October 14, 2015 Meeting

The October 14, 2015 Waterloo Technical Society (WTS) meeting was called to order by President Gary Dorhout at 7:15 pm.

A total of 53 were in attendance. Treasurer Ken Friend reported a previous balance of $1,039.08. There were receipts of $0.00 interest and $290 in membership dues. Expenses were $18 for the September guest speaker's meal. An outstanding purchase of the Public Address Speaker System of $337.92 is not paid. The ending balance was $1,311.08. Ken reported 11 honorary and 29 paid members for a total of 40 members.

Old Business. No old business was discussed..

New Business. No new business was presented.

President Dorhout introduced our guest speaker, Mr. Doug Vernier. Mr. Doug Vernier is president of V-Soft Communications and senior consulting engineer at Doug Vernier Telecommunications in Cedar Falls. He worked for three decades at the University of Northern Iowa where he was Director of Broadcasting Services and Assistant Professor. He retired from that position in 2002. He has served two terms on the Board of Directors of National Public Radio and is a past president of Public Radio in Mid America. He is recognized by the Society of Broadcast engineers as a lifetime Professional Broadcast Engineer. His degrees are from the University of Michigan, where he studied engineering and telecommunications. Doug, who says he's an early adopter, became a Tesla Model S, all electric, car owner in March of this year.

Doug spoke about his 2015 Tesla Model S all electric automobile. It is the first, all electric, car to travel more than 300 miles on one charge of its Lithium-Ion batteries. It does not burn gasoline, uses no oil, has no radiator, no drive shaft, and will do zero to sixty miles per hour in 2.8 seconds. The Tesla is the brain child of Elon Musk, the man who created Pay Pal, Space X and SolarCity. Consumers Reports gives the Tesla 103 points in its latest review, three points above the top of their scale.
Doug had his Tesla Model S in the parking lot for a first hand view after the meeting.

History. Nicola Tesla was a pioneer in electrical energy generation. After having a disagreement while working for Thomas Edison, he championed the use of alternating current electricity as opposed to direct current proposed by Edison. Tesla's method was finally adopted as the U.S. standard while Tesla was working for Westinghouse Electric Company.

The original electric car was produced in 1917. At the turn of the 20th Century there were electric cars (38%) and gasoline cars (22%). The electric cars could travel 15-20 mph for a range of 30-40 miles. In 2003 Martin Eberhard and Mark Tempering invented the modern version of the electric car. Tesla Motors was founded in 2003 by a group of engineers in Silicon Valley who wanted to prove that electric cars could be better than gasoline-powered cars. With instant torque, incredible power, and zero emissions, Tesla's products would be cars without compromise. Each new generation would be increasingly affordable, helping the company work towards its mission: to accelerate the world's transition to sustainable transport.



Figure 1. Tesla roadster.

Tesla's engineers first designed a powertrain for a sports car built around an AC induction motor, patented in 1888 by Nikola Tesla, the inventor who inspired the company's name. The resulting Tesla Roadster was launched in 2008. Accelerating from 0 to 60 mph in 3.7 seconds and achieving a range of 245 miles per charge of its lithium ion battery, the Roadster set a new standard for electric mobility. Tesla would sell more than 2,400 Roadsters, now on the road in more than 30 countries.



Figure 2. 2015 Tesla Model S.

In 2012, Tesla launched Model S, the world's first premium electric sedan. Built from the ground up to be 100 percent electric, Model S has redefined the very concept of a four-door car. With room for seven passengers and more than 64 cubic feet of storage, Model S provides the comfort and utility of a family sedan while achieving the acceleration of a sports car: 0 to 60 mph in about five seconds. Its flat battery pack is integrated into the chassis and sits below the occupant cabin, lending the car a low center of gravity that enables outstanding road holding and handling while driving 265 miles per charge. Model S was named Motor Trend's 2013 Car of the Year and achieved a 5-star safety rating from the U.S. National Highway Traffic Safety Administration.



Figure 3. Tesla S interior showing 17" touch screen.



Figure 4. Tesla S dashboard.



Figure 5. Zero profile door handles on S when key fob is distant.



