DECLARATION OF SCOTT ANDREWS

I, Scott Andrews declare as follows,

1. I hold a B.Sc. degree in Electrical Engineering from the University of California, Irvine and a M.Sc. degree in Electronic Engineering from Stanford University. I have been involved in the development of hybrid vehicle technology with a variety of organizations. For example, at Toyota, I supported the assessment of new power transistor technology and manufacturing methods for the first generation Prius hybrid vehicle powertrain controllers. Also, in 2003, I developed a hybrid vehicle design with a colleague who later co-founded the vehicle company Tesla Motors. The goal of the design was to create a high performance vehicle that would use (i) electrical power to provide high torque on demand and (ii) a conventional small internal combustion engine to power the vehicle under low power/low torque demand driving. This work also led to an overall vehicle systems engineering methodology wherein all of the vehicle sensors, actuators and processes were treated as objects in a database system that provided a fully back annotate-able connection between use case descriptions and component and process specifications. In other positions, I have been responsible for the research and development projects relating to numerous vehicle information systems, user interface systems, sensory systems, control systems, and safety systems, and I also had the opportunity to collaborate with numerous researchers and suppliers to the

auto industry. I currently consult with the U.S. Department of Transportation, major carmakers and suppliers on vehicle information systems, safety systems, and communication systems. I am also a member of the Institute of Electrical and Electronics Engineers (IEEE), the IEEE Standards Association, the Society of Automotive Engineers (SAE), the Institute of Navigation (ION), and the International Council on Systems Engineering (INCOSE). My qualifications are further set forth in my *curriculum vitae* (Exhibit A). I have been retained by Volkswagen Group of America, Inc. in connection with its petition for *inter partes* review of U.S. Patent No. 8,214,097 ("the '097 patent"). I have over 20 years of experience in fields relevant to the '097 patent.

2. I have reviewed the '097 patent, as well as its prosecution history and the prior art cited during its prosecution. I have also reviewed U.S. Patent Nos. 7,104,347 ("the '347 patent"), and 7,237,634 ("the '634 patent") which share substantially the same specification as the '097 patent, as well as the prosecution history of both patents. I have also reviewed German Published Patent Application No. 44 44 545 ("Barske"), U.S. Patent No. 5,495,912 ("Gray"), Vittone et al., FIAT Research Centre, *Fiat Conceptual Approach to Hybrid Car Design*, 12th International Electric Vehicle Symposium (1994) ("Vittone"), U.S. Patent No. 5,343,970 ("Severinsky '970"), U.S. Patent No. 5,865,263 ("Yamaguchi"), and U.S. Patent No. 4,707,984 ("Katsuno").

The ’097 Patent

3. The ’097 patent describes a hybrid vehicle that includes an internal combustion engine, an electric motor, and a battery, all of which are controlled by a microprocessor in accordance with the vehicle’s instantaneous torque demands (*i.e.*, road load), so that the engine is run only under conditions of high efficiency. *See* ’097 patent, at Abstract. The engine is capable of operating efficiently between a lower-level setpoint (“SP”) and a maximum torque output (“MTO”). The vehicle can operate in a number of operating modes, including a “low-load mode” (also referred to as “Mode I”), in which the vehicle is propelled only by the electric motor, a “highway cruising mode” (also referred to as “Mode IV”), in which the vehicle is propelled only by the engine, and an “acceleration mode” (also referred to as “Mode V”), in which the vehicle is propelled by both the engine and the electric motor. The microprocessor determines the mode of operation based on road load. If the road load is below the setpoint (SP), the vehicle operates in Mode I (motor only); if the road load is between the setpoint (SP) and the maximum torque output (MTO) of the engine, the vehicle operates in Mode IV (engine only); if the road load is above the maximum torque output (MTO) of the engine, the vehicle operates in Mode V (motor and engine).

4. The rate of change of the engine’s torque output is limited to limit undesirable emissions and to improve fuel economy. *See* ’097 patent, at col. 38,

line 62 to col. 39, line 1. More specifically, the rate of change of engine torque is limited to less than the engine's inherent maximum rate of increase in output torque such that combustion of fuel within the engine occurs at a substantially stoichiometric ratio.

The Volkswagen Development of Hybrid Vehicles

5. Since the mid-1970s, Volkswagen and Audi have been developing hybrid vehicle technologies, including hybrid drive systems that control the application of torque from an internal combustion engine, an electric motor, or both, depending on driving parameters.

6. For example, Barske, filed in 1994, describes certain aspects of Volkswagen's hybrid technology. Barske describes a parallel hybrid vehicle having an internal combustion engine and an electric motor, with a battery, for propelling the vehicle. Barske describes using a crankshaft to couple or decouple modules of the engine and the motor from the drive train, depending on certain factors identified in Table II, reproduced below. *See* Barske, at p. 2, lines 6 to 8, p. 3, line 31 to p. 4, line 5, Table II. Specifically, Table II indicates that the determination of which power source will be used to propel the vehicle (the electric motor, the first engine module, the second engine module, or some combination thereof), is based on load: "small load," "medium load," or "full load."

Table II

Motor		Function
a)	Electric motor	Small load and braking energy recovery system
b)	First module	Medium load, in particular with full cylinder charge
c)	First module + electric motor	As b), braking energy recovery system, battery charging or additional electric traction (acceleration)
d)	First and second module	Full load and output
e)	First and second module + electric motor	As d), braking energy recovery system, battery charging or additional electric traction (great acceleration)
f)	Second module + generator	Charging the battery, Emergency current generator.
g)	Second module + generator + electric motor	As a), charging the battery using the second module in the single point operating mode during the electric traction

7. Barske's control strategy is based on load in the same manner claimed in the '097 patent. For example, Barske describes mode "a)," corresponding to Paice's "low load mode I," in which the vehicle is propelled by only the electric motor under conditions of "small load." Barske also describes modes "b)" and "d)," corresponding to Paice's "highway cruising mode," in which the vehicle is propelled by only the internal combustion engine (either by the first module of the

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