headroom (inches): 39.5, front hip room (inches): 50.1, rear hip room
(inches): 46.7, front leg room (inches): 40.6, rear leg room (inches): 40.9, front shoulder room (inches): 53.8, rear shoulder room
(inches): 53.6 and interior volume (cu ft): 98.9
- Knee airbags driver
- Low tire pressure indicator
- Remote power locks includes trunk/hatch and speed sensing
- Power steering
- Front power windows with two one-touch, rear power windows
- 3-point reel rear seat belts on driver side, passenger side and center side
- Three asymmetrical split bench front facing removable rear seats with zero adjustments tip/tumble
- Rear view mirror
- Front seat back storage
- Cloth seat upholstery with additional cloth
- Seating: five seats
- Front side airbag
- Four speaker(s)
- Plastic steering wheel with tilt adjustment
- Tachometer
- Driver and passenger vanity mirror
- Ventilation system

4. Qualifications of Expert Witness

C. Arthur (Art) MacCarley **amaccarl@calpoly.edu** **http://www.ee.calpoly.edu/faculty/amaccarl** **and** ***http://www.loragen.com***

Professor and Chair, Electrical Engineering. Professor of Computer Engineering.

California Polytechnic State University, San Luis Obispo, CA 93407
Director, Cal Poly Transportation Electronics Laboratory
Principal Engineer, Loragen Coproration, San Luis Obispo, California
Registered Professional Engineer, Colorado

Academic specialization in control systems and microprocessor embedded systems
Research specialization in automotive electronics, applications of electronics and computers in transportation, alternative fuel and electric vehicles

Education

Purdue University, West Lafayette, Indiana
Ph.D. Electrical Engineering (Computer-based Control Systems), 1987. Thesis: Suboptimal Control via Numeric Saturation in Linear Digital Compensators.
University of California, Los Angeles, California
M.S. Electrical Engineering, 1978. Thesis: Electronic Fuel Injection Techniques for Hydrogen Fueled Internal Combustion Engines.
B.S. (Cum Laude) Engineering, Mechanical/Alternative Energy Specialization, 1976.

Employment

3/88 to present *California Polytechnic State University, Professor and Associate Chair, Electrical Engineering*
Teach undergraduate and graduate courses in control systems and computer engineering. Former Director, Computer Engineering Program. Research funded by NSF, DOE, DOT, Caltrans and PG&E on advanced highway monitoring and detection systems, electric vehicles, electronic engine controls, and alternative fuels.

6/97 to present *Loragen Corporation, Advanced Technology Group, Principal Engineer*
Interdisciplinary team contracted to deploy or evaluate advanced electronics and computer-controlled systems on highways. Provides high-tech experience for Cal Poly faculty and students. Clients include US Department of Energy, California Department of Transportation, Univ. of California Berkeley, Hughes SBRC.

1/84 to 12/87 *Purdue University, School of Electrical Engineering, David Ross Fellow*
Research in microprocessor-based control systems and advanced indirect sensing methods. Lead teaching assistant for digital laboratory; instructor for two undergrad laboratories; teaching asst. for two grad courses.

8/82 to 9/83 *American Bosch Division of United Technologies, Springfield, MA., Senior Engineer*
Design and optimization of electronic diesel engine controls. Lead engineer, controls group, responsible for development and testing of electronic engine control algorithms.

5/82 to 8/82 *Consulting Engineer in Private Practice, Denver, CO.*
Designed, constructed and tested electronic fuel injection and ignition control system for natural gas fueled engines, for CNG Vehicle Equipment Co., Fort Collins, Colorado.

5/79 to 5/82 *Denver Research Institute, University of Denver, CO., Research Engineer*
Principle investigator on three programs involving the development and testing of alternative fuel engines and vehicles. Designed electronic engine controls and on-board metal-hydride hydrogen fuel storage systems.

9/77 to 5/79 *Hughes Aircraft Co. Digital Communications Lab, El Segundo, CA., Member of Technical Staff*
Design, analysis and computer optimization of circuits for NASA Space Shuttle, GMS2 and GOES satellites.

6/75 to 9/77 *Research Assistant, UCLA School of Engineering and Applied Science*
Designed electronic fuel injection system for hydrogen-fueled vehicles, and cryogenic hydrogen fuel storage systems. Projects funded by US Dept. of Transportation, US Postal Service, and private donations.