Figure 6. S recharging port opens when cord is in proximity

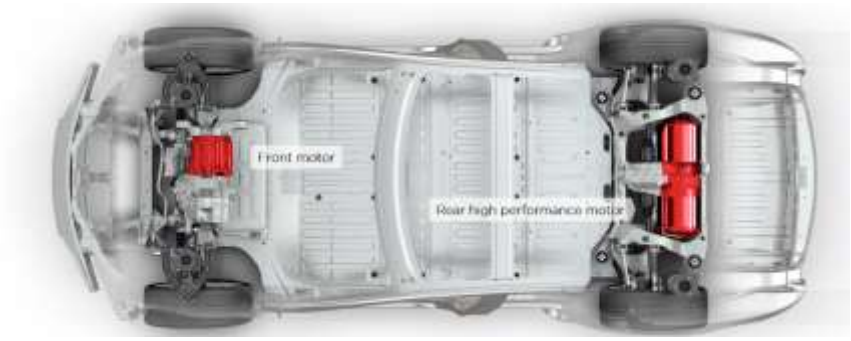


Figure 7. Tesla S showing all-wheel drive with one front motor and two in the rear.

In late 2014, Tesla CEO Elon Musk unveiled two dual motor all-wheel drive configurations of Model S that further improve the vehicle's handling and performance. The 85D features a high efficiency motor at the front and rear, giving the car unparalleled control of traction in all conditions. The P85D pairs a high efficiency front motor with a performance rear motor for supercar acceleration, achieving a 0 to 60 mph time of 3.2 seconds – the fastest four-door production car ever made.



Figure 8. Tesla Model X to appear in 2016.

Now with more than 50,000 vehicles on the road worldwide, Tesla is preparing to launch Model X, a crossover vehicle that enters volume production in 2015. Featuring exhilarating acceleration, falcon wing doors, and room for three rows of seating, Model X defies categorization.

Tesla owners enjoy the benefit of charging at home so they never have to visit a gas station or spend a cent on gasoline. For long distance journeys, Tesla's Supercharger network provides convenient and free access to high speed charging, replenishing half a charge in as little as 20 minutes. Superchargers now connect popular routes in North America, Europe, and Asia Pacific. There is only one charging station in Iowa at Council Bluffs with three more planned for Des Moines, Iowa City and Davenport.

Tesla's vehicles are produced at its factory in Fremont, California, previously home to New United Motor Manufacturing Inc., a joint venture between Toyota and General Motors. The Tesla Factory has returned thousands of jobs to the area and is capable of producing 1,000 cars a week.



Figure 9. Tesla Model 3 expected in 2020 to be priced around $35,000.

The company is expanding its manufacturing footprint into other areas, including in Tilburg, the Netherlands, where it has an assembly facility, and Lathrop, California, where it has a specialized production plant. To reduce the costs of lithium ion battery packs, Tesla and key strategic partners including Panasonic have begun construction of a gigafactory in Nevada that will facilitate the production of a mass-market affordable vehicle, Model 3. By 2020, the gigafactory will produce more lithium ion cells than all of the world's combined output in 2013. The gigafactory will also produce battery packs intended for use in stationary storage, helping to improve

robustness of the electrical grid, reduce energy costs for businesses and residences, and provide a backup supply of power.

Tesla S Features.

Table 1. Comparison of Model S Performance Features

Performance Feature	70D AWD	85D AWD	P85D AWD	70 RWD	85 RWD
Kwh battery with all-wheel drive	70	85	85	70	85
Kwh battery with upgrade		90	90		90
Miles range (EPA)	240	270	253	230	265
Seconds 0-60 mph	5.2	4.2	3.2	5.5	5.4
Seconds ¼ mile	13.5	12.5	2.8[1]	13.8	13.5
Hp	328	417	10.9[1]	315	373
Hp front and rear motor power	259	259	259[2]		
Hp rear motor power			503[3]	382[3]	382[3]
Lb-ft motor torque	387	485	713	325	325
Mph top speed	140	155	155	140	140

[1] With Ludicrous Speed Upgrade
[2] Front motor
[3] Rear motor

Table 2. Overall dimensions of Tesla S

Length 196.0"	Wheelbase 116.5"	Width 86.2" With mirrors folded 77.3"
Track Front 65.4", Rear 66.9"	Clearance 5.65" With air suspension 4.7" - 6.4"	Head room Front 38.8", Rear 35.3"
Leg room Front 42.7", Rear 35.4"	Shoulder room Front 57.7", Rear 55.0"	Hip room Front 55.0", Rear 54.7"
Seating capacity 5 adults	Total cargo volume 31.6 cu ft	Rear cargo volume 26.3 cu ft With seats down 58.1 cu ft
Front trunk cargo volume 5.3 cu ft	Turning circle 37 ft	Curb weight 4,647.3 lbs
Weight distribution Front 48%, Rear 52%		

Body

- Lightweight aluminum body reinforced with high strength, boron steel elements
- UV and infrared blocking safety glass windshield
- Rain sensing, adjustable speed windshield wipers
- Frameless, tempered safety glass front windows
- Solar absorbing, laminated safety glass rear window with defroster
- Flush mounted door handles
- Power folding, heated side mirrors with memory
- 19" aluminum alloy wheels with all-season tires (Michelin Primacy MXM4 245/45R19)
- Aluminum roof
- Xenon headlights with automatic on/off
- LED daytime running lights
- Backlit side turn signals, front side marker lights and rear reflex lights
- LED rear taillights and high-mounted LED stop lamp

Powertrain

- Model S is an electric vehicle available in both rear wheel and all-wheel drive configurations. The liquid-cooled powertrain includes the battery and one or more motors, drive inverters and gear boxes.
- 70 kWh or 85 kWh microprocessor controlled, lithium-ion battery
- Three phase, four pole AC induction motor with copper rotor
- Drive inverter with variable frequency drive and regenerative braking system

Suspension, Steering, and Brakes

- Double wishbone, virtual steer axis coil spring front suspension and independent multi-link coil spring rear suspension
- Variable ratio, speed sensitive, rack and pinion electronic power steering
- Electronic Stability Control
- Traction Control
- Anti-Lock disc brakes (ABS) with ventilated rotors and electronically actuated parking brake; front: 355 mm x 32 mm; rear: 365 mm x 28 mm

Charging

- 10 kW capable on-board charger with the following input compatibility: 85-265 V, 45-65 Hz, 1-40 A (Optional 20 kW capable Dual Chargers increases input compatibility to 80 A)
- Peak charger efficiency of 92%
- 10 kW capable Universal Mobile Connector with 120 V, 240 V, and J1772 adapters

Interior

- Twelve way, power adjustable, heated front seats with memory
- Hand wrapped microfiber and synthetic leather interior surfaces in black
- Piano black décor accents
- Center armrest with two cup holders
- Open center console storage area
- Metal interior door handles
- Electrochromatic mirrors
- 60/40 split fold-down second row seats
- 200 watt, seven speaker stereo system with AM/FM/HD radio. Supports MP3, AAC, and MP4 music formats. System includes four speakers, two tweeters and one center channel speaker.

Instrumentation

- 17" capacitive touchscreen with media, communication, cabin, and vehicle controls
- Bluetooth wireless technology for hands-free calling and streaming music
- Three spoke, multi-function steering wheel with tactile controls
- Tire pressure monitoring system

Warranty

- 4 year, 50,000 mile (whichever comes first)
- 8 year, unlimited mile
- Battery warranty covers damage from improper charging procedures and battery fire, even if the fire results from driver error

Convenience

- Onboard maps and navigation with free updates for 7 years
- Mobile connectivity
- Keyless entry
- Driver profiles
- Driver seat detection sensor for start/stop functionality
- Cruise Control

- High definition backup camera
- Manual rear liftgate
- Power tilt and telescopic steering column
- Power windows featuring one-touch up and down with resistance reversing to protect against pinched fingers
- Micro-filter ventilation system with replaceable filters
- Front LED map lights and rear LED reading lights
- Front sun visors
- Front trunk and rear cargo area with keyless open
- 12 V power outlet
- Automatic climate control with dual zone temperature settings, air distribution controls and recirculation
- Glove compartment
- Wi-Fi ready
- Dual front USB ports for media and power

Safety

- Forward looking camera, radar, and 360 degree sonar sensors
- Blind spot warning
- Automatic emergency braking
- Lane departure warning
- Parking sensors
- Speed limit display
- Eight airbags: head, knee and pelvis airbags in the front plus two side curtain airbags
- Driver and front passenger seat sensors
- Driver seat position sensor
- Three point driver and front passenger safety belts with retractor pretensioners and secondary lap anchor pretensioners and load limiters
- Three point second row safety belts for all three seats
- Acoustic front row safety belt warning
- Rollover crash sensor
- Crash sensor for high voltage disconnect
- Three second row LATCH attachments for child seat installations (accommodates three child seats simultaneously: two with LATCH and one with top tether and belt)
- Rear door child safety locks
- Interior, manual release mechanism for all doors, front trunk, and rear cargo area
- Anti-theft alarm and immobilizer system

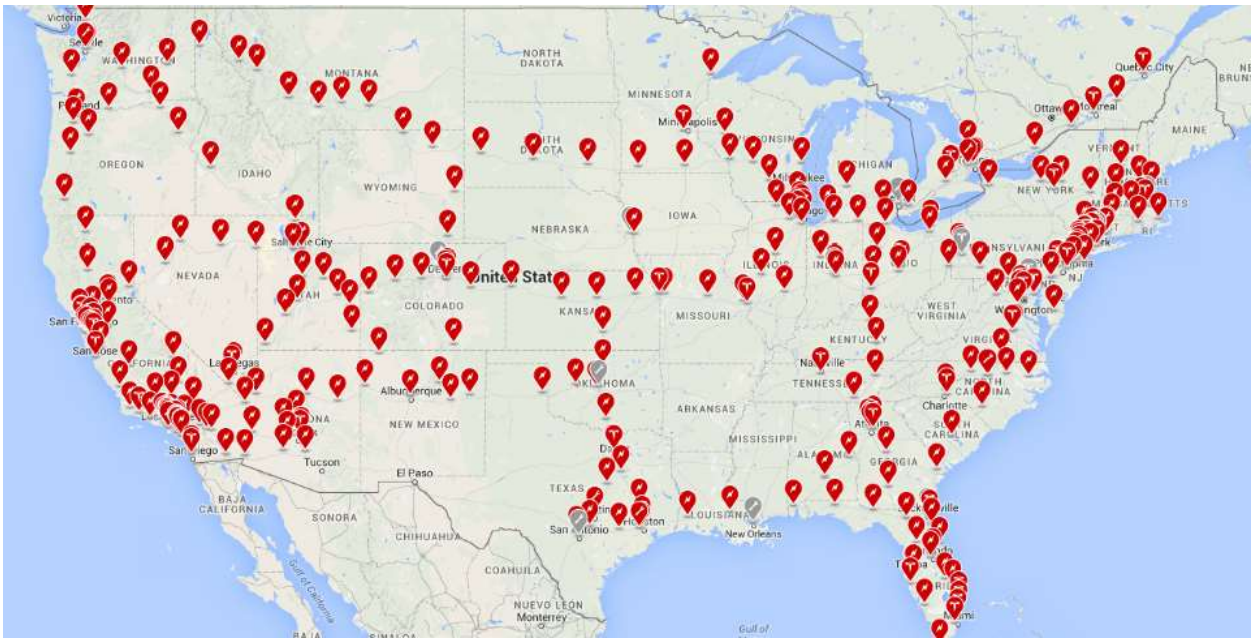


Figure 10. Tesla charging stations, U.S.A.

Next Meeting. The November 11, 2015 will hear Mr. Brent Maitland who will talk about his experience as UNI Power Plant manager with a tour following his presentation.

Meeting Adjourned. President Dorhout accepted a motion for adjournment at 8:35 pm. With a viewing of the Tesla S outside the Clarion following.

Respectfully submitted,

James R. Stevenson