Honors and Awards Received

Dean's Honor List, UCLA, 1975 and 1976.
Tau Beta Pi Engineering Honorary Society.
Eta Kappa Nu Electrical Engineering Honorary Society.
Recipient of Hughes Aircraft Corporation Graduate Fellowship, 1977-78.
Huffsmith Award, University of Denver, for best research paper of the year, 1980.
Overall Champion, and winner of six individual class awards, 1981 Society of Automotive Engineers High Altitude Clean Air and Fuel Economy Rally.
Recipient of David Ross Fellowship for doctoral study, 1985-87.
Cal Poly Meritorious Promise and Professional Practice (MPPP) Award, 1990.
Award recipient, DOE/NIST New Invention Competition, 1992.
Most Inspirational Instructor Award, runner-up, 1989 and 1992.
Outstanding Faculty-Student Involvement Award, 1992 and 1993.
Outstanding Faculty Advisor, 1995, 1996, 1997, 1998.
Northrup-Grumman Excellence in Teaching and Applied Research Award, 1997.
Litton Industries Excellence in Research and Development Award, 1997.
Society of Automotive Engineers "Best Oral Presentation" Award, SAE International Congress, 2000.
Society of Women Engineers Team Tech Competition Project Advisor, Recognition Plaque, 2003.
Computer Engineering Program Appreciation Plaque, Director of Computer Engineering 2000-2003.
Student Appreciation Award, Service as Computer Engineering Program Director, 2003.
Society of Women Engineers Team Tech Competition Project Advisor, Recognition Plaque, 2004.
Caltrans nomination for State of California Award for most cost-effective research of the year, 2004.

Professional Society Memberships

Society of Automotive Engineers (SAE), Senior Member, 1976-present.
International Association for Hydrogen Energy (IAHE), original society member, 1976-1982.
Institute of Electrical and Electronic Engineers (IEEE), 1976-present.
Sigma Xi Scientific Research Society (since 1980), Cal Poly Chapter President 1991/92.
American Society of Engineering Educators (ASEE), Senior Member, 1989-2006.

Professional Service

As student at UCLA 1973-78, member and captain of UCLA Hydrogen Car Team, developer of first practical hydrogen fueled vehicles, winner of several collegiate competitions. Developed electronic fuel injection for hydrogen fueled engines, which overcame the previously unsolved problem of intake backfiring.

As director of the Alternative Fuels Laboratory at University of Denver Research Institute 1979-82, developed first electronically fuel injected multi-fuel (ethanol, methanol, gasoline) vehicle for US DOE. Also three hydrogen fueled vehicles (for Daimler Benz, US DOE, Eimco Mining Equipment Co., and City of Denver).
As senior engineer for American Bosch, control systems team leader for development of first microprocessor-controlled diesel fuel injection system, 1981.
As doctoral student in electrical engineering at Purdue, lead teaching assistant in digital and microprocessor laboratory, teaching assistant for nationally televised course “Advanced Microprocessors”, David Ross Fellow for research in distributed sensor processors (now known as sensor nets) and robotic controls.
Faculty advisor to 150+ senior projects, 20+ MS theses in electrical and computer engineering, 1988-present.
Faculty advisor of student or team winning the Hewlett Packard Senior Project of the Year Award, 1989, 90, 91, 92, 93, 95, 98, 99, 2000, 2002.
Produced first computer-typeset lab manual in College, using UNIX TROFF/EQN on CSc Pyramid, 1988.
Patent Disclosure “Indirect Sensing Method for Diesel Fuel Injection Quantity Control,” CP Foundation, 1989.
Purchased, deployed and wrote practical users manuals for EE Dept. network of 15 UNIX Workstations, 1990.
Served as UNIX and network system administrator for the EE Dept., 1990-1999.
Presentations for Electrical Engineering Graduate Seminar almost every year since 1989.
Faculty Advisor and Branch Counselor to Cal Poly Student IEEE Chapter, 1990-97.
Cal Poly representative to Chancellor's Technology Transfer Task Force, 1993.
Academic Senator, 1993-95.
Principal Evaluator, US Dept of Transportation Federal Highway Administration Field Operational Test, “Evaluation of Video Intersection Detection System”, 1993-06.
Principal Evaluator, US Dept of Transportation Federal Highway Administration Field Operational Test, “Evaluation of Integrated Freeway Ramp Meter and Arterial Control System”, 1993-06.
Patent Disclosure “Rapid Battery Interchange,” Cal Poly Foundation, 1993.
Invited speaker for IEEE Central Coast Professional Section Meetings, 1995, 1999 and 2007.
Cal Poly Intellectual Property Committee, 1995-97.
Developed modern EE/CPE Embedded Systems Laboratory, teaching both Intel and Motorola MCs, 1996.
Founder and Incorporator of Loragen Corp., San Luis Obispo, CA (consulting and independent evaluation team of Cal Poly faculty and students) 1997.
Interviewed by KSBY News for technical opinion on ordinance banning cell phone use at gas stations, 1998.
Co-author of Cal Poly College of Engineering Mission Statement document, 1998.
Academic Senate Research Committee, College of Engineering Representative, 1996-99.
College of Engineering Strategic Planning Committee, 1997-98.
College of Engineering Research and Professional Development Committee, Chair, 1997-99.
Faculty advisor, Cal Poly Electric Vehicle Engineering Club and Electric Racing Team, national winner of 4th place 1998 and 2nd place 1999.
Expert witness for California Department of Transportation Legal Division (1999-present).
Director of Cal Poly Computer Engineering Program 2000–03.
Spent June-August of 2000 fundraising for CPE and EE; traveled to 18 companies throughout California. Resultant contacts and donations provide continuing annual support of CPE, EE and CsC.
Designated by Advancement Office in 2000 as the official contact between the College of Engineering and Bert and Candace Forbes, helping to secure $3 million dollar donation to Cal Poly CPE, half to the EE Dept.
Organized and offered the first Computer Engineering Program Banquet, September 2001.
Created first Industrial Advisory Board for the Computer Engineering Program, December 2001.
Founder and permanent faculty co-advisor of Cal Poly Computer Engineering Honor Society, Fall 2001-present.
Created and advised three Computer Engineering Capstone team projects with industrial collaborators.
Appointee, Caltrans working group on telecommunications, meeting annually 2002-present.
Raytheon Excellence in Teaching Award Selection Committee, 2004, 05, 06.
Raytheon Excellence in Applied Research Award Selection Committee, 2004, 05, 06.
Northrup-Grumman Excellence in Teaching and Research Award Selection Committee, 1999, 2004, 05, 06.
Developed and continue to operate Caltrans Detector Testbed on I-405 in Irvine, 2002-present.
Faculty advisor to the SWE *Team Tech* National Competition Team, 2003 (2nd place) and 2004 (1st place)
Developed “SIBS Bill Analyzer” computer program for Caltrans. Program for auditing and controlling state telecommunications costs, attributed with saving over $4 million in first year of use, 2004.
Member and Inter-committee Liaison, TRB Committee on User Information Systems, 2005-present.
Faculty advisor, Cal Poly Advanced Autonomous Vehicle Club, 2005-present.
Faculty advisor to the Cal Poly DARPA Grand Challenge Team, (semifinalists) 2005-06.

Chair of Tenured and Probationary Faculty Committee, Tenured Faculty Committee, and Probationary Review Committee, Cal Poly Electrical Engineering Department, 2005-06.
Expert witness in automotive electronics on four automobile accident cases, 2005-07.
Developed Cal Poly EE "Control Systems" educational web site http://telab.ee.calpoly.edu/~amaccarl
Invited participant in the "Baker Forum", focusing on sustainability issues, 2006.
Completed short "CDR Certification Course" conducted by Collision Safety Institute, (for qualification as automotive crash data expert witness), Vallejo, CA, July 2006.
Co-organizer of special session "Next Generation of Driver Information Systems" at 2007 TRB Annual Meeting.
College of Engineering Domain 5 (Professional Development) Advisory Committee, 2007.
Member of SurGE, Cal Poly Sustainable Initiatives Working Group, headed by Margot McDonald, Architecture
Selected to participate in US Congressional Caucus meeting on "Education in Simulation and Modeling," 2007.
College of Engineering RPT Committee, tasked with re-writing CENG RPT Policy Document, 2007.
College of Engineering Project-Based Learning Center Committee, representing CPE, 2006-present.
College of Engineering Computers and Networks Committee, representing EE and CPE, 2006-present.
Founder and faculty advisor to interdisciplinary Electric Vehicle Engineering Club, 2007.
Active in many forums as advocate for improvement of research environment at Cal Poly.
Published lecture notes and laboratory manuals for 12 Electrical and Computer Engineering courses at Cal Poly, San Luis Obispo.
Principal Investigator on 36 funded research projects involving various areas of advanced controls and transportation electronics 1989-present, totaling over $3.5 million in external funding. All projects have involved and provided employment for undergraduate and graduate students. Complete list on request.
Currently (2007) PI on three multi-year Caltrans-funded research and development projects.
Member, National Academy of Engineering Transportation Research Board User Information Committee, 2006-
Chair, Cal Poly Electrical Engineering Dept., 2007-2010.
Member, College of Engineering Committee to write new Retention, Probation and Tenure Document, 2006-08.
Invited Speaker, Cal Poly Focus the Nation campus-wide event. Presented "Global Warming: Problems and Solutions, An Engineering Approach", with Yarrow Nelson and Linda Vanasupa, Jan 31, 2008.
Invited Speaker, Inaugural Cal Poly Kennedy Library Science Café Series. Presentation: "My Methanol Motorcycle", Jan 28, 2009.

Journal Publications and Book Chapters

"Development of a Sodium Borohydride Hydrogen Fuel Storage System for Vehicular Applications," Physica Status Solidi (A) Applied Research, pp. 315-321, 1976.
"Energy Primer", contributed section "Hydrogen Energy", published by Portola Institute, Santa Cruz, CA, 1976.
"Electronic Fuel Injection Techniques for Hydrogen Powered I.C. Engines," International Journal of Hydrogen Energy, V5.2, Pergamon Press, Oxford, England, 1980. Co-author: W.D. VanVorst.
"Alternative Automotive Fuels Handbook," Publication of National Science Foundation, under Grant No. ISP-8009001, administered by University of Denver Research Institute, 1981.
"State Feedback Control of Nonlinear Systems," International Journal of Control, V.43, No.5, 1986. Co-author: S. H. Zak.
"An Auxiliary Sensor Processor to Provide Real Time Fuel Delivery Feedback for a Microprocessor Based Diesel Engine Controller," chapter in SAE publication "Recent Advances in Electronic Diesel Engine Control" and 1987 SAE Transactions. Co-author: D. G. Meyer.
"A Study of Numeric Saturation Effects in Linear Digital Compensators," Electrical Engineering Technical Journal, Purdue University, School of Electrical Engineering, 1988. Co-author: D. G. Meyer (thesis advisor).
"An Indirect Sensing Technique for Closed-Loop Diesel Fuel Quantity Control," Society of Automotive Engineers Transactions, 1990. Co-authors: W. Clark and K. Nakae (students).
"Sample Rate Selection for Discrete Time Switching Controls", IFAC Journal, International Assoc. for Mathematics and Computer Simulation and International Federation of Operational Research Societies, Pergamon Press, Inc. 1990
"Evaluation of Video Image Processing Systems for Traffic Detection," Transportation Research Record No. 1360, National Research Council, Wash. DC., 1992. Co-authors: S. Hockaday, D. Need, S. Taff.
"Video Cameras for Roadway Surveillance: Technology Review and Product Evaluation Results," Transportation Research Record No. 1410, National Research Council, Washington D.C., 1993. Co-authors: D. Need, R. Neiman (students).
"Video Technologies for Roadway Surveillance and Automated Detection," Society of Automated Engineers, Transactions, 1995. Co-author: L. Ponce (student).

"Advanced Imaging Techniques for Traffic Surveillance and Hazard Detection," Intellimotion (journal), Vol 6 No.2, Partners for Advanced Transit and Highways, University of California, Berkeley, March 1997.
"Evaluation of Infrared and Millimeter-wave Imaging Technologies Applied to Traffic Management," Society of Automotive Engineers, Transactions, and chapter in SAE publication "Journal of Passenger Car Electronic and Electrical Systems", 2001.
"Computer Vision Detection System for Network Model Validation," Transportation Research Record 01-3442, National Research Council, Washington D.C., 2001. Co-author: B.M. Hemme (student).
"Technical Evaluation of the Anaheim Advanced Traffic Control System Field Operational Test," Transportation Research Record, National Research Council, Washington D.C., March 2004. Co-authors: J. E. Moore II, S. P. Mattingly, M. G. McNally.
"Methods and Metrics of Evaluation of Evaluation of an Automated Real-Time Driver Warning System," Transportation Research Record, No. 05-1423, National Research Council, Washington DC, January 2005.
"A Study of the Response of Highway Traffic to Dynamic Fog Warning and Speed Advisory Messages," TRB 06-3086, Transportation Research Record, National Research Council, Washington, DC, Feb 2007. Co-authors: C. Ackles, T. Watts (students).
"Automated Consensus-based Data Verification in the Caltrans Detector Testbed" Transporatation Research Record, National Research Council, Washington DC, January 2007. Co-author: J. Slonaker.

Conference Papers and Published Articles

"Development of a Sodium Borohydride Hydrogen Fuel Storage System for Vehicular Applications," American Society of Aeronautical Engineers Conference on Future Transportation Fuels, AIAA Proceedings, 1976.)
"Electronic Fuel Injection Techniques for Hydrogen Powered I.C. Engines," Proc. Second World Hydrogen Energy Conference, Zurich, Switzerland, International Association of Hydrogen Energy, Coral Gables, FL, 1978. Co-author: W.D. VanVorst.
"Hydrogen Fuel Applications for Urban Transit," Proc. AIAA Society and Aerospace Technology Workshop, Los Angeles, California, 1979.
"Development of a High Speed Injection Valve for Electronic Hydrogen Fuel Injection," Proc. Third World Hydrogen Energy Conference, Tokyo, Japan, International Association of Hydrogen Energy, Coral Gables, Florida, September, 1980.
"A Study of Factors Influencing Thermally Induced Backfiring in Hydrogen Fueled Engines, and Methods for Backfire Control," Proc. Intersociety Energy Conversion Engineering Conference, American Society of Mechanical Engineers, Atlanta, GA, July, 1981.
"An Auxiliary Sensor Processor to Provide Real Time Fuel Delivery Feedback for a Microprocessor Based Diesel Engine Controller," SAE International Congress, Detroit, Mich., Feb. 1987. Co-author: D. G. Meyer.
"An Indirect Sensing Technique for Closed-Loop Diesel Fuel Quantity Control," Proc. Society of Automotive Engineers International Congress, Detroit, MI, 1990. Co-authors: W. Clark and K. Nakae (students).
"Sample Rate Selection for Discrete Time Switching Controls", Proc. 11th Triennial World Congress of the the International Federation of Automatic Control, Tallinn, Estonia, USSR. International Assoc. for Mathematics and Computer Simulation and International Federation of Operational Research Societies, Pergamon Press, Inc. Aug. 13-17, 1990
"Computer Image Processing Techniques for Highway Traffic Monitoring," Proc. AMSE Workshop on Computer Applications in Transportation, UC Berkeley, California, 1991. Co-author: E. Sullivan.
"Testing and Feasibility of VIPS for Traffic Detection," Proc. Second International Conference on Applications of Advanced Technologies in Transportation Engineering, Minneapolis, MN, American Society of Civil Engineers, August 18-21,1991. Co-author: A. Chatziioanou.
"Dynamic Extension of Static Traffic Flow Models for Computer Simulation," Proc. IEEE Pittsburgh Simulation and Modeling Conference, Pittsburgh, PA, May 1992. Co-author: E. Sullivan
"Evaluation of Video Image Processing Systems for Traffic Detection," Transportation Research Board Annual Meeting, National Research Council, Washington, DC, 1991. Co-authors: S. Hockaday, D. Need, S. Taff.
"Video Cameras for Roadway Surveillance: Technology Review and Product Evaluation Results," Transportation Research Board Annual Meeting, National Research Council, Washington, DC, 1992. Co-authors: D. Need, R. Neiman (students).
"Video Technologies for Roadway Surveillance and Automated Detection," Proc. Society of Automotive Engineers International Congress, Detroit, January, 1995. Co-author: L. Ponce (student).
"Economic Analysis of Electric Vehicle Configuration," 20th International Conference on Computers and Industrial Engineering, Kyongjo, Korea, 1996. Co-author: A. Seifoddini.
"Electric Vehicles – Promise and Reality", quoted and contributed several pages on the state of the art of battery electric vehicles to US DOE-sponsored Renewable Energy Institute web site (no longer avail) 1996.

"Assessment of an Automated Driver Warning Systems: CAWS", Presentation and published notes for California Department of Transportation, Stockton, California, June 14, 1998.
"EDSRS: Electronic Diesel Smoke Reduction System," Poster Session for the National Conference on Strategic Technologies, US Department of Energy, Office of Industrial Technology, Washington, DC., Jan 7, 1999.
"Infrared and Millimeter-wave Imaging For Traffic Surveillance and Detection," Proc. Transportation Research Board Annual Meeting, National Research Council, Washington D.C., January, 1999. Co-authors: B. Hemme (student), L. Klein.
"Review and Assessment of Battery Interchange Methods For Electric Vehicles," Proc. SAE Future Car Conference 2000, Society of Automotive Engineers, Washington, DC. January 2000.
"Evaluation of Infrared and Millimeter-wave Imaging Technologies Applied to Traffic Management," Proc. SAE International Congress and Exhibition, Society of Automotive Engineers, Detroit, March 2000.
"Battery Interchange Alternatives to In-Vehicle Charging: Technical, Safety and Economic Considerations," Proc. FISITA 2000 World Automotive Congress, Seoul, Korea, June 2000.
"Lessons Learned from Irvine Integrated Freeway Ramp Metering/Arterial Adaptive Signal Control Field Operational Test," Transportation Research Board Annual Meeting, 01-3354, National Research Council, Washington D.C., Jan 2001. Co-authors: S.P. Mattingly (student), M.G. McNally, J.E. Moore
"Computer Vision Detection System for Network Model Validation," Transportation Research Board Annual Meeting, National Research Council, Washington, DC, 2000. Co-author: B.M. Hemme (student).
"Evaluation of Video Traffic Sensors for Intersection Signal Actuation: Methods and Metrics," Transportation Research Board Annual Meeting, No. 02-3920, National Research Council, Washington DC, January 2002.
"Technical Evaluation of the Anaheim Advanced Traffic Control System Field Operational Test," Transportation Research Board Annual Meeting, National Research Council, Washington, DC, March 2003. Co-authors: J. E. Moore II, S. P. Mattingly, M. G. McNally.
"Methods and Metrics of Evaluation of Evaluation of an Automated Real-Time Driver Warning System," Transportation Research Board Annual Meeting, National Research Council, Washington, DC, March 2004.
"A Study of the Response of Highway Traffic to Dynamic Fog Warning and Speed Advisory Messages," Proc. Transportation Research Board Annual Meeting, National Research Council, Washington DC, Jan 2006. Co-authors: C. Ackles, T. Watts (students).
"A Data Fusion Approach to Automated Vehicle Detector Testing" IEEE Digital Signal Processing and DSP in Education Conference, Teton, WY, Sept 2006. Co-authors: Neils Nesse (student) and John Slonaker.
"Automated Consensus-based Data Verification in the Caltrans Detector Testbed" Proc. 2007 Transportation Research Board Annual Meeting, National Research Council, Washington DC, January 2006. Co-author: John Slonaker.
"Global Warming: Problems and Solutions, An Engineering Approach", Invited Published Presentation, Focus the Nation, National Academic Initiative for Global Awareness, Jan 31, 2008. Co-authors: Yarrow Nelson, Linda Vanasupa.
"Adaptive Automatic Ground Truth Generation for Testing of Vehicle Detectors", accepted for publication at 2009 Transportation Research Board Annual Meeting, National Research Council, Washington DC, January 2009.
"Teaching Sustainability in Cal Poly Electrical and Computer Engineering Programs", Presentation at UC/CSU Conference on Sustainability in Curricula, UC Santa Barbara, June 22, 2009.

Published Research Reports

"Development of a Multi-fuel Vehicle using Electronic Fuel Injection," Final Project Report, Regional Technology Advancement grant, US Department of Energy, Region 8, September, 1981.
"Acceleration of Automobiles Fueled by Natural Gas and Gasoline: A Comparison", Report to the National Science Foundation, Published by Denver Urban Observatory and City of Denver, University of Denver Research Institute, 1982.
"Evaluation of Image Processing Technology for Application on Highway Operations," Final Report to the California Department of Transportation, TR 91-2, June 1991. Co-author: S. Hockaday.
"Noise-Optimal Control of HEMT LNA's for Compensation of Temperature Deviations," The Telecommunications and Data Acquisition Progress Report, 42-109, NASA JPL/Caltech, May 1992.
Co-authors: J.J. Bautista, P.A. Willis.
"Evaluation of Closed-Circuit Television Technology for Application in Highway Operations," Final Project Report, Caltrans Contract 51J932, Caltrans Division of New Technology, San Luis Obispo, CA., 1992.
"Video Cameras for Roadway Surveillance: Technology Review and Product Evaluation Results," Report to the California Dept. of Transportation, Cal Poly Transportation Electronics Laboratory, 1992.

"Feasibility Study: Rapid Battery Interchange for Electric Vehicles," published study commissioned by Pacific Gas and Electric Co., Transportation Electronics Laboratory, Cal Poly EL/EE Dept. PR93-1, 1993.

"Rapid Battery Interchange Electric Transit Bus Demonstration, Phase I," final project report (published) to Pacific Gas and Electric Co. Transportation Electronics Laboratory, Cal Poly EE Dept. PR95-5, 1995.

"Design and Deployment Planning (Phase II), Rapid Battery Interchange Electric Transit Bus" Project report published by California Energy Commission. Cal Poly Transportation Electronics Laboratory PR96-1,1996.

"Design Considerations for Automated Electric Vehicle Battery Interchange," Transportation Electronics Laboratory, California Polytechnic State University, SLO, Report published by sponsor Pacific Gas and Electric Company, No. TEL4881a97, January 1997.

“City of Anaheim / Caltrans / FHWA Advanced Traffic Control System Field Operational Test Evaluation Task C, Video Detection System,” final project report, US Dept. of Transportation FHWA and Caltrans agreement No. SA 1272-18286, Partners for Advanced Transit and Highways, UC Berkeley, April 18, 1998.

“Video-based Vehicle Signature Analysis and Tracking, Phase 1: Verification of Concept and Preliminary Testing,” PATH publication based on final project report, Caltrans MOU 262, Cal Poly Transportation Electronics Laboratory Report No. TEL5881a97. Partners for Advanced Transit and Highways, University of California, Berkeley, January 10, 1998.

"Evaluation of Caltrans District 10 Automated Warning System, First Year Report," Cal Poly Transportation Electronics Laboratory Document TEL5881B98R, published by Partners for Advanced Transit and Highways (PATH), University of California, Berkeley, July 6, 1998.

“Video-based Vehicle Signature Analysis and Tracking, Phase 2: Algorithm Development and Field Testing,” final project report, Partners for Advanced Transit and Highways, University of California, Berkeley, 1999.

"Evaluation of Caltrans District 10 Automated Warning System, Second Year Report," Cal Poly Transportation Electronics Laboratory Document TEL5881B99, Published by Partners for Advanced Transit and Highways (PATH), Univ of California, Berkeley, March 4, 1999.

"An Indirect Sensing Technique for Diesel Fuel Quantity Control," Final Report, U.S. Department of Energy, ERIP Project 583 Contract No. DE-FG01-94CE15583 May, 1999.

"Evaluation of SCOOT Performance in the Anaheim Advanced Traffic Control System Field Operational Test," Intellimotion, Published by Partners for Advanced Transit and Highways, University of California, Berkeley, November 1999. Co-authors: J. Moore, R. Jayakrishnan, M. McNally

"Evaluation of Infrared and Millimeter-wave Imaging Technologies," Project Final Report, Partners for Advanced Transportation and Highways, Feb. 2001.

"Documentation of the Irvine Integrated Corridor Freeway Ramp Metering and Arterial Adaptive Control Field Operational Test," California Partnership for Advanced Transit and Highways (PATH) Research Report UCB-ITS-PRR-2001-02, Report for MOU RTA 65V313-5, California Department of Transportation, Office of New Technology, Jan. 2001. Co-authors: M. McNally and J.E. Moore II.

“V2SAT Operators Manual“ published project deliverable under University of California Contract No. T01-65A0071-4122-L, California Department of Transportation, August 2002, with major addendum 2003.

“Calnet/SIBS Bill Analyzer Operators Manual”, deliverable under contract to Caltrans Division of Research and Innovation Contract, March 2004.

“Caltrans Detector Testbed / V2SAT Technical Report, 2004”, deliverable under University of California Purchase Order 0031 P 00 681648, California Department of Transportation, August 2004.

“Instrumentation and Evaluation of District 10 Caltrans Automated Warning System (CAWS)” Volumes 1-5, Document Nos. L-D10-FR-01 though -05, California Office of Traffic Safety (OTS) Grant RS0034, Caltrans Contract 51A0050, distributed by California Office of Traffic Safety, Sacramento, CA., Sept. 2005.

“Video Vehicle Detector Verification System Operators Manual,” Project deliverable to California Dept. of Transportation and Univ. of California, Berkeley under Task Order 5327, 2006, and supplement 2007.

“A Spy Under the Hood: Controlling Risk and Automotive EDR” Risk Management Magazine, Vol. 55, Issue: February 01, 2008. Co-author: Peter Thom

“Caltrans Traffic Detection Plan”, Published report for the California Department of Transportation under contract to Cambridge Systemetrics, Washington DC. 2008. Co-authors: Daniel Krechmer, Lawrence Klein.

Unpublished Project Reports (list on request)

Author or co-author of over 150 unpublished research reports and advisory papers for sponsoring clients DOE, NSF, DOT/ FHWA, Caltrans, California Office of Traffic Safety, Hughes SBRC, Univ of Calif Berkeley, Univ of Calif Irvine, Cal Poly SLO, and corporate sponsors,1979-present.

Proposals Submitted (list on request)

Author, co-author or major contributor to over 100 research proposals to state, federal and industrial sponsors.

Journal, Conference and Proposal Reviews (lists of individual titles on request)

California Partner for Advanced Transportation and Highways, annual reviewer, 1991-present.
Prentice Hall, Academic Publishing Division, contract textbook review, 1995.
Society of Automotive Engineers (World Congress and Transactions), annual reviewer, 1995-2003.
Transportation Research Board Committees, annual reviewer for multiple committees: Intelligent Transportation Systems, Visibility, Motorcycles and Vulnerable Vehicles, and User Information Systems, 1999-present.
IEEE Transaction on Intelligent Transportation Systems, annual reviewer, 2001-present.
Intelligent Transportation Journal, Pergamon Press, 1998, 99, 2003.
METRANS (Los Angeles Metropolitan Transit), annual reviewer, 2002, 04, 05.
Cal Poly C3RP proposal reviewer, 2005, 2006.

University Courses Developed

EE 342, Control Systems Laboratory. Redesigned lab, wrote new lab manual, 1988.
Created new courses:
- EE 563 Graduate Seminar, 1989.
- EE 514 Advanced Topics in Automatic Control, 1988.
- EE/CPE 432 Digital Control Systems, 1989.
- EE/CPE 472 Microprocessor Controls Laboratory, 1989.
- EE/CPE 336 Microprocessor Embedded Systems Lecture and Laboratory, 1994.
- Tentative X-Course "Automotive and Highway Electronics", to be offered 2007-08 AY, budget permitting.

Assisted in the creation (2003), and instructor for CPE 350 and 450 Capstone Course Sequence, 2006-present.
Course coordinator, EE 436 and 336, Embedded Systems Laboratories.
Course coordinator, EE 342 Controls Laboratory 1993-2003.
Course coordinator and major revisions, EE/CPE 219,259,319,359 digital area lectures and labs, 990-1998.
Course coordinator, EE 432/472 Digital Control Systems lecture and laboratory.
Course coordinator, EE 513 Control Theory, and EE 514, Advanced Topics in Controls.

Relevant Non-Professional Accomplishments

Owner or builder of three battery-electric vehicles, used for local transportation and demonstration/education.
Commute daily with self-constructed methanol-fueled ultra-low-emission vehicle.
Operator of alcohol fuel storage facility, including all required permits, insurance and safety measures.
Designer/installer of four active solar systems power and thermal systems